Democratic Socialist Republic of Sri Lanka

# Data Collection Survey on Disaster Management Program in Sri Lanka

# FINAL REPORT

**February, 2013**


**Japan International Corporation Agency (JICA)**

**EARTH SYSTEM SCIENCE Co., Ltd. (ESS)**
**IDEA Consultants, Inc. (IDEA)**
**NIPPON KOEI Co., Ltd. (NK)**



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**Exchange Rate**

| Currency | Rate ／ USD |
|---|---|
| Japanese Yen （JPY） | 93.88 |
| Sri Lanka Rupee （LKR） | 127.37 |

（Feb, 2013）


**Location Map of Survey Area**

# Photo List

**Photo-1 Bathalagoda Tank**

This tank is located in Kulunegala, Northwestern Province. The administration office of ID is close, they are measuring the daily water level.

**Photo-2 Kimburarwana Tank**

Many tanks in Sri Lanka are used for irrigation rather than flood control, adjustment of water discharge is carried out manually.

**Photo-3 Flooded House in December 2012**

These houses had been flooded up to about 1.5m at that time. The river bank has been eroded by the flood and also revetment work was partially collapsed.

**Photo-4 Flood Mark of the Past（Ratunapura）**

The flood water level of Kalu river in 1913 and 1947 is marked on the plate in the police government office.

**Photo-5 Alert Siren (Ratunapura)**

This siren is used as a warning and for distributing information in the community at the time of a disaster.

**Photo-6 Extensometer of Landslide Area**

This extensometer is still running, its state of maintenance is not good. And other observation equipment was seen such as a groundwater observation hole. And also there was a water gage, borehole inclinometer, etc.

**Photo-7 Situation of Countermeasure Construction**

As a pilot site of NBRO, countermeasure construction of the slope along the road is currently under construction. This place is carrying out drainage and planting works on the cutting slope.

**Photo-8 Debris flow in Matale**

This debris flow occurred Central Province in 17th December 2012. Herewith three houses was flooded, seven people died. According to an interview, the two-day total rainfall was assumed to be about 700mm.

**Photo-9 Half Collapse House by Landslide**

A cliff (height 80cm, width 4m) is confirmed in the vicinity the house. At that time sediment discharge to the road was over 20m, traffic had become difficult.

**Photo-10 Relief from Japan**

Relief goods such as tents and sleeping mats, etc. from Japan were delivered to various places that were suffering flood damage.

**Photo-11 Interim Report Meeting (at JICA Sri Lanka Office)**

The person in charge of related organizations (DMC, DOM, ID, NBRO, etc.) attended the meeting, and discussed present issues and organizational control.

**Photo-12 Final Meeting（at DMC Conference Room）**

The person in charge of many related organizations and also the Secretary of the Ministry of Disaster Management attended the meeting. We discussed the survey results and future direction.

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# Abbreviations

| | |
|---|---|
| ADB | Asian Development Bank |
| ARTI | Agrarian Research and Training Institute |
| AWS | Automatic Weather Station |
| CBDRM | Community-Based Disaster Risk Management |
| CBO | Community-Based Organization |
| CC&CRMD | Coast Conservation and Coastal Resources Management Department |
| CEA | Central Environmental Authority |
| CEB | Ceylon Electricity Board |
| CHPB | Center for Housing Planning and Building |
| CMACast | China Meteorological Administration forecast |
| CMC | Colombo Municipal Council |
| COMS | Communication, Ocean and Meteorological Satellite |
| DIA | Disaster Impact Assessment |
| DiMCEP | Disaster Management Capacity Enhancement Project Adaptable to Climate Change |
| DM | Disaster Management |
| DMC | Disaster Management Centre |
| DEM | Digital Elevation Model |
| DOA | Department of Agriculture |
| DOM | Department of Meteorology |
| DRM-P | Disaster Risk Management through partnerships |
| DSWRPP | Dam Safety and Water Resources Planning Project |
| EUMETSAT | European Organization for the Exploitation of Meteorological Satellites |
| EWS | Early Warning System |
| FEWS | Flood Early Warning System |
| FHM | Flood Hazard Map |
| FRM | Flood Risk Map |
| GDP | Gross Domestic Product |
| GIZ | German Development Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit) |
| GN | Grama Niladhari |
| GPS | Global Positioning System |
| GSMB | Geological Survey and Mines Bureau |
| GTS | Global Telecommunication System |

| | |
|---|---|
| HFA | Hyogo Framework for Action |
| IATA | International Air Transport Association |
| ICAO | International Civil Aviation Organization |
| ID | Irrigation Department |
| IFRC | International Federation of Red Cross |
| IPCC | Intergovernmental Panel on Climate Change |
| JICA | Japan International Cooperation Agency |
| LA | Local Authority |
| LSSD | Landslide Studies and Service Division |
| MASL | Mahaweli Authority of Sri Lanka |
| MDM | Ministry of Disaster Management |
| MED | Ministry of Economic Development |
| MEPA | Marine Environmental Protection Authority |
| MFPs | Minor Flood Protection schemes |
| MIWRM | Ministry of Irrigation & Water Resources Management |
| MOU | Memorandum of Under Standing |
| NARA | National Aquatic Resources Agency |
| NBRO | National Building Research Organization |
| NCDM | National Council for Disaster Management |
| NDMCC | National Disaster Management Coordination Committee |
| NDMP | National Disaster Management Program |
| NDRSC | National Disaster Relief Service Centre |
| NEOC | National Emergency Operation Center |
| NEOP | National Emergency Operation Plan |
| NGOs | Non-Governmental Organizations |
| NPP | National Physical Planning |
| NPPD | National Physical Planning Department |
| NSF | National Science Foundation |
| NWP | Numerical Weather Prediction |
| NWS&DB | National Water Supply and Drainage Board |
| PA | Public Awareness |
| PTWC | Pacific Tsunami Warning Center |
| RDA | Road Development Authority |
| SLIDA | Sri Lanka Institute of Development Administration |
| SLLRDC | Sri Lanka Land Reclamation & Development Corporation |
| SLRCS | Sri Lanka Red Cross Society |

| | |
|---|---|
| SOP | Standard Operation Procedure |
| UDA | Urban Development Authority |
| UNCRD | United Nations Centre for Regional Development |
| UNDAC | United Nations Disaster Assessment and Coordination |
| UNDP | United Nations Development Programme |
| UNICEF | United Nations Children's Fund |
| UNISDR | United Nations International Strategy for Disaster Reduction |
| VSAT | Very Small Aperture Terminal |
| WB | World Bank |
| WMO | World Meteorological Organization |
| WRB | Water Resource Board |

# 1. Introduction

## 1.1 Background of the Survey

In Democratic Socialist Republic of Sri Lanka (hereinafter Sri Lanka), an area that is vulnerable to disasters, the Sri Lanka Disaster Management Act, No. 13 of 2005 was developed after the Indian Ocean Earthquake and Tsunami of 2004. In accordance with the act, the Ministry of Disaster Management (MDM, established in 2005) and the Disaster Management Center (DMC) were established. Even though disaster correspondence and the disaster operation system are strengthening, the budget, human resources and level of the system, knowhow and technical aspects are not sufficient. The challenge is how to strengthen effective disaster management.

The Japan International Cooperation Agency (hereinafter JICA) established a "Climate Change and Disaster Management Program" as a focal assistance program and in the program, a "Comprehensive Study on Disaster Management in Sri Lanka" (2006-2009) was conducted. The study was associated with DMC and related disaster management agencies. The study had three components- flood management policy for four rivers, a trial run of early warning systems and strengthening of disaster management from community level disaster management activities. At the same time, a grant aid, "the Project for Improvement of Meteorological and Disaster Information Network in the Democratic Socialist Republic of Sri Lanka" (2007) assisted introduction of an automatic meteorological observation system. In addition, JICA is conducting a technical cooperation project called "Disaster Management Capacity Enhancement Project Adaptable to Climate Change (DiMCEP)" (2010-2013) for further capacity development of related disaster management agencies (an end-line evaluation was conducted in September 2012).

As loan assistance, an Emergency Natural Disaster Rehabilitation Project was established corresponding to the damage from a flood in 2011. In addition, a "Road Disaster Prevention Project in Disaster Vulnerable Area" is planned to be conducted in 2012 or 2013.

Through these assistances, the Government of Sri Lanka recognizes the importance of strengthening disaster management. In this situation, there is a need to develop a medium-long term strategy for assistance to Sri Lanka. To create the strategy, it is necessary to clarify the bottleneck of a disaster management implementation system through a capacity assessment of the existing disaster management implementation system of Sri Lanka government and related agencies. In addition, analyzing the challenge to the disaster management sector (mainly in frequency of occurring disasters, floods and sediment-related disasters since the number of victims in these disasters is relatively large) is also needed.

## 1.2 Purpose of the Survey

Main purposes of this Survey are as follows:

- To review the efforts taken by the Government of Sri Lanka, Japanese Government, JICA and other donors on strengthening the disaster management implementation system after 2005
- To collect basic information and information to consider the priority of disaster management policy including JICA medium-long term assistance policy (with program aims and an evaluation method) and the assistance approach (rolling plan and project implementation plan)

## 1.3 Assignment of the Project Expert

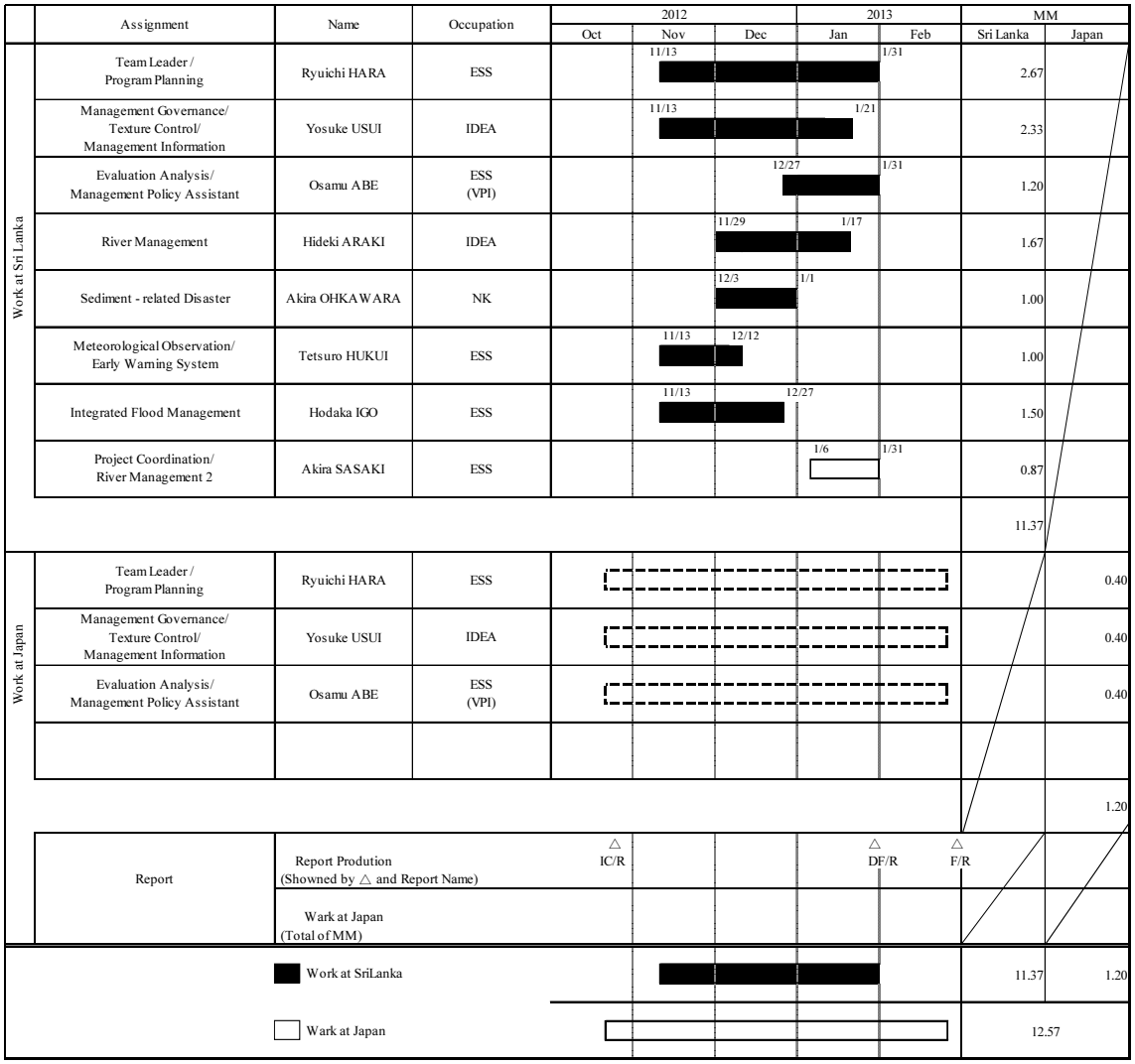
Member of the project experts is shown in Table 1-1.

**Table 1-1 Member of the Project Experts**

| No. | Name | Assignment | Occupation |
|---|---|---|---|
| 1 | Ryuichi HARA | Team Leader/<br>Program Planning | Earth System Science Co., Ltd. |
| 2 | Yosuke USUI | Management Governance/<br>Texture Control/<br>Management Information | IDEA Consultants, Inc. |
| 3 | Osamu ABE | Evaluation Analysis/<br>Management Policy Assistant | Earth System Science Co., Ltd.<br>(Value Planning International, Inc.) |
| 4 | Hideki ARAKI | River Management | IDEA Consultants, Inc. |
| 5 | Akira OHKAWARA | Sediment-related Disaster | NIPPON KOEI Co., Ltd. |
| 6 | Tetsuro HUKUI | Meteorological Observation/<br>Early Warning System | Earth System Science Co., Ltd. |
| 7 | Hodaka IGO | Integrated Flood Management | Earth System Science Co., Ltd. |
| 8 | Akira SASAKI | Project Coordination/<br>River Management 2 | Earth System Science Co., Ltd. |

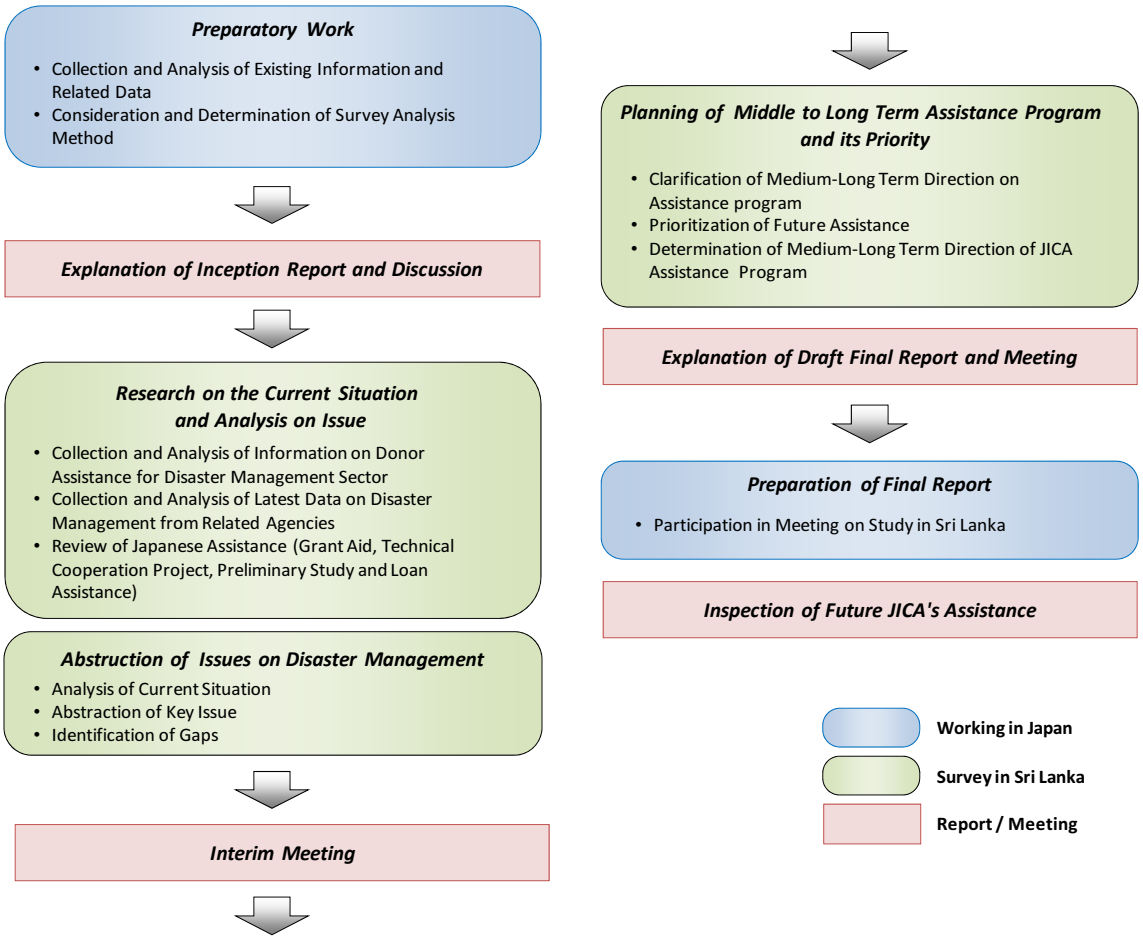
Source: JICA Survey Team

This survey started from November 2012, and completed at the end of January 2013. Actual assignment of the project experts is shown in Figure 1-1, and a flowchart of the survey is shown in Figure 1-2.




Source: JICA Survey Team

**Figure 1-1 Actual Assignment of the Survey Experts**




Source: JICA Survey Team

**Figure 1-2 Flowchart of the Survey**

# 2. Present Conditions of Disaster Management in Sri Lanka

## 2.1 Socio-Economic and Natural Conditions

### 2.1.1 Socio-economic conditions

Sri Lanka is the 53rd most populated nation in the world (from the World Bank), with a population of 20.2 million (2012 Census). Sinhalese and Tamil are the two official languages of Sri Lanka and English is defined as the link language in the Constitution of Sri Lanka.

In the 19th and 20th centuries, Sri Lanka became a plantation economy, famous for its production and export of cinnamon, rubber and Ceylon tea. The development of modern ports under British rule raised the strategic importance of the island as a center of trade. While the production and export of tea, rubber, coffee, sugar and other agricultural commodities remains important, Sri Lanka has moved steadily towards an industrialized economy with the development of food processing, textiles, telecommunications and finance. The main economic sectors of the country are tourism, tea export, clothing, rice production and other agricultural products.*[1], *[2]

### 2.1.2 Natural Conditions

Sri Lanka is an island country located in the Indian Ocean, within the tropics between 5° 55' to 9° 51' North latitude and between 79° 42' to 81° 53' East longitude. The total land area is about 65,610 square kilometers. The central part of the southern half of the island is mountainous with heights of more than 2,000 meters. The highest mountain is Pidurutalagala which is 2,524 meters in height. The core regions of the central highlands contain many complex topographical features such as ridges, peaks, plateaus, basins, valleys and escarpments. The remainder of the island is practically flat except for several small hills that rise abruptly in the lowlands. These topographical features strongly affect the spatial patterns of winds, seasonal rainfall, temperature, relative humidity and other climatic elements, particularly during the monsoon season.

Due to the location of Sri Lanka, the climate of the island could be characterized as tropical.

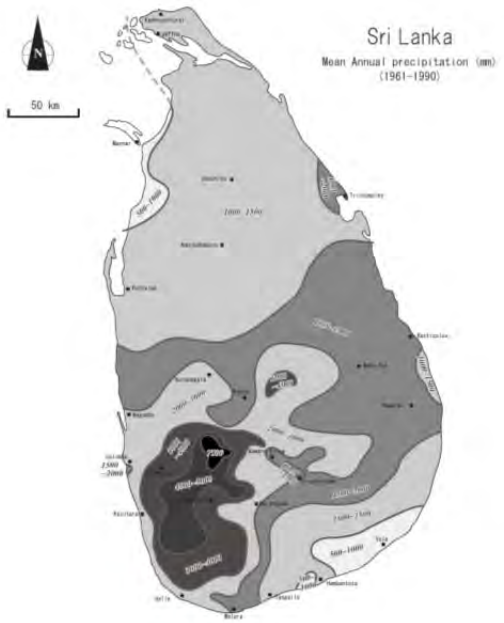
*[1] Risk Factor Analysis on Water Related Disaster in Democratic Socialist Republic of Sri Lanka (Public Works Research Institute et al.,2007)
*[2] Ministry of Foreign Affairs of Japan HP basic data of Democratic Socialist Republic of Sri Lanka (http://www.mofa.go.jp/mofaj/area/srilanka/data.html)

The climate of Sri Lanka is dominated by the above mentioned topographical features of the country and the Southwest and Northeast monsoons regional scale wind regimes. The climate experienced during a 12 month period in Sri Lanka can be characterized into 4 climate seasons as follows.

1. First Inter-monsoon Season - March - April
2. Southwest monsoon season - May - September
3. Second Inter-monsoon season - October - November
4. Northeast Monsoon season - December - February

The rainfall pattern is influenced by the monsoon winds of the Indian Ocean and Bay of Bengal and is marked by four seasons. The mean annual rainfall varies from under 900mm in the driest parts (southeastern and northwestern) to over 5000mm in the wettest parts (western slopes of the central highlands). Sometimes tropical cyclones bring overcast skies and rains to the southwest, northeast, and eastern parts of the island. The average yearly temperature for the country, as a whole, ranges from 26° C to 28° C.

One hundred and three rivers rise in the Central Highlands and flow in a radial pattern toward the sea. Ninety six river basins out of the hundred three river basins are small with the catchment areas less than 1,000 square kilometers. Most rivers, except the large rivers including Mahaweli Ganga (Mahaweli River) which is the largest river in Sri Lanka, change flow seasonally, and have no flow during the dry season. Meanwhile, the rivers that originate from the humid western slope flow even during the dry season. *[1]




Source: Assistance Policy Formulation Survey 2002 (Democratic Socialist Republic of Sri Lanka) Report

**Figure 2-1 Annual Mean Precipitation in Sri Lanka**

## 2.2 Disaster Records

Various types of disasters have struck Sri Lanka. The types of hazards that have potential impacts within Sri Lanka are summarized below:

**Table 2-1 Type of Hazards that has Impacts within Sri Lanka**

| Natural Hazards | Technological Hazards | Human Caused Hazards |
|---|---|---|
| - Drought<br>- Flooding<br>- Landslide<br>- Cyclones<br>- Tornados<br>- Severe storms<br>- Coastal erosion<br>- Tsunami<br>- Epidemics<br>- Forest fires<br>- Lightening<br>- Earthquake | - Industrial hazards<br>- Hazardous material spills<br>- Communication system failure<br>- Chemical accidents<br>- Gas pipeline failure<br>- Water contamination<br>- Water supply and distribution failure<br>- Maritime hazards<br>- Radiological emergency/ disaster<br>- Marine and inland oil spills | - Epidemics<br>- Civil or internal strife<br>- Explosions<br>- Air raids<br>- Air pollution<br>- Traffic accidents<br>- Gem mining related subsidence<br>- Sand mining erosion<br>- Terrorism<br>- Radiological disasters<br>- Urban and forest fires<br>- Marine and inland oil spills<br>- Nuclear disasters |

Source: Sri Lanka National Disaster Management Plan 2013 – 2017 (Draft), Nov. 2012

The DMC of the MDM with technical and financial support from UNDP has initiated the development of a database on past disaster incidents from 1974 to date. This database named the Disaster Information Management System (DesInventar) has been recording the damage due to various types of hazards. Based on the database of the DesInventar, the damage due to the above listed types of natural hazards are summarized as shown in Table 2-2. Meanwhile, the correspondences between the types of natural disasters and the causes of the disasters in the DesInventar are shown in Table 2-3.

The most devastated disaster was recorded by the 2004 Indian Ocean Tsunami. The disasters due to landslide (sediment-related disaster), flood and cyclone are dominant disasters with human losses in the Sri Lanka. Drought is also dominant in the number of people affected.

**Table 2-2 Historical Disaster Damages due to Natural Hazards**

| No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Hazard type | Landslide | Flood | Drought | Earthquake | Tsunami | Cyclones |
| No. of records | 2,483 | 9,080 | 1,997 | 82 | 89 | 192 |
| No. of deaths | 896 | 519 | 2 | 0 | 30,959 | 855 |
| No. of injured | 302 | 322 | 0 | 0 | 19,611 | 600 |
| No. of missing | 39 | 19 | 1 | 0 | 1,908 | 21 |
| No. of houses destroyed | 2,239 | 49,176 | 10 | 1 | 57,085 | 31,324 |
| No of houses damaged | 10,152 | 157,435 | 78 | 103 | 48,208 | 148,408 |

| | | | | | | |
|---|---|---|---|---|---|---|
| No. of peoples affected | 120,384 | 13,900,794 | 12,922,514 | 70 | 1,076,240 | 1,690,930 |
| No. of peoples relocated | 348 | 33 | 0 | 0 | 0 | 0 |
| No. of peoples evacuated | 2,798 | 74,093 | 600 | 0 | 0 | 3,941 |
| No. of lost cattle | 0 | 0 | 0 | 0 | 0 | 0 |
| No. | 7 | 8 | 9 | 10 | 11 | |
| Hazard type | Tornado/ Strong Wind | Coastal erosion | Lightning | Forest fires | Epidemics | |
| No. of records | 3,864 | 78 | 446 | 149 | 88,833 | |
| No. of deaths | 88 | 0 | 374 | 1 | 368 | |
| No. of injured | 416 | 1 | 389 | 0 | 0 | |
| No. of missing | 15 | 0 | 3 | 0 | 0 | |
| No. of houses destroyed | 3,834 | 135 | 21 | 16 | 0 | |
| No of houses damaged | 36,728 | 386 | 183 | 17 | 0 | |
| No. of peoples affected | 278,469 | 3,223 | 1,629 | 187 | 588,797 | |
| No. of peoples relocated | 16 | 0 | 0 | 0 | 0 | |
| No. of peoples evacuated | 1,375 | 646 | 3 | 10 | 0 | |
| No. of lost cattle | 0 | 0 | 0 | 0 | 4,149,120 | |

Source: Data from DesInventar Sri Lanka, Recording Period from Jan/1974 to Sep/2012

**Table 2-3 Correspondence between Natural Hazards and Causes of Disasters in DesInventar**

| No. | Type of Hazards | Cause of Disaster in DesInventar |
|---|---|---|
| 1 | Landslides | Cutting Failure, Land Subsidence, Landslide, Sedimentation, Earth Slip, Rock Fall |
| 2 | Flooding | Flash Flood, Flood, Rains, Surge, Tidal Wave, Urban Flood |
| 3 | Drought | Drought |
| 4 | Earthquake | Ground Vibration |
| 5 | Tsunami | Tsunami |
| 6 | Cyclones | Cyclone, Cyclone & Flood |
| 7 | Tornado/Strong Wind | Gale, Hailstorm, Storm, Strong Wind, Tornado |
| 8 | Coastal erosion | Coastline |
| 9 | Lightening | Lightning |
| 10 | Forest fires | Forest Fire |
| 11 | Epidemics | Epidemic, Plague |

Source: JICA Survey Team

## 2.3 Current Status of Disaster Management

### 2.3.1 Actions taken by the Sri Lanka Government after 2004 and its Output

The Indian Ocean Tsunami in 2004 clearly illustrated the need for Sri Lanka to take priority action in strengthening disaster preparedness and response.*[3] There have been efforts by individual specialized agencies in different aspects of disaster management in the past decade or so. However, in the absence of a legal framework for disaster management, so far there has been no coordinated mechanism for a holistic approach to DM in Sri Lanka.*[4] Therefore, the Government of Sri Lanka came up with reinforcement of national DM organizations. In May 2005, the Sri Lankan Parliament passed the Sri Lanka Disaster Management Act no.13 of 2005, which provides the framework for disaster risk management and the legal basis for instituting a disaster management system. The Act addresses disaster management holistically, leading to a policy shift from response based mechanisms to a proactive approach towards disaster risk reduction.*[5]

Pursuant to the Act, the National Council for Disaster Management (NCDM), which is the highest policymaking body in the country on DM, was established. In addition, the Government of Sri Lanka established a DMC and MDM in June 2005 and October 2005, respectively. Previous bodies established to carry out coordination of DM and specialized institutions for DM were put under the MDM. including the DMC Department of Meteorology (DOM) and National Building Research Organization (NBRO).*[3] At the end of 2007, the MDM established a national platform known as the National Disaster Coordination Committee (NDMCC). The NDMCC provides a forum for more than 65 international donors, UN agencies, NGOs, media, professional associations, academic institutions and private sector partners to share information on DM.

In the aspect of policy planning, a National Disaster Management Plan and National Emergency Operation Plan were proposed and will be approved in 2012. DMC made a DRM road map for the following decade (Toward a Safer Sri Lanka, Road Map for Disaster Risk Management) in December 2005.*[4] The road map was revised in April 2006. The components of the road map

*[3] Disaster Response Preparedness Mission to Sri Lanka (UNDAC, 2011; http://www.hpsl.lk/docs/UNDAC_SL_Report_Final_Email.pdf)
*[4] Towards a Safer Sri Lanka Road Map for Disaster Risk Management (Sri Lanka Gov., 2005; http://www.preventionweb.net/files/17954_goslroadmapdismanagcentre.pdf)
*[5] Corporate Plan (2010-2014) (Disaster Management Centre, Sri Lanka Gov., 2010; http://www.dmc.gov.lk/attchments/Corporate%20Plan/document.pdf)

are: 1. Policy, Institutional Mandates and Institutional Development, 2. Hazards, Vulnerability and Risk Assessment, 3. Multi-hazard Early Warning Systems, 4. Preparedness and Response Plans, 5. Mitigation and Integration of Disaster Risk Reduction into Development Planning, 6. Community-based Disaster Risk Management, 7. Public Awareness, Education and Training. Through the programs in the road map, there are some outcomes for DRM, such as making hazard maps for disasters in vulnerable areas or urban areas and construction of an early warning system (EWS) using early warning towers, radio communication systems and telephones.*[5]

Table 2-4 shows acts and plans for DRM in Sri Lanka. The National Organizations related to DRM are also shown in Table 2-5.

**Table 2-4 Acts and Plans for DRM in Sri Lanka**

| Acts and plans for DRM | State |
|---|---|
| Disaster Management Act no. 13 of 2005 *[6] | Approved (2005)<br>Amendment of the act was drafted (as of 2012). |
| Disaster Management Policy | Draft (2011)<br>Disaster Management Act provides to approve these plans and policies.<br>※NDMP,NEOP will be approved in 2013. |
| National Disaster Management Plan (NDMP) | |
| National Emergency Operation Plan (NEOP) | |
| Emergency Operations Plan | |
| Towards a Safer Sri Lanka Road Map for Disaster Risk Management *[4] | Approved (2005), Revised (2006)<br>DRM road map for following decade |
| Corporate Plan (2010-2014), Disaster Management Centre *[5] | Approved (2010)<br>Revised corporate plan (2012 to 2016) is under approval. |

Source: JICA Survey Team

**Table 2-5 National Organizations related to DM in Sri Lanka**

| | Organizations |
|---|---|
| Responsible for DM | DMC under MDM |
| Highest Policy making | National Council for Disaster Management (NCDM) |
| Committees | Technical Advisory Committee<br>Emergency Response Committee |
| National Platform | National Disaster Management Coordination Committee (NDMCC) |
| Emergency Response | National Emergency Operation Centre under DMC |

*[6] Disaster Management ACT, No. of 2005 (Sri Lanka Gov., 2005; http://www.disastermin.gov.lk/web/images/pdf/DMACTNO13_E.pdf)

| | Organizations |
|---|---|
| | National Disaster Relief Service Centre (NDRSC) under MDM<br>Emergency Response Committee |
| EWS<br>Hazard Map | Department of Meteorology (DOM) under MDM<br>Geological Survey and Mines Bureau (GSMB)<br>National Building Research Organization (NBRO) under MDM |
| Flood | Ministry of Irrigation & Water Resources Management (MIWRM), Department of Irrigation (DOI), Mahaweli Authority of Sri Lanka (MASL), Sri Lanka Land Reclamation & Development Corporation (SLLRDC), Ceylon Electricity Board (CEB), National Water Supply and Drainage Board (NWS&DB) |
| Land Slide | National Building Research Organization (NBRO) under MDM |
| Coastal Erosion | Coast Conservation and Coastal Resources Management Department (CC&CRMD) |
| Others | National Science Foundation (NSF), National Aquatic Resources Research and Development Agency (NARA), Colombo Municipal Council (CMC) & Fire Brigade, Ceylon Electricity Board (CEB), Sri Lankan Navy, Sri Lanka Army, Sri Lanka Air Force, Sri Lanka Police, Sri Lanka Coast Guard, Atomic Energy Agency, Ministry of Local Government, Ministry of Mass Media & Information, Ministry of Public Administration, Marine Environment Protection Authority, Department of Agriculture, Road Development Authority (RDA),Others |
| Climate Change | Central Environmental Authority (CEA) |

Source: JICA Survey Team

Progress of the "Road Map" is summarized and presented in Annex 1-2. From 2007 to 2009, the Government of Sri Lanka has provided funds exceeding LKR 250 million to strengthen the response capacity of local authorities. The Total budget of DMC in 2009 was ca. LKR 1 billion, however more than half of it was covered by foreign aid.*[5] There is a challenge to maintain the budget for DRM, whereas some DRM projects for floods, landslides and droughts are carried out in various places. The total number of DRM projects to be started in 2011 was 39. Locations of the projects were distributed in 14 districts. Total allocation was ca. LKR 75 million.

Based on the interview results by the Survey Team and the Draft Corporate Plan (2012-2016) of DMC, the challenges for the future of DMC are summarized as follows:

### (1) Organization and Human Resources

After restructuring in 2011, DMC consists of four functional divisions (, one staff support division and internal audit unit. At present (2012), total workforce is 155 personnel as of 2012 for the capacity of 254 personnel approved by the management services of the government. And

is a situation of overwhelming understaffed, especially vacancies of the directors and deputy directors who determine the future direction of the disaster management and have vital roles of coordination with the related agencies and promotion of the activities by the related agencies. Therefore, the activities of the DMC are depending on the leadership of the director general, commitment of the senior staffs, and the various assistances from UNDP. In this context, there is a fear that the activities of DMC cannot be implemented smoothly if there is turnover of the director general or senior officials, or withdrawal of personnel of UNDP. There are the reasons of understaffing of DMC, such as low remuneration of the government officials, disaster management as an emerging sector which is a few educated and skilled personnel, insufficient human resources development plan and proper performance and rewarding system, etc. Therefore, it is required for DMC to fulfill the vacancies of staffs by recruiting and educating the personnel from the universities or receiving personnel transfer from the other related government agencies. In the short term, it is recommendable to receive policy advisors from the donor countries or the universities.

### (2) Review of Disaster Management Plans/Disaster Emergency Operations

At present, the disaster management plans and the disaster emergency operation plans of the respective levels are drafted and implemented. In order to enhance the disaster management in the country, it is recommendable to review the work performance, to feed back the review results to the plans and to revise the related laws and regulations as appropriate.

### (3) Facilitation of Formulation and Implementation of Disaster Mitigation Action Plans

According to the draft national disaster management plan, the disaster mitigation action plans will be prepared by all public and private sector institutions. However, the plans for the related agencies are not prepared yet. In order to make the disaster management more proactive, it is recommendable for the related agencies to prepare the plans and to coordinate those plans and actions. It is required to DMC to facilitate formulation of the plans, coordinate the respective actions in line with the national priority, and facilitates implementation of the coordinated plans.

### (4) Enhancement of Capacities in Search and Rescue

At present, district search and rescue teams have been established in all 25 districts for disaster response. However, the teams are newly established and being trained. In addition, the first search and rescue responders in the communities have not been established yet. It is required to accelerate these activities.

### (5) Promotion of Community-based Disaster Management Activities

At present, community-based disaster management has been disseminated under the assistance from JICA, UNDP, SLRCS and NGOs. In order to disseminate the CBDM to all the communities in the country, however, it is required to foster the trainer for the CBDRM.

## 2.3.2 Approach and Achievement of Past Projects by JICA and other Donors

Projects assisted by JICA and other donors are listed in Annex-3, and classified in the priority areas of the "Hyogo Framework of Actions" (HFA) as shown in Annex-4.

### (1) JICA Projects

After the 2004 Indian Ocean earthquake and tsunami disaster, JICA conducted three urgent technical cooperation projects for development planning, namely, "Recovery, Rehabilitation and Development Project for Tsunami Affected Areas of the Northern and Eastern Region", "Recovery, Rehabilitation and Development Project for Tsunami Affected Areas of the Southern Region" and "Recovery, Rehabilitation and Development Project for Tsunami Affected Trunk Roads on the East Coast". After that, the technical cooperation project for development planning, namely "Comprehensive Study on Disaster Management in Sri Lanka" was conducted during the period from 2006 to 2009, aiming to enhance the capacity for disaster prevention. This study addressed enhancement of disaster management capacity and systems for newly established disaster management organizations. In parallel with the study, a grant aid project, namely the "Project for improvement of Meteorological and Disaster Information Network" was conducted and contributed to increasing the reliability of the early warning system through upgrading and expanding meteorological observation equipment.

In addition to the above projects, JICA has been conducting a technical cooperation project "Disaster Management Capacity Enhancement Project" in order to enhance the capacity of the organization related to disaster management and achieve the goals of the "Road Map for Disaster Risk Management". In addition, JICA has been conducting a loan aid project "Emergency Natural Disaster Rehabilitation Project" after the 2011 flood disaster, and technical cooperation for development assistance "Data Collection Survey on Road Protection against Natural Disasters (Landslide-disaster)" in 2012.

As mentioned above, JICA has been conducting several disaster management projects through several schemes continuously. Major Japanese ODA projects related to disaster management are listed in Table 2-6.

**Table 2-6 Major Japanese ODA Projects related to Disaster Management**

| Technical cooperation for Development Planning | | |
|---|---|---|
| Project Title | from | to |
| The study on storm water drainage plan for the Colombo metropolitan region | 2001 | 2003 |
| Recovery, Rehabilitation and Development Project for Tsunami Affected Area of Northern and Eastern Region | 2005 | 2008 |
| Recovery, Rehabilitation and Development Project for Tsunami Affected Area of Southern Region | 2005 | 2006 |
| Recovery, Rehabilitation and Development Project for Tsunami Affected Trunk Roads on the East Coast | 2005 | 2006 |
| Comprehensive Study on Disaster Management | 2006 | 2009 |
| Preparatory Study for Flood Risk Management and Climate Change Adaptation in South Western Sri Lanka | 2010 | - |
| Data Collection Survey on Road Protection against Natural Disasters (Landslide-disaster) | 2012 | 2012 |
| Technical Cooperation Project | | |
| Project | from | to |
| Tsunami and Conflict Affected Communities Upliftment Project in the North East Region | 2006 | 2007 |
| Disaster Management Capacity Enhancement Project Adaptable to Climate Change | 2010 | 2013 |
| JICA Partnership Program | | |
| Project | from | to |
| Practical Community countermeasure for earthquake and tsunami disaster mitigation though PTA(Participatory Technology Assessment) | 2006 | 2007 |
| Project on Promotion of Sustainable Disaster Mitigation Education and Trauma Counseling | 2010 | 2013 |
| Loan Aid | | |
| Project | from | (Mil.JY) |
| Sri Lanka Tsunami Affected Area Recovery and Takeoff (STAART) Project | 2005 | 10,006 |
| Emergency Natural Disaster Rehabilitation Project | 2011 | 7,000 |
| Grant Aid | | |
| Project | from | (Mil.JY) |
| The Project for Improvement of Meteorological and Disaster Information Network | 2007 | 807 |
| Emergency Aid | | |
| Project | from | (Mil.JY) |
| Emergency Aid for Flood Disaster | 2003 | 12 |
| Emergency Aid for the 2004 Indian Ocean earthquake and tsunami disaster | 2004 | 111 |
| Non Project Type Grant Aid (the 2004 Indian Ocean earthquake and tsunami disaster) | 2004 | 8,000 |
| Emergency Aid for Flood Disaster (through IFRC) | 2010 | 19 |
| Emergency Aid for Flood Disaster (through UNICEF) | 2010 | 28 |

Source: JICA Survey Team

### (2) As mentioned above, JICA has been conducting several disaster management projects through various schemes continuously. UNDP and Others

After the 2004 Indian Ocean earthquake and tsunami disaster, disaster management in Sri Lanka has also been assisted by the international community including UNDP, other

inter-governmental organizations and countries.

The World Bank (WB) conducted recovery projects for the 2004 Tsunami disaster. WB also has been conducting projects related to dam safety and water resources management planning. In addition, the WB has been conducting urban development planning addressing the disaster management aspect in "the Greater Colombo Development Project" (2012-2017).

**Table 2-7 Major WB Projects related to Disaster Management**

| Project | Amount | from | to |
|---|---|---|---|
| ARF Training on Developing a Common Framework for PDNA, Recovery and Reconstruction in Asia (Bangkok) | $100,000 | 2011 | 2011 |
| DRR technical assistance to priority countries in South Asia | $ 240,989 | 2011 | 2012 |
| Improving Sri Lanka's response and recovery in the aftermath of natural disaster | $ 200,000 | 2008 | 2011 |
| Mainstreaming Disaster Risk Management in Sri Lanka | $ 1,300,000 | 2011 | 2013 |
| Emergency Northern Recovery Project | $ 65,000,000 | 2009 | 2013 |
| Dam Safety and Water Resources Planning | $ 69,330,000 | 2008 | 2015 |

Source: JICA Survey Team

Meanwhile, the UNDP has played a major role in international assistance to Sri Lanka related to disaster management, through assisting policy making and establishment of the DMC. Recently the UNDP has been addressing the assistance of disaster management, such as preparation of a national road map for disaster management and a national emergency disaster management plan, capacity enhancement and human resources development of the DMC through implementation of a national road map, establishment of a disaster management coordination platform, and institutionalization of early warning systems.

**Table 2-8 Major UNDP Projects related to Disaster Management**

| Project Name | Amount | from | To |
|---|---|---|---|
| Transitional Recovery Support to Flood Disaster in Southwest Sri Lanka | $1,850,962 | 2003 | 2008 |
| Capacity Building in Disaster Risk Management | $ 1,176,470 | 2006 | 2008 |
| Preparatory assistance for Establishing Disaster Management Framework and Disaster Management Centre in Sri Lanka | $ 847,210 | 2005 | 2008 |
| Disaster Risk Management through partnerships (DRM-P) in Sri Lanka | $ 699,035 | 2009 | 2009 |
| Strengthening Early warning system in Sri Lanka | $ 125,000 | 2005 | 2007 |
| Sustainable Recovery of Natural Resources of Tsunami Affected Coastal Areas of Sri Lanka with People's Participation | $ 190,476 | 2006 | 2008 |
| Strategic Support to "Operationalize the Road Map Towards Safer Sri Lanka | $ 2,100,000 | 2008 | 2012 |

Source: JICA Survey Team

## 2.4 Selection of Key Issues of Disaster Management

Disaster types and components to be assisted by JICA are selected in consideration of the impacts of disasters by the natural hazards, the activities for the natural hazards focused on by the Sri Lanka government, and current efforts, future direction and discrepancies of the management activities of respective hazards, as described below:

### 2.4.1 Impact of Disasters

Based on the disaster records mentioned in Section "2.1 Disaster Records", the impact of disasters due to the 11 types of natural hazards are illustrated as shown in Figure 2-2 and summarized in the Table below:

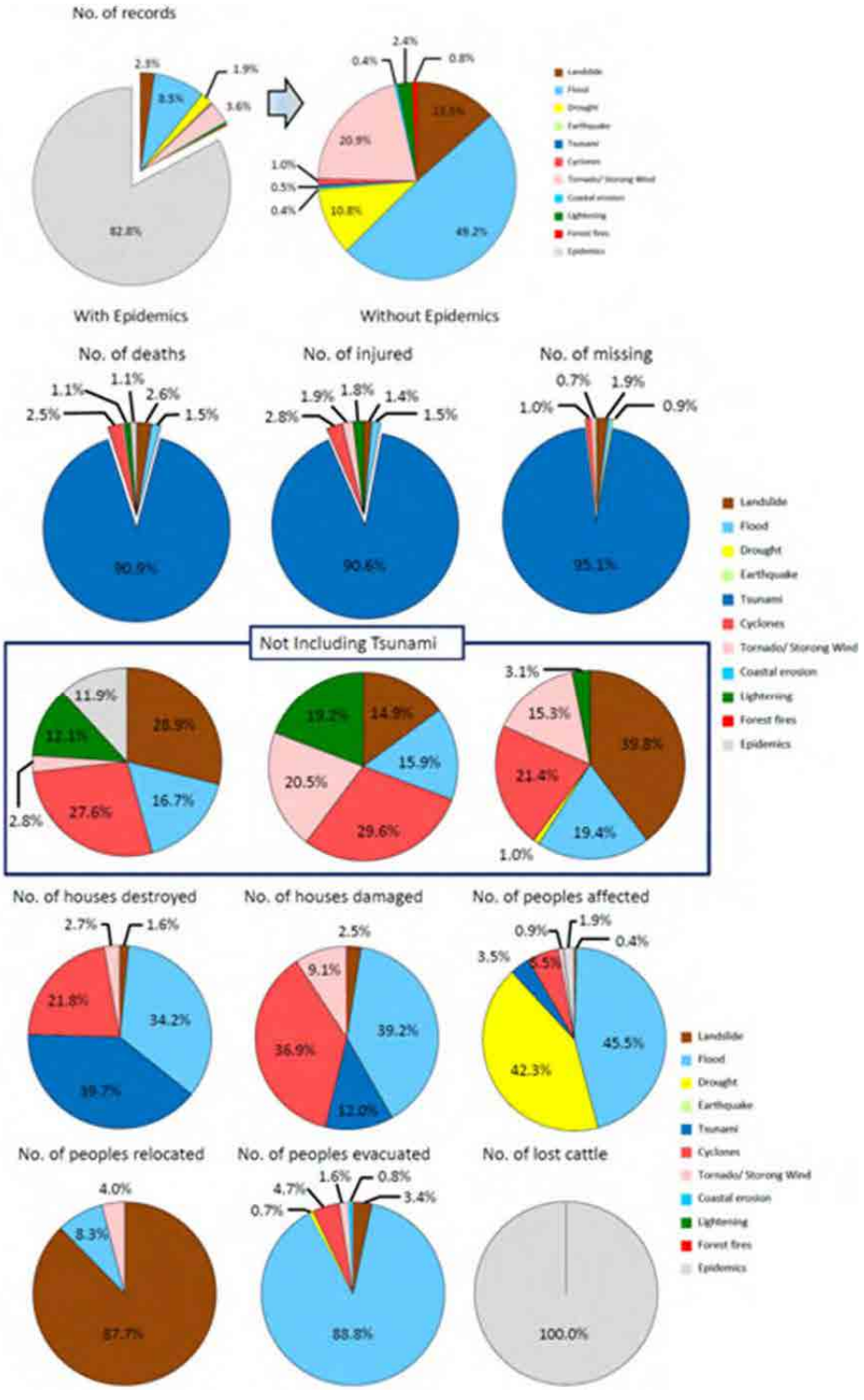
**Table 2-9 Impacts of Disasters**

| Disaster Type | Frequency | Area Spread | Loss and Damages | Impact on Population |
|---|---|---|---|---|
| Flood | Extremely High | Very High | Very High | Very High |
| Landslide | Very High | High | High | High |
| Drought | Very High | Very High | High | Very High |
| Tsunami | Rare | High | Very High | Extremely High |
| Earthquake | Rare | Significant | Significant | Significant |
| Cyclones | Rare | High | Very High | Very High |
| Tornado/ Strong Wind | Very High | High | High | High |
| Coastal Erosion | Rare | Significant | Significant | Significant |
| Lightning | High | High | Significant | Significant |
| Forest Fires | Rare | Significant | Significant | Significant |
| Epidemics | Extremely High | Very High | High | High |

Source: Sri Lanka National Disaster Management Plan 2013 – 2017 (Draft), Nov. 2012, modified

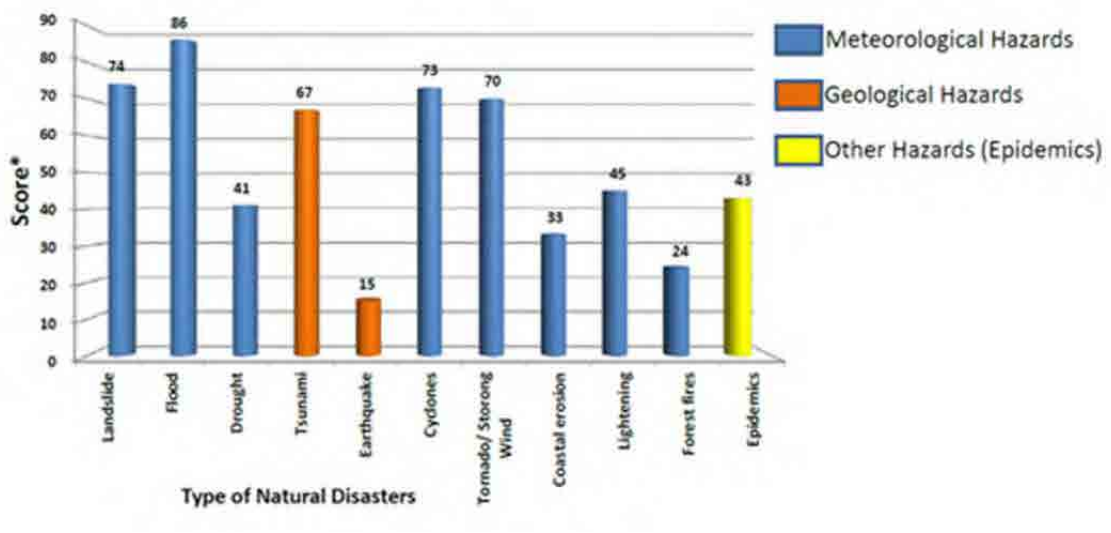
The scores of the impacts of respective types of disasters are estimated considering the order of the damage among respective types of disasters. The estimation results are shown in Annex 1-1 in this report and shown in Figure 2-3.

Flood disaster has the highest impact in the country and the impacts of the disasters due to landslides, cyclones and tornados/strong winds follow flood disaster. Tsunami disaster is the most devastating disaster in Sri Lanka. However, the frequency of tsunami is quite rare.




Data from DesInventar Sri Lanka, Recording Period from Jan/1974 to Sep/2012

**Figure 2-2 Impacts of Disasters**

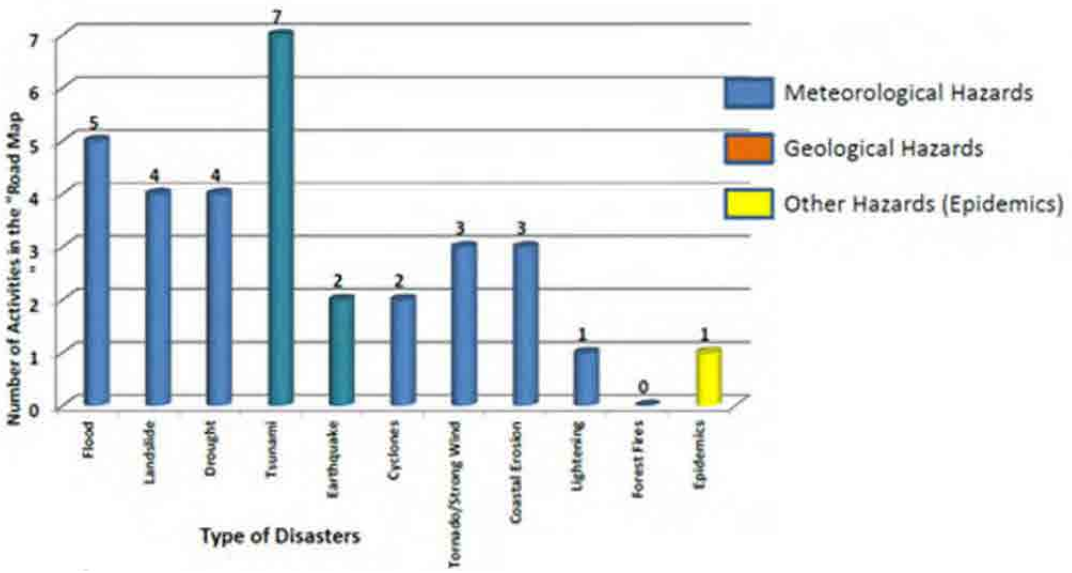



Source: DesInventar Sri Lanka, Recording Period from Jan/1974 to Sep/2012: modified JICA Survey Team

**Figure 2-3 Scores of Impacts of Disasters**

### 2.4.2 Priority of Disasters

The disaster management activities in Sri Lanka are being implemented in accordance with "the Road Map for Disaster Risk Management". The activities in the Road Map for the respective types of the disasters are summarized in Annex-5 and the numbers of the activities for the respective types of disasters are shown in Figure 2-4.




Source: DesInventar Sri Lanka, Recording Period from Jan/1974 to Sep/2012: modified JICA Survey Team

**Figure 2-4 Number of Activities in the "Road Map"**

The Road Map pays special attention to the disasters due to floods, landslides, drought and Tsunami.

### 2.4.3 Current Efforts, Future Direction and Discrepancies

Current efforts and future direction for the management of each type of disaster and the discrepancies between those are summarized in Annex 1-2.

### 2.4.4 Selection of Key Issues of Disaster Management

The impacts of the disaster, the national disaster priority and the discrepancies between the present management activities and the future direction are summarized as follows:

**Table 2-10 Summary of Disasters**

| | Landslide | Flood | Drought | Tsunami | Earthquake | Cyclones | Tornado/Strong Wind | Coastal Erosion | Lightning | Forest Fires | Epidemics |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Disaster Impact Order** | 2 | 1 | 8 | 5 | 11 | 3 | 4 | 9 | 6 | 10 | 7 |
| **National Priority Order** | 3 | 2 | 3 | 1 | 7 | 7 | 5 | 5 | 9 | 11 | 9 |
| **Discrepancy between the present efforts and the future direction** | G | G | S | S | S | S | S | S | S | S | S |
| Management Framework | G | G | S | | | | | | | | |
| Risk Assessment | G | G | | | | | | | | | |
| Early Warning | G | G | G | | | G | G | | S | S | |
| Response | S | S | S | S | S | S | S | S | S | S | S |
| Mitigation Works | G | G | | | | | | | | | |
| Awareness/ education | G | G | S | S | S | S | S | S | S | S | S |

Note: G: Great Discrepancy, S: Small Discrepancy

Source: DesInventar Sri Lanka, Recording Period from Jan/1974 to Sep/2012: modified JICA Survey Team

Based on the above summary, this survey will focus on the following issues and components.

**Table 2-11 Priority Issues and Components**

| | |
|---|---|
| Hazards | Flood, Landslide |
| Components of disaster management | • Management framework (coordination among the related government agencies, especially promotion of formulation and implementation of disaster preparedness and |

| | |
|---|---|
| | prevention)<br>• Early warning (meteorological observation),<br>• Response (search and rescue)<br>• Awareness (CBDRM) |

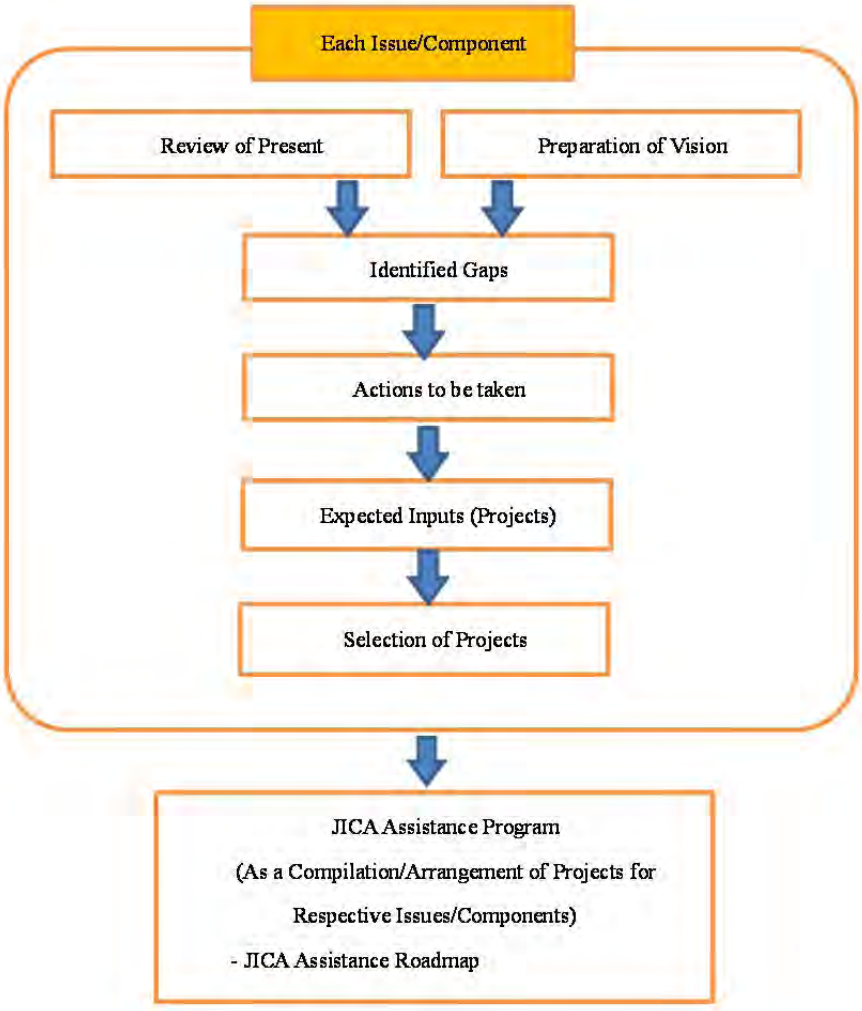
Source: JICA Survey Team

# 3. Assistance Program Formulation

## 3.1 Preparation Flow of Assistance Program

### 3.1.1 Preparation Flow

The JICA assistance program for the disaster management is prepared through the following processes:

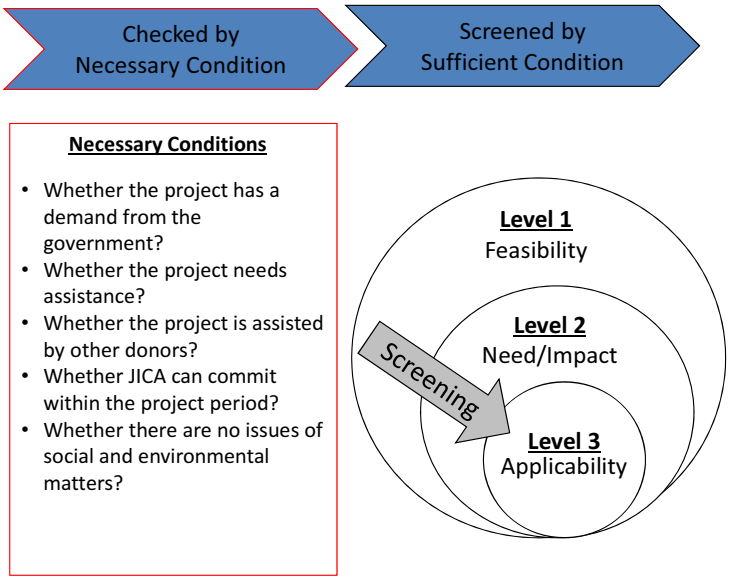



Source: JICA Survey Team

**Figure 3-1 Preparation Flowchart of JICA Assistance Program**

### 3.1.2 Selection Criteria

The candidate projects for each issue/component in the JICA assistance program will be selected through the following two steps:




Source: JICA Survey Team

**Figure 3-2 Selection of Candidate Projects**

The selection criteria of the sufficient condition are applied as follows:

**Table 3-1 Sufficient Condition in Detail**

| Screening Level | Criteria | Check point |
|---|---|---|
| Level 1: Feasibility | Feasibility | Whether the project goal can be achievable? |
| | Maturity | Whether the executive agencies are determined and coordinated? |
| | | Whether the executive agencies have enough capacity or the project has a capacity enhancement aspect? |
| | | Whether EIA is required for the implementation, or EIA is included in the project? |
| | | Whether land acquisition and resettlement are included in the project and is achievable before the project? |
| | Financial Status | Whether there is any other financial resource other than JICA? |
| Level 2: Need/Impact | Effectiveness | Whether the project is effective in terms of reducing the disaster? |
| | Efficiency | Whether the project is efficient in terms of time and/or finance? |
| | Impact | How beneficial is the project to the people of Sri Lanka? |
| | Sustainability | How sustainable is the benefit of the project or whether the project includes a component to secure sustainability? |
| Level 3: Applicability | Japan's experience | Whether Japan's experiences are applicable to the project in engineering and managerial aspects? |
| | Time Frame | Whether JICA can commit to the project in that time frame? |

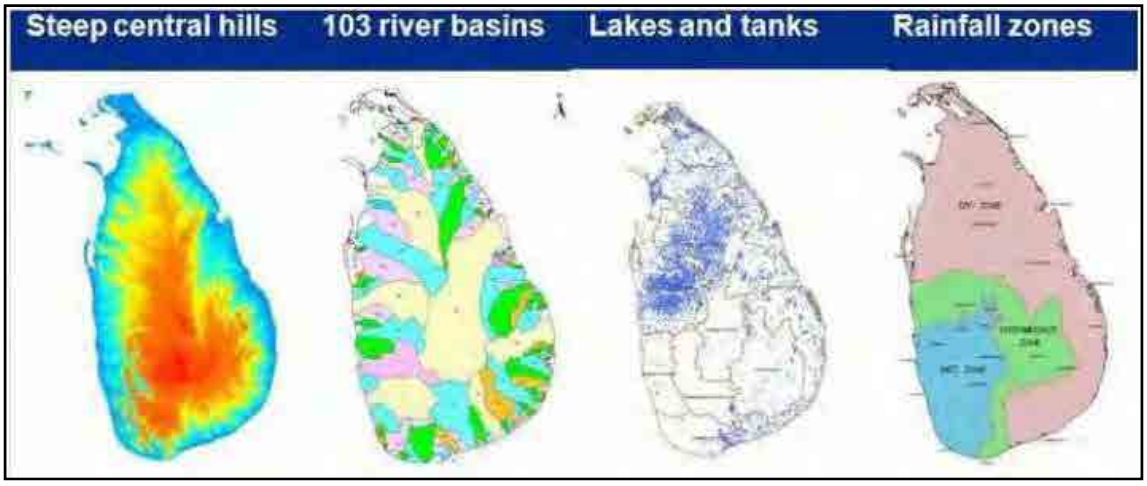
Source: JICA Survey Team

## 3.2 Flood Management

### 3.2.1 Present Condition

#### (1) Present Condition of Flood Disaster

The major basin characteristics in Sri Lanka are shown in Figure 3-3. It has 1) steep slopes in the central hilly region, 2) 103 river basins in total, 3) a lot of lakes and tanks nation-wide and 4) high annual rainfall in the south-east and low in the northern region.




Source：UNDAC "Disaster Response Preparedness Assessment Mission to Sri Lanka"*[3]

**Figure 3-3 Hydrogeological Characteristics in Sri Lanka**

On the other hand, the IPCC (Intergovernmental Panel on Climate Change) fourth assessment report in 2007 shows that future global warming makes temperatures rise in the whole of Sri Lanka and annual rainfall to rise in several regions. It is also reported that torrential rainfall will increase because of the changes of seasonal rainfall patterns and fluctuation ranges. Climate change will cause more serious flood damage in Sri Lanka.

In recent years, the Colombo metropolitan region and southern provinces had serious flood damage in April 2010. In addition, more than 50,000 houses were damaged and more than 1,200,000 people affected by several severe floods during Oct. 2010 to Feb. 2011. Roads of 18,237 km and 1,752 agriculture/irrigation facilities were damaged and one-third of the total rice products were lost by this flood. Then, Sri Lanka was forced to expend a huge amount on repair costs of USD 1 billion (2% of GDP) (See Table 3-2).

*Flood in 2011*

As seen in the situations caused by flood damage and the Indian Ocean tsunami in 2004, poor people who are living in low-lying areas, so-called socially disadvantaged people, are the most vulnerable to natural disasters. Natural disasters create bipolarization of income and social disparities. There is a huge expense required for the damage to the infrastructure and agriculture due to natural disasters. Damage due to natural disasters will also be a limiting factor in national development activities.

**Table 3-2 Status of Recent Major Floods in Sri Lanka**

| Year | Disaster Type | Deaths | Injured | Victims | Economic losses (USD) |
|---|---|---|---|---|---|
| 2003 | Flood | 235 | 0 | 695,000 | 29,000,000 |
| 2004 | Tsunami | 35,399 | 23,176 | 1,019,000 | 1,316,500,000 |
| 2005 | Flood | 6 | 29,000 (families) | 145,000 | - |
| 2006 | Flood | 25 | 72,000 (families) | - | - |
| 2007 | Flood, Landslide | 12 | - | 87,000 | - |
| 2008 | Flood | 23 | - | 418,000 | - |
| 2010 | Flood | 20 | - | 576,000 | - |
| 2010 ～2011 | Flood | 65 | 75 | 2,097,000 | 1,024,000,000 |

Source: Asian Disaster Reduction Center and others

Severe flood disasters occur almost every year in Sri Lanka which have caused a number of human and economic losses, and have been increasing in recent years. Table 3-3 shows flood damages in Sri Lanka after 2000.

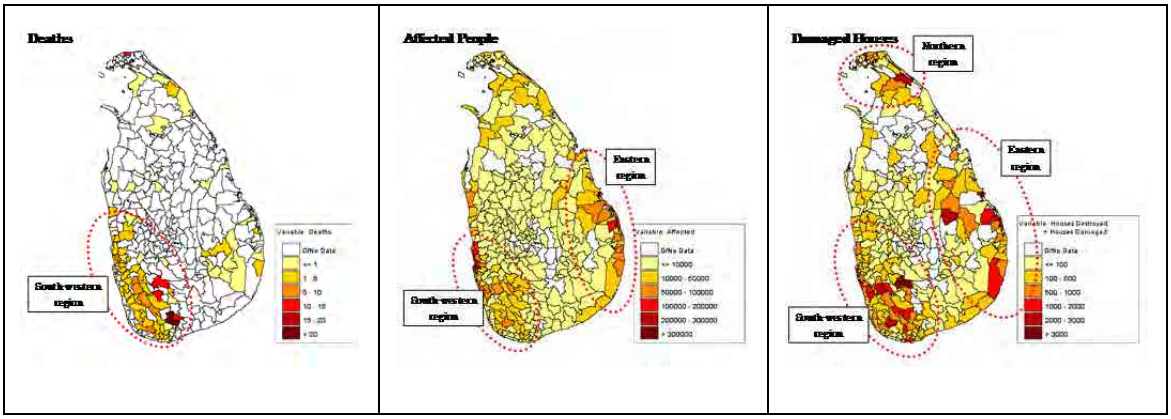
**Table 3-3 Flood Damages in Sri Lanka**

| Year | Deaths | Injured | Affected | Houses Destroyed | Houses Damaged |
|---|---|---|---|---|---|
| 2000 | 3 | | 264,521 | 731 | 1,404 |
| 2001 | | | 85,276 | 1,277 | 1,212 |
| 2002 | 1 | | 217,555 | 244 | 1,743 |
| 2003 | 151 | 94 | 733,479 | 7,797 | 24,084 |
| 2004 | 4 | | 340,068 | 1,002 | 4,795 |
| 2005 | 17 | 12 | 415,471 | 907 | 9,051 |
| 2006 | 34 | 22 | 605,903 | 1,334 | 5,412 |
| 2007 | 16 | 12 | 499,881 | 1,635 | 9,690 |
| 2008 | 44 | 11 | 1,262,306 | 1,305 | 6,323 |
| 2009 | 3 | 2 | 453,429 | 140 | 1,534 |

| Year | Deaths | Injured | Affected | Houses Destroyed | Houses Damaged |
|---|---|---|---|---|---|
| 2010 | 24 | 10 | 1,163,932 | 1,180 | 7,199 |
| 2011 | 69 | 81 | 2,524,402 | 9,144 | 37,839 |

Source: www.desinventar.lk (2000~2011 flood event)

The Magnitude of the floods can be understood by damages of deaths, affected, houses destroyed and houses damaged by floods. Using these indicators, spatial and time (year and month) distribution of flood damages are examined and summarized in Annex-6.




Source: DesInventar

**Figure 3-4 Spatial Distribution of Flood Damages**

The South-western and eastern region in Sri Lanka are mainly vulnerable to floods because of geographical and hydro-meteorological conditions. Serious flood damage occurred especially in May 2003, and January and February 2011 after 2000.

### (2) Flood Damages in Major River Basins

(Source: Preparatory Survey on Correspondence to Flood Damage in South/West Region and Climate Change Adaptation Interim Report, March 2011)

#### (a) Kelani River Basin

In the last 20 years, the biggest flood in the Kelani river basin occurred in June 1986 and damaged properties and infrastructures such as roads and bridges. Many cities along the river suffered from flood damage and the agricultural land of approximately 200 $km^2$ was inundated because of the flooding.

Torrential rainfall hit the Kelani River basin twice in about one month from the end of April to the beginning of June 2008. The second flood that occurred on May 30 to June 1 was larger than the previous one occurring on April 28. A very wide area from Hanwella to Kelanimulla

(Colombo side) and from Pugoda to Maluwana (Gampaha side) was inundated during both floods. The average inundation depth in the areas seems to be between 0.5 to 1.0 m in the basin during the two flood events.

In order to control the inundation of the downstream stretches during minor floods, several minor flood protection schemes (MFPs) have been constructed by ID. The city of Colombo and its suburbs adjacent to the north and south banks of the Kelani River are protected by flood bunds acting as major flood protection schemes.

### (b) Kalu River Basin

Ratnapura is most vulnerable to floods in the Kalu River basin. Serious floods occurred in 1913, 1940, 1941, 1947 and 2003. It is obvious that Flooding in the Kalu Ganga basin in May 2003 was serious in terms of flood damage. The total damage is thus estimated at approximately Rs. 73 million. The total rainfall depth from 16th to 18th May was recorded at 432.2 mm at Ratnapura.

Flood damage in May 2003 is summarized in Table 3-4.

**Table 3-4 Flood Damages in Kalu River basin in May 2003**

| Description | Status |
|---|---|
| Victims | 34,473 (families) |
| Death toll | 122 (people) |
| Refuge people | 30 (people) |
| People who lost house | 1,613 (people) |
| Fully damaged house | 2,544 (houses) |
| Partially damaged house | 8,683 (houses) |
| Damaged school | 47 (schools) |
| Damaged well | 4,452 (nos.) |

Source: F/S report on Kalu Ganga flood mitigation project (IDI, Nul. 2004)

The Kalu River basin has been hit by consecutive floods in April and May 2008. A large scale inundation occurred in the upstream area in the Ratnapura District. The 3-day rainfall from Apr. 27 to 29 reached 473 mm at Kukulegama and 258 mm at Ratnapura. The other significant flood occurred in the beginning of June 2008 brought about by heavy rainfall in the Kuda Ganga catchment. Therefore, the downstream area in the Kalutara District was widely inundated and suffered from damage to paddy fields household effects, etc.

No remarkable water resources development and flood mitigation measures are carried out in the Kalu River basin except projects on small scale irrigation development and the local water supply.

### (c) Gin River Basin

Significant floods in the Gin River basin occurred in 1979, 1993, 1999 and 2003. The May 2003 flood was the worst one. Until early morning on the 17th of May 2003, mainly the upstream area of the Gin River received heavy rainfall over 350 mm in the Sinharaja Forest. Flood water overtopped the flood bund at Nelwa around 20 km upstream from the river mouth and stagnated in three to four days.

Inland flood water could not drain out through the sluice gates because of the higher water level in the Gin River. Flood water of more than 2.0 m depth covered roads, it made it difficult to evacuate and 17 people were killed.

A flood protection scheme which included a levee system and some pumping stations was implemented in 1970s in the lower reaches of the river. In addition, the bypass canal Kapu Ela connected to the main stream at Holuagoda also discharges water flow into the Indian Ocean at Galle.

### (d) Nilwara River Basin

Significant floods in the Nilwara River basin were recorded in 1978, 1993, 1999 and 2003, and the May 2003 flood was the worst one. The Nilwara River basin was inundated widely in May 2003. It was reported that most of the pumping facilities did not work properly because of malfunction of submerged pumps and/or poor maintenance in routine operations. In Matara, inundation lasted for more than 10 days. It has been reported that approximately 8,000 people were evacuated.

Flood damage in May 2003 is summarized in Table 3-5.

**Table 3-5 Flood Damages in Nilwara River basin in May 2003**

| Description | Status |
|---|---|
| Damaged houses | 47,637 (houses) |
| Victims | 145,875 (people) |
| Fully damaged houses | 5,562 (houses) |
| Partially damaged houses | 2,138 (houses) |
| Death toll | Flood: 30 (people)<br>Landslide: 34(people) |
| Missing person | 17 (people) |
| Damaged well | 2,941 (nos.) |

Sources: Flood Report in 2003 (IDI, November 2004)

North of Matara city and its suburbs often get flooded during the rainy season. To cope with this

problem a flood protection scheme was initiated by ID in 1979 with assistance from the Government of France. This flood protection scheme included a levee system and three pumping stations.

### (3) Present Condition of Flood Mitigation

Different aspect of water resources management is being handled by a large number of national institutions. Some of the functions of these institutions include:

- Water resources planning and development
- Irrigation
- Flood control
- Agriculture
- Drinking water supply and sanitation
- Health

While water scarcity is not an immediate challenge, since the early 1990s the water demand has been increasing because of rapid urbanization and industrial development. Old and better management faces critical challenges, including a lack of policy clarity on resources development and allocation, the many overlapping institutions and laws in the sector, and absence of reliable data. A consensus emerged in the early 1990s on the need for a comprehensive policy to tackle these factors. In this context, a set of comprehensive water resources management (CWRM) projects assisted by the Asian Development Bank (ADB) was began in 1992, in order to streamline water resources management arrangements and introduce demand base management to the Sri Lanka. The guiding principles of the CWRM were that Sri Lanka's water resources management should be holistic and efficient in line with international concepts of the Integrated Water Resources Management (IWRM) and water as an economic good. Alongside a broad effort to make water resources management more integrated and sustainable, the new policy introduced a number of unfamiliar approaches to the sector, some of which were highly controversial including the idea of entitlements (ownership rights to water) and water tariffs to introduce demand management. The introduced policies caused fierce debate among the agencies concerned, politicians, medias and civil society groups about fears of commodification and privatization of water and threats to paddy cultivation and small farmers. As the results, the ADB funded projects were suspended in 2004 and the whole CWRM process remains in jeopardy.

Flood Protection Ordinance has been the only legal background of flood management activities for Irrigation Department. However, Irrigation Department is carrying out maintenance of flood protection facilities, while the ordinance stipulated that the maintenance work is under the

responsibility of Government Agents, flood early warning, and other flood management activities by practice basis without any legal backgrounds because Irrigation Department is the only organization that has technical capability to handle these important issues. In the Mahaweli River basin, flood management is also in the charge of the Mahaweli Authority. However, the authority does not have a specific section for flood management.

Following is an outline of the present condition of flood mitigation in Sri Lanka.

### (a) Management Framework

- Different aspects of water resources management are being handled by a large number of national institutions such as ID, MASL, CEB, NWS&DB, district secretariats, municipal councils/local authorities, SLLRDC, Agrarian Services Department and CC&CRMD.
- Similarly there is a large number of legislation dealing directly or indirectly with water management. However, the legal support and implementation strategies for flood mitigation are inadequate. The multiplicity of the institutions and legislation, and unclear responsibility and accountability are cited as reasons for these situations.

### (b) Risk assessment

- A flood event map in the south-western region was completed in 2012 and released to the public in December 2012. (http://www.hazard.lk/Maps/MFloods.htm)

### (c) Early warning

- Two (2) flood early warning systems are in place (Kelani and Kalu river basins) by ID
- Thirty six (36) AWS are in operation by DOM
- Hydro-meteorological data collection network and information system are being updated by DSWRPP.

### (d) Response

- National and district emergency response plans are being prepared.

### (e) Flood prevention works

- Aging and critical infrastructure facilities are being rehabilitated / improved by the Irrigation Department (ID), Disaster Management Centre (DMC) and district secretariats.
- Large dams are being rehabilitated by the Dam Safety and Water Resources Planning Project (DSWRPP).
- Delisting works of the dams are being done by the ID and Mahaweli Authority of Sri Lanka (MASL).

- Urban flood measures are being studied and implemented by ID, Sri Lanka Land Reclamation and Development Corporation (SLLRDC) and DMC.
- Integrated flood management master plans in south-western Sri Lanka were prepared. However, the master plans have not been authorized by the residents in the basins yet.

#### (f) Awareness/education

- Pilot project of school education is being carried out.
- CBDRM Plans of some communities are being prepared.

### 3.2.2 Future Vision

A number of efforts towards effective water and flood management have been made within each responsible agency. However, well coordinated basin-wide management has not been achieved yet.

The following "Future Vision" and short and long-term goals are desired for flood mitigation strategy in Sri Lanka.

#### (1) Overall goal

"One river, one plan, one management" concept is achieved at all river systems in Sri Lanka.

- Water resources of a river system are managed by the well coordinated management system based on a well integrated plan in accordance with the National Physical Planning Policy and Plan.
- The residents in the basin are aware of flood hazards and live with floods calmly.

#### (2) Short-term goal (after 5 years)

- Flood risks in the country will be identified and the priority basin of the flood mitigation in country will determined in consideration of national development policies and plans.
- 1/2 of the critical flood mitigation structures will be rehabilitated.
- The comprehensive flood mitigation plan of the priority basin will be formulated based on the consensus among the related agencies and public.

#### (3) Long-term goal (after 10 years)

- The flood mitigation works of 1/3 of the flood prone basins will be started in accordance with comprehensive flood mitigation plans based on the consensus among the related agencies and public.

### 3.2.3 Major Gaps

Throughout the history of Sri Lanka, water has played a key role in development of the country and economic status of its people, and in shaping its culture and the tradition. For more than 2,500 years, the Sri Lankan's civilization, which developed on the basis of irrigation technology, inherited a legacy of unsurpassed know-how in the technology of building tanks and irrigation canals. Admirable lesson of water from the history is presented in the well known wording by King Parakramabahu "Utilize Every Drop of Water Coming from the Rain without Letting it to Waste into Sea". In line with these, at present over 80% of the surface water in the Sri Lanka is used by the irrigation sector and 60% of people reliant on the paddy cultivation.
At present, there are many agencies concerned with the water resources management, such as MIWRM, DOI, MASL, CEB, NWS&DB, Agrarian Services Department, SLLRDC, District Secretariats and LOs.

Rapid urbanization in Sri Lanka leads uncontrolled housing developments in flood prone areas in recent years. Urbanizing in lowland areas has made them more vulnerable to floods and will be cause of increasing of flood damages. In addition, development activities without conservation of flood retarding/retention function in upper basin will also because of increasing of flood damages in lower basins.
Regional development without adequate flood management will be the cause of a flood catastrophe such as the mega flood disaster 2011 in Thailand.
Major gaps between the present condition and future Vision are examined and identified as follows:

- Un clear agency and coordination framework for Basin-wide flood management

Therefore,

- Insufficient policy/consensus making for floods among the residents in the basin
- Insufficient overall flood risk assessment in the country
- Insufficient coordination among flood mitigation, urban development and land use
- Insufficient proactive/critical structural measures against floods
- Insufficient provision of Flood Early Warning System (FEWS) including research activities
- Insufficient progress of Community Based Disaster Management (CBDRM) Plans

- Un clear agency and coordination framework for Basin-wide flood management

In Sri Lanka, different organizations have been implementing river management with their respective roles. For example, floods and water use for irrigation are managed by ID, NWSDB is in charge of water supply, and reservoirs for hydro-power generation are under the

management of CEB. As a result, river water has been managed with the organization's own interest and a responsible agency who manages the river water with the consolidated manner is unclear.

- Insufficient policy/consensus making for floods among the residents in the basin

Water management in Sri Lanka has a long history over two millenniums. Therefore, the Sri Lankan culture of water-use also plays an important role in flood management. Water is a free economic good especially for farmers in Sri Lanka, so that consensus building in water management including flood management among local residents is also an important subject, because water-users have paid very much attention to water.

In addition, urbanizing in lowland areas has made them more vulnerable to floods in recent years. Adaptation of non-structural measures, such as the establishment of early warning systems, will be needed in order to minimize the flood damage under the flooding condition. How to make a consensus of what local residents reducing flood damages in the region is an important subject.

- Insufficient overall flood risk assessment in the country

Flood damages in Sri Lanka occur almost every year but actual flood damages and conditions are not clarified well. Assessments for actual flood damages and social/economical impact are insufficient. Results of flood risk assessment such as flood risk map and flood hazard map will be a strategic tool for flood management plan, evacuation plan and so on. Nationwide flood risk assessment is desired immediately.

- Insufficient coordination among flood mitigation, urban development and land use

Flood damages in Sri Lanka occur almost every year but actual flood damages and conditions are not clarified well. Assessments for actual flood damages and social/economical impact are insufficient. Results of flood risk assessment such as flood risk map and flood hazard map will be a strategic tool for flood management plan, evacuation plan and so on. Nationwide flood risk assessment is desired immediately.

- Insufficient coordination among flood mitigation, urban development and land use

Conservation of forestation and natural retarding area in the basin, provision of flood control pond within the development area, planning of land-use and basin/urban development following the basin flood management concept, these actions are important to prevent the increasing of flood damages. Urban drainage plan to solve inundation problems should follow the flood

management master plan after the setup of the basin-wide master plan.

Rapid population growth and urbanization in low lying areas has made them more vulnerable to floods and will be cause of increasing of flood damages. Timely appropriate actions are required to prevent the further flood damages.

- Insufficient proactive/critical structural measures against floods

Major flood protection schemes in Kelani, Gin and Nilwara River Basin were implemented before 1980's. And no other new major flood protection schemes have been implemented after that. Flood control structures of these major flood protection schemes such as dike, sluice gate and drainage pump are aged and need replacement and/or rehabilitation to ensure its functions.

Commonly, tanks (dam reservoir) in Sri Lanka, which were constructed mainly for water resources development, play an important role for flood mitigation because it also has a flood control volume. Many tanks are aged and required rehabilitation to ensure the safety.

- Insufficient provision of Flood Early Warning System (FEWS) including research activities

It is desired that enhancement and utilization of hydrological data for flood management by using the results of "Hydro-meteorological Information System Improvement (DSWRPP)".

While aggressive structural measures for flood control can not be expected, development and expansion of flood early warning systems as a non-structural measures to mitigate flood damage is desired.

- Insufficient progress of Community Based Disaster Management (CBDRM) Plans

Flood early warning systems as a non-structural measures to mitigate flood damages can function properly with community activities such as safe evacuation, shifting household goods to safe place. Then, mitigation of flood damage can be achieved with appropriate community disaster management plan and evacuation activity of the community.

Sustainable enhancement of community based disaster management activity is required to minimize flood damages with developments of community disaster management plan and flood early warning systems.

### 3.2.4 Required Actions and Projects

Required actions for flood management in the following areas, which are classified in the Hyogo Framework for Action (HFA), were examined based on present conditions, Vision and major gaps for flood management.

- HFA 1: Governance
- HFA 2: Risk Identification, Assessment, monitoring and early warning
- HFA 3: Use knowledge, innovation, education, build culture
- HFA 4: Reduce the underlying risk factors
- HFA 5: Preparedness for effective response and recovery

Consequently, Annex 8-1 shows the required actions for flood management with the proposed implementation time frame. Candidate projects with an approximation time frame and budget are also summarized in Annex 8-2.

### 3.2.5 Selection of the Projects

Future JICA assistant projects in the flood mitigation field are examined and tentatively selected among the candidate projects by using the selection criteria mentioned in Section 3.1.

Consequently, the following three (3) projects have been tentatively selected and an outline of the projects is shown in Annex 8-4.

Program for mitigation countermeasures for critical infrastructures against flood disasters:

- Project on Comprehensive Flood Management for Priority Basins **(F02 & F10)**
  (Coordination framework, master plan, urgent construction works)
- Urban Drainage Improvement Project in Priority Basins together with Urgent Rehabilitation Plan for aged Flood Mitigation Structures **(F 02 + F05 & F 10 & F13)**
  (Coordination framework, plan, urgent construction works)

Program for flood disaster mitigation capacity development:

- Nationwide Flood Risk Assessment for Disaster Management Plans **(F 07)**

It is noted that the "Project on Comprehensive Flood Management for Priority Basins" requires high motivation and ownership by the Government of Sri Lanka especially for establishment of a basin-wide coordination framework.

**Table 3-6 List of Proposed Projects (Flood Management)**

| Outline of Candidate Projects |
|---|
| (a) Comprehensive Flood Management Master Plan for 1st Priority River Basins- together with Urgent Rehabilitation Plan for aged Flood Mitigation Structures<br>(Tentative priority basins: South-Western Region or Eastern Region)<br>(i) Purpose<br>－To establish suitable coordination frameworks for flood mitigation at central level and basin level |

- To formulate feasible and appropriate flood management master plan together with the coordination bodies
- To formulate urgent rehabilitation plan for aged flood mitigation structures
- Implementation of project(s) based on the
  "Comprehensive Flood Management Master Plan" and
  "Urgent Rehabilitation Plan for aged Flood Mitigation Structures"

(ii) Activities

- Preparation of coordination frameworks for flood management at central level
- Preparation of coordination frameworks for flood management at basin level
- Policy/consensus making against flood among the residents and local communities such as farmer's organization in the basin
- Formulation of comprehensive flood management master plan
  - for South-western region: Revision of Flood Management Plan for Kelani, Kalu, Gin and Nilwara Rivers
  - for Eastern region: Review of Flood Mitigation in Ampara & Batticaloa Districts of Sri Lanka (DMC/UNDP)
  - Structural measures:

  Proactive/critical structural measures against flood (structural measure)
  - Non-structural measures:

  Provision of FEWS

  Preparation of CBDRMPs for pilot communities
  - Selection of priority project(s)
  - Feasibility study on priority project(s)
  - Preparation of implementation program for priority project(s)
- Formulation of urgent rehabilitation plan for aged flood mitigation structures and implementation program
  - Inventory study on aged flood mitigation structures
  - Review of basic flood management strategies for structures
  - Selection of priority structures for urgent rehabilitation
  - Preparation of implementation program for urgent rehabilitation
  - Detailed Design on selected priority structures for urgent rehabilitation
- Detailed Design and Implementation of Project(s) on "Comprehensive Flood Management Master Plan for 1st Priority River Basins"
- Implementation of "Urgent Rehabilitation Plan for aged Flood Mitigation Structures"

(iii) Outputs

- Coordination frameworks for flood mitigation at central, basin and local levels
- Comprehensive flood management master plan 1st priority river basins
- Urgent rehabilitation plan for aged flood mitigation structures
- Flood mitigation structural measures
- FEWS
- CBDRMPs for pilot communities

  Strengthening of existing flood mitigation structures (Rehabilitated structures)

(b) Urban Drainage Improvement Plan in Selected Cities

| |
|---|
| (Priority cities in 1st priority basins)<br>(i) Purpose<br>− To formulate feasible and appropriate drainage improvement plan together with flood mitigation coordination bodies<br>− Implementation of project(s)<br>(ii) Outputs<br>− Drainage improvement plan for selected cities<br>− FEWS<br>− CBDRMPs for pilot communities<br>− Flood mitigation structural measures |
| (c) Nationwide Flood Risk Assessment for Disaster Management Plans<br>(i) Purpose<br>− Update the topographic maps in flood prone areas, including land use<br>− Update flood hazard map of flood prone basins<br>− Provision of district DM plans<br>(ii) Outputs<br>− Nationwide DEM<br>− Preliminary flood simulation model<br>− FHMs and/or Flood Risk Maps<br>− District DM plans for selected districts |

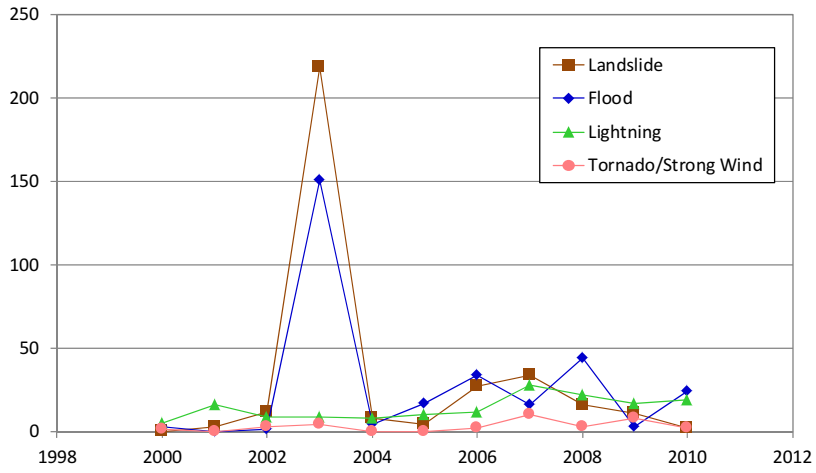
Source: JICA Survey Team

## 3.3 Sediment-related Disaster Management (including Landslides)

### 3.3.1 Present Condition

#### (1) Current status of landslide occurrences

Figure 3-5 shows the number of deaths by disasters from 2001 to 2010 excluding the tsunami disaster in 2004 in order to analyze the current status of natural disasters in Sri Lanka.




Source：Disaster Information Management System (http://www.desinventar.lk/), DMC

**Figure 3-5 Number of Deaths in the Top 4 Disasters (except Tsunami Hazard)**

Sediment-related disasters have frequently occurred in mountainous areas of the central and southwest part of the country due to heavy rain, fragile geological conditions and topographic conditions on steep slopes, as well as uncontrolled development and adverse land use. They affect human, houses, national roads, and other important infrastructures.

The event of heavy rain in May 2003 caused a number of sediment-related disasters with 150 deaths and 20,000 people affected. In addition, the damage of infrastructures such as roads, information systems, electricity networks and irrigation facilities was severe.

Floods and sediment-related disasters occurred in December 2010 to February 2011 in five (5) provinces including eastern province, central Provinces and Uva Province, caused serious damages to residents and economic activities. For these reasons the government of Sri Lanka has commenced countermeasures for sediment-related disasters.

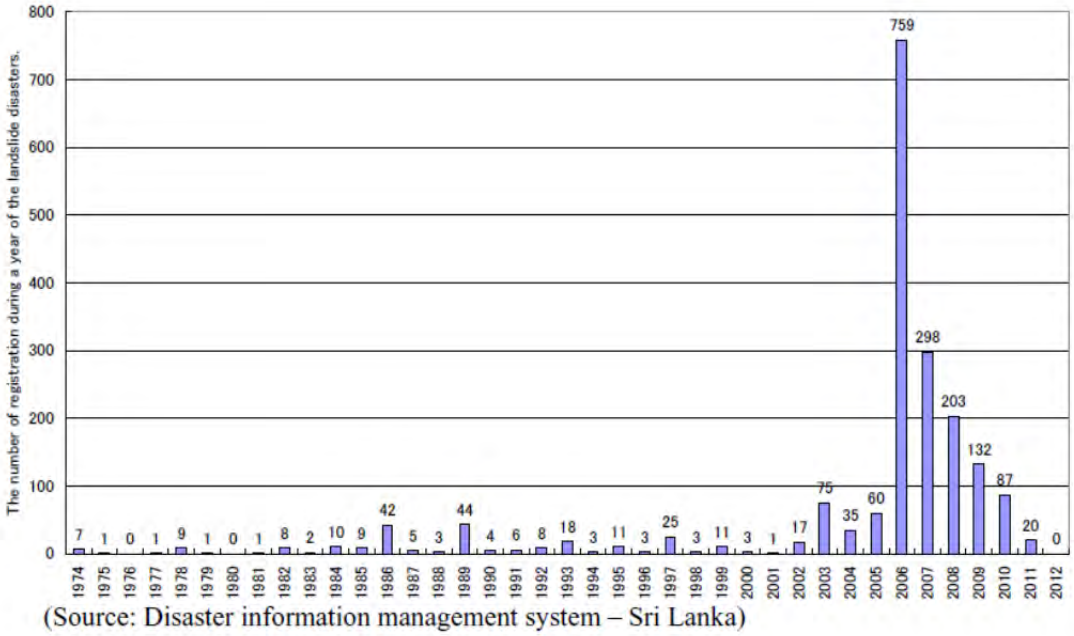
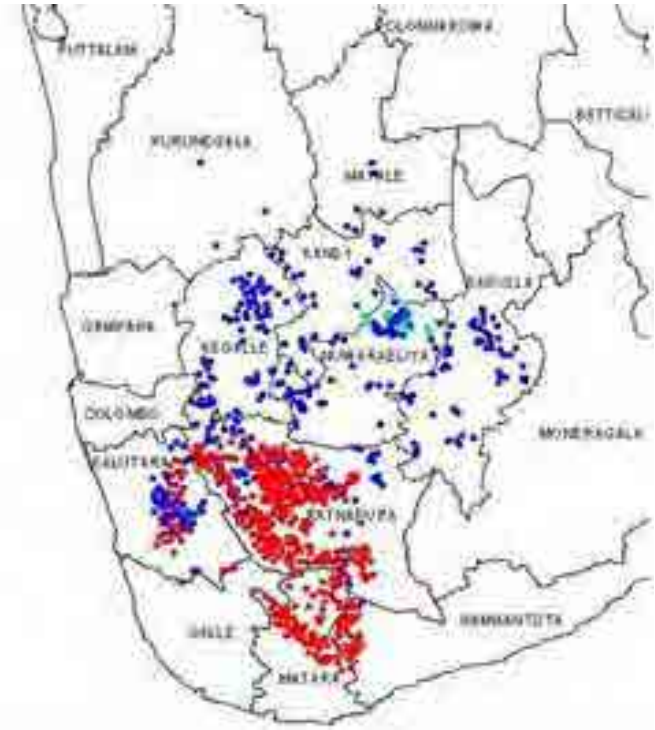



**Figure 3-6 Number of Landslide Occurrence in Main 7 Provinces**



Source: NBRO

**Figure 3-7 Location of Reported Landslides 1947-2010**

Figure 3-6 shows the number of sediment-related disasters in 1974 to 2012 in 7 main provinces. According to the Figure, 49 landslides occurred per year and 759 landslides

occurred in 2006 (The details are not clear.). From 2007 to 2012, the number of sediment-related disasters goes up to 700 times and affected 2,200 houses, and the number of disaster victims reached 34,000 people.

Figure 3-7 shows the location of reported landslides from 1947-2010, they are concentrated in the south-western region of mountainous areas. Photo 1 shows the landslide that occurred in November 2012 along the Southern Expressway. Thus sediment-related disasters have affected important infrastructures and economic activities.

According to the data of RDA , along the A Rank national highways (the highest priority highways) in sediment-related disaster risk areas, there are 6 sites of rank C (the highest priotity areas for sediment-related disasters), and 10 sites of rank B (higher priority areas) and also 23 sites of rank A (high priority areas ).

Road closures caused by sediment-related disasters have been occurring frequently up to now, and the road closures have affected social life and economic activities especially in the sites of rank B and C of sediment-related disaster risk areas.

Table  shows the records of sediment-related disasters occurred on the major national highways of rank A in 2003 - 2012 .

According to these tables, road closures have often occurred because of sediment-related disasters along the national highways, and they took several days for rehabilitation works.

Source: NBRO

**Figure 3-8 Landslide in Southern Expressway on Nov.02 2012**

## Table 3-7 High Risk Areas of National Roads (Rank A ～ Rank C)

| | No | Route No | Name of the Road | Location | | Rank | EE Division | District |
|---|---|---|---|---|---|---|---|---|
| | | | | Start (km) | End (km) | | | |
| 1 | A004-134 | A004 | Colombo - Ratnapura - Wellawaya - Baticaloa | 134/15 | 134 | A | | Ratnapura |
| 2 | A004-162 | A004 | Colombo - Ratnapura - Wellawaya - Baticaloa | 162/8 | | A | | Ratnapura |
| 3 | A004-185 | A004 | Colombo - Ratnapura - Wellawaya - Baticaloa | 185/6 | | A | Bandarawela | Badulla |
| 4 | A004-193 | A004 | Colombo - Ratnapura - Wellawaya - Baticaloa | 194/11 | | A | Bandarawela | Badulla |
| 5 | A004-196 | A004 | Colombo - Ratnapura - Wellawaya - Baticaloa | 196+300 | 196+800 | A | Bandarawela | Badulla |
| 6 | A005-042 | A005 | Peradeniya - Badulla - Chenkalladi | 43/1 | 43/6 | A | Nuwara Eliya | Nuwara Eliya |
| 7 | A005-082 | A005 | Peradeniya - Badulla - Chenkalladi | 82+100 | 82+700 | A | Bandarawela | Badulla |
| 8 | A007-042 | A007 | Avissawella - Hatton - Nuwara Eliya | 42/14 | | A | Nuwara Eliya | Nuwara Eliya |
| 9 | A007-047 | A007 | Avissawella - Hatton - Nuwara Eliya | 47 | 48/1 | A | Nuwara Eliya | Nuwara Eliya |
| 10 | A007-069 | A007 | Avissawella - Hatton - Nuwara Eliya | 68 | 69/1 | A | Nuwara Eliya | Nuwara Eliya |
| 11 | A021-020 | A021 | Kegalle - Bulathkohupitiya - Karawanella | 19+800 | 20+000 | A | Ruwanwella | Kegalle |
| 12 | A026-027 | A026 | Kandy - Mahiyangana - Padiyatalawa | 27 | 28/1 | A | Kadugannawa | Kandy |
| 13 | A026-029 | A026 | Kandy - Mahiyangana - Padiyatalawa | 29 | 30/1 | A | Kadugannawa | Kandy |
| 14 | A026-036 | A026 | Kandy - Mahiyangana - Padiyatalawa | 36 | 37/1 | A | Kadugannawa | Kandy |
| 15 | A026-045 | A026 | Kandy - Mahiyangana - Padiyatalawa | 46/2 | 46/3 | A | Nuwara Eliya | Nuwara Eliya |
| 16 | A026-048 | A026 | Kandy - Mahiyangana - Padiyatalawa | 48/9 | 48/10 | A | Nuwara Eliya | Nuwara Eliya |
| 17 | A026-049 | A026 | Kandy - Mahiyangana - Padiyatalawa | 50/4 | 50/5 | A | Nuwara Eliya | Nuwara Eliya |
| 18 | A026-051 | A026 | Kandy - Mahiyangana - Padiyatalawa | 51/1 | 51/2 | A | Nuwara Eliya | Nuwara Eliya |
| 19 | A026-055 | A026 | Kandy - Mahiyangana - Padiyatalawa | 55/4 | 55/6 | A | Nuwara Eliya | Nuwara Eliya |
| 20 | A026-056 | A026 | Kandy - Mahiyangana - Padiyatalawa | 56 | | A | Nuwara Eliya | Nuwara Eliya |
| 21 | A026-058 | A026 | Kandy - Mahiyangana - Padiyatalawa | 58/2 | 58/4 | A | Nuwara Eliya | Nuwara Eliya |
| 22 | A026-060 | A026 | Kandy - Mahiyangana - Padiyatalawa | 60/3 | 60 | A | Nuwara Eliya | Nuwara Eliya |
| 23 | A113-010 | A113 | Gampola - Nawalapitiya | 16/5 | 11/3 | A | Ruwanwella | Kegalle |
| 24 | A004-154 | A004 | Colombo - Ratnapura - Wellawaya - Baticaloa | 154/7 | | B | | Ratnapura |
| 25 | A004-173 | A004 | Colombo - Ratnapura - Wellawaya - Baticaloa | 173/11 | | B | Bandarawela | Badulla |
| 26 | A004-174 | A004 | Colombo - Ratnapura - Wellawaya - Baticaloa | 175/1 | 175/3 | B | Bandarawela | Badulla |
| 27 | A005-043 | A004 | Colombo - Ratnapura - Wellawaya - Baticaloa | 43/8 | 43/9 | B | Nuwara Eliya | Nuwara Eliya |
| 28 | A005-044 | A005 | Peradeniya - Badulla - Chenkalladi | 44/2 | 44/3 | B | Nuwara Eliya | Nuwara Eliya |
| 29 | A005-063 | A005 | Peradeniya - Badulla - Chenkalladi | 63/3 | | B | Nuwara Eliya | Nuwara Eliya |
| 30 | A007-031 | A007 | Avissawella - Hatton - Nuwara Eliya | 31/1 | 31/2 | B | Ruwanwella | Kegalle |
| 31 | A007-045 | A007 | Avissawella - Hatton - Nuwara Eliya | 45 | | B | Nuwara Eliya | Nuwara Eliya |
| 32 | A007-054 | A007 | Avissawella - Hatton - Nuwara Eliya | 54/1 | | B | Nuwara Eliya | Nuwara Eliya |
| 33 | A007-057 | A007 | Avissawella - Hatton - Nuwara Eliya | 57/9 | | B | Nuwara Eliya | Nuwara Eliya |
| 34 | A005-046 | A005 | Peradeniya - Badulla - Chenkalladi | 46/5 | 46/6 | C | Nuwara Eliya | Nuwara Eliya |
| 35 | A005-091 | A005 | Peradeniya - Badulla - Chenkalladi | 91+019 | | C | Bandarawela | Badulla |
| 36 | A005-135 | A005 | Peradeniya - Badulla - Chenkalladi | 135+200 | 135+700 | C | Bandarawela | Badulla |
| 37 | A005-167 | A005 | Peradeniya - Badulla - Chenkalladi | 168/8 | 168/9 | C | Bandarawela | Badulla |
| 38 | A016-010 | A016 | Beragala - Hali Ela | 10/12 | 11/1 | C | Bandarawela | Badulla |
| 39 | A113 -015 | A113 (AB013) | Gampola - Nawalapitiya | 16/5 | 16/6 | C | Kadugannawa | Kandy |

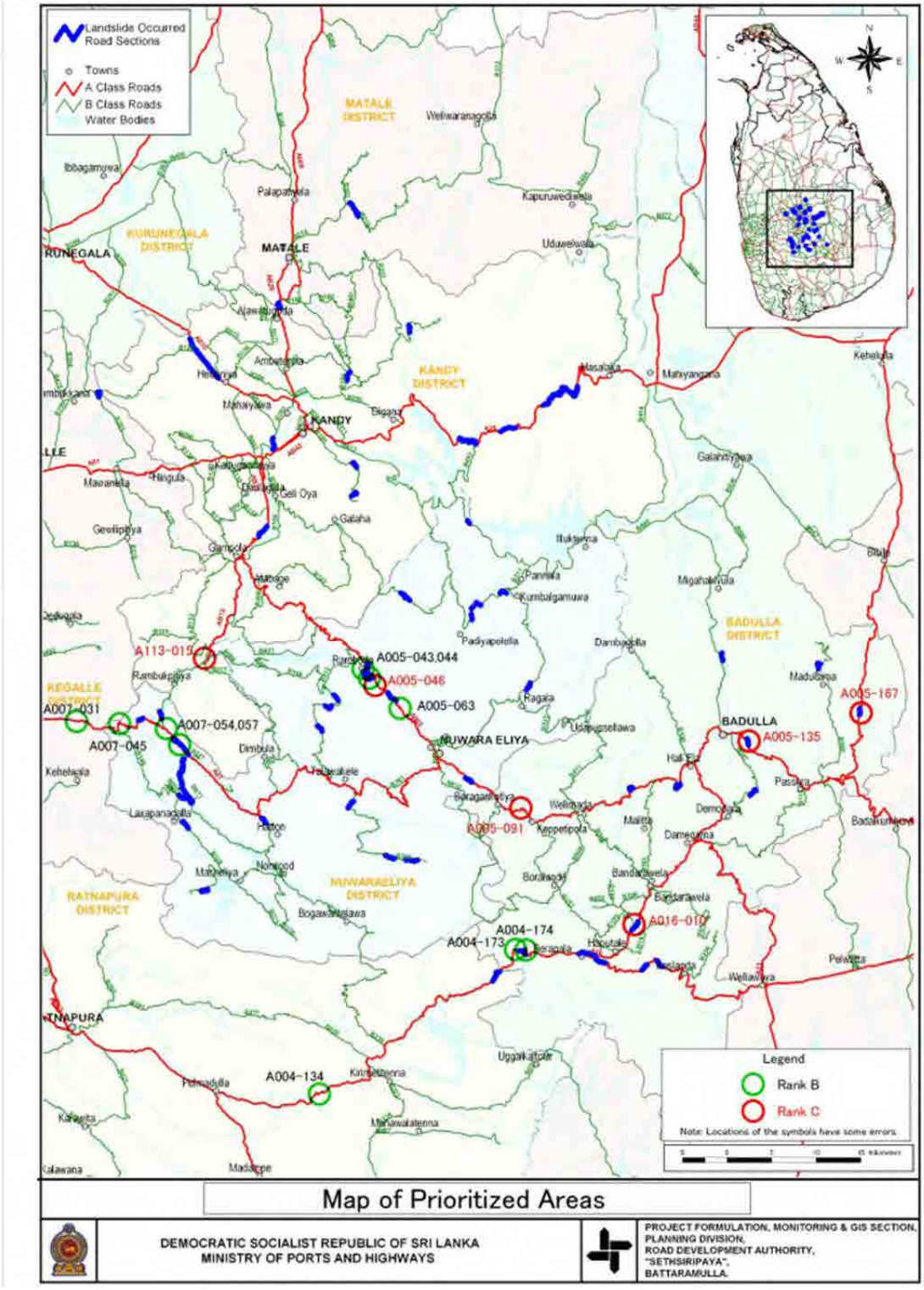
Note: Rank A: Risk Areas of National Roads for Disaster Management
Rnak B: Priority Areas of National Roads for Disaster Management
Rank C: High Priority Areas of National Roads for Disaster Management

Source: RDA

## Table 3-8 Landslide Records (from 2003 to 2012)

| No. | Day/Month/Year of the Road disaster | Type of the Landslide Disaster | Volume/Length of Landslide | Duration of Road Closure | Expenditure for Recovery Rs. (Mn) | Remarks |
|---|---|---|---|---|---|---|
| A004-134 (Rank A) | 05-Oct-02 | Rockfall | 2.5dia rockfall | 0.5 day | 0.5 | |
| | 16-Jul-08 | Rockfall | 1dia rockfall | 0.5 day | 0.5 | |
| | 18-Dec-09 | Rockfall | 1.2dia rockfall | | 0.2 | |
| | 10-Jan-11 | Landslide | 20m Length rock | | 0.2 | |
| A005-162 (Rank A) | 12-Oct-02 | Rockfall & Landslide | 60m along the road | 3days | 7.0 | Four houses damaged |
| | 16-Jul-08 | Rockfall | 50m along the road | 1day | 1.0 | |
| A007-031 (Rank B) | 01-Aug-97 | Wash away of the Road Side and collapse of Rock & Boulders form High side | 45m along the Road | 02 days | 2.0 | Earth shoulder damages & Road Side and Carriageway become Unstable |
| A005-091 (Rank C) | 01-Nov-11 | Rock fall & sliding of soil from the embankment | 70 m along the road | 5 Days one side and 1 day both sides | - | |
| A005-167 (Rank C) | 12-Jan-05 | Lunugala Landslide | 300m | | 5.0 | Road was never closed due to the landslide |
| A016-010 (Rank C) | 20-Nov-10 | PBC 2nd mile post landlslide | 44m | | 2.0 | Road was never closed due to the landslide |
| A113-015 (Rank C) | 01-Jun-93 | Gampola - Nawalapitiya Road between Culvert 16/4 and 16/5 landslide Damage the Road | 45m along the road | 10days | 20.0 | It is moving in rainy season |

Source: RDA



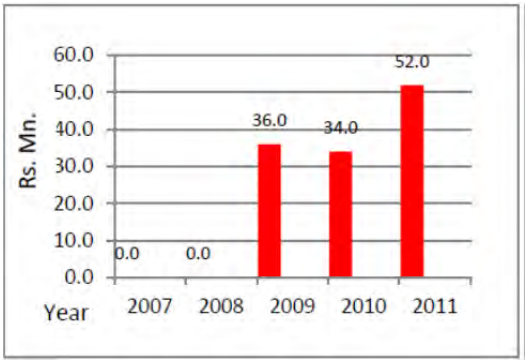

Source: RDA

**Figure 3-9 Map of High Risk Areas of National Roads (Rank B and Rank C)**

### (2) Policy, Plan, Budget and Organization

In order to sustain an 8% economic growth rate, Sri Lanka implemented a policy which aims to improve and expand the national road network as a national basic policy. In these days, it is important to strengthen the capacity of disaster management in order to protect infrastructures and the livelihood of residents from floods and sediment-related disasters. Especially, it is important to strengthen the capacity of sediment-related disaster management in order to avoid the impact of excessive precipitation to road networks in mountainous areas.

According to Figure 3-10 the budget of countermeasures for sediment-related-disasters in NBRO has been increased after 2009, and the institutional framework has been strengthened.




Source: NBRO

**Figure 3-10 Budgets of Countermeasures for Sediment-related Disasters in NBRO**

The National Building Research Organization: Building Research Institute (NBRO) was established in 1984. There are six (6) engineering departments and three (3) administrative departments in the NBRO. After an organizational change in 2007, the NBRO has been under the MDM.

Surveys for sediment-related disasters have been conducted since 1988, and the LSSD (Landslide Studies and Service Division) is in charge of measures for sediment-related disasters.

Activities by the LSSD focus on assessment for sediment-related disaster prone areas at the moment. It will be important to develop a scientific analysis for mechanisms of sediment-related disasters, monitoring and analysis in LSSD in order to conduct early warning systems and countermeasures for sediment-related disasters.

**Table 3-9 The Number of Engineers of LSSD (2012)**

| Position | Required Number | Member |
|---|---|---|
| Director | 1 | 1 |
| Senior Scientist | 7 | 5 |
| Scientist | 37 | 18 |
| Technical officer | 2 | 7 |
| Technical Assistant | 17 | 6 |
| Management Assistant/ Field Assistant | 19 | 9 |
| Driver | 14 | 5 |
| Semi Skilled Labor | 0 | 1 |
| Unskilled Labor | 18 | 6 |
| Total | 115 | 58 |

Source: NBRO

### (3) Institutional framework, facilities and techniques for sediment-related disasters

#### (a) Technical Guidelines

In collaboration between RDA and NBRO, "Guidelines for construction in landslide prone areas (Technical Guidelines)" have been prepared, and they are promoting the strengthening of sediment-related disaster countermeasures in projects of road construction and improvement. The use of guidelines is in an experimental period at the moment.

#### (b) Types of Sediment-related Disasters

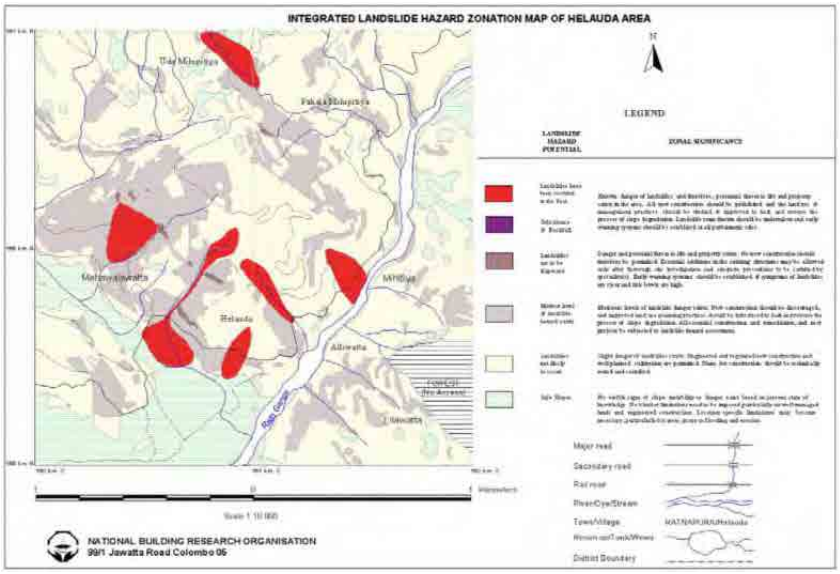
Sediment-related disasters are generally classified into three types, (1) debris flow, (2) landslides and (3) slope collapse. Types of countermeasures for each classification are also different (see Table 3-10). However, in Sri Lanka, sediment-related disasters have not been classified. They have been classified as only one type, which are landslides.

#### (c) Priority of Sediment-related Disasters

Analysis of the current status of damage (type and size of disasters, economic impacts, etc.) on major infrastructures such as national highways from sediment-related disasters has just commenced in target areas of ten (10) provinces. Along the targeted national highways, a priority (Rank A to C) of each sediment-related disaster countermeasure has been given. However, the criteria of prioritization should be refined to expand projects on countermeasure works for sediment-related disasters throughout Sri Lanka.

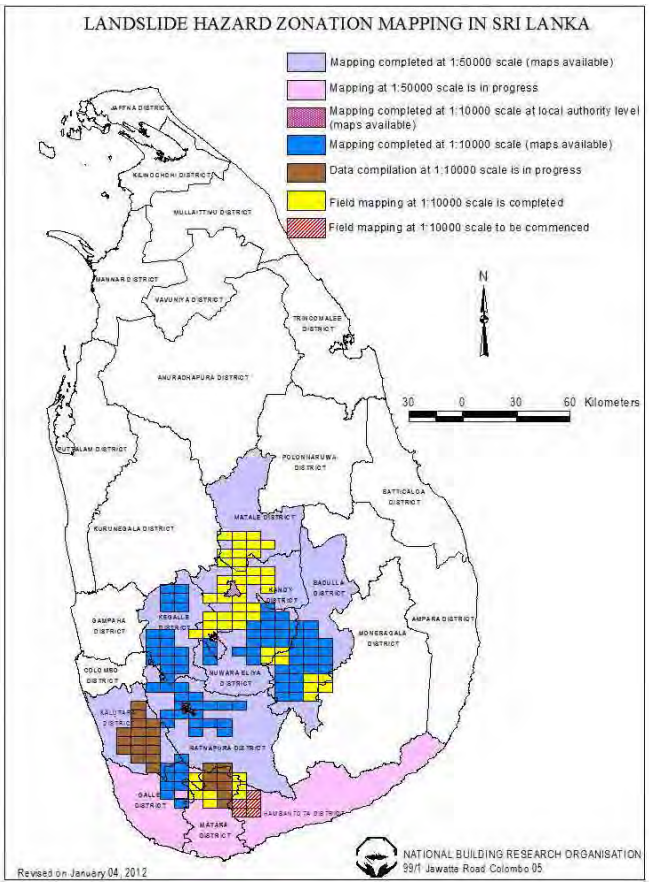
### (d) Practical Use of Hazard Maps

Although the NBRO created hazard maps (Figure 3-11) based on past sediment-related disaster records, topographical-based maps have not been updated and disaster records are not sufficient. On the other hand, along national roads in seven (7) provinces with higher priorities (Rank A and B), risk assessments regarding type, size and economic loss of disasters have been conducted.




Source: NBRO's presentation

**Figure 3-11 Example of a Hazard Map**




Source: NBRO

**Figure 3-12 Hazard Map Publishing Area**

### (e) Prediction and Survey for Sediment-related Disasters

With improvement of the AWS and weather observation systems supported by UNDP, the number of precipitation stations has been increased. Therefore data of precipitation will be collected in order to predict sediment-related disasters and to establish criteria for early warning. On the other hand, there seems to be a room for improvement of capacity on monitoring of mass movement and analysis of the mechanism. These capacities are important to improve the capacity of NBRO for prediction and early warning of sediment-related disasters. DiMCEP has been conducting capacity strengthening for sediment-related disaster management. Therefore, the results of the project have to be examined to improve the capacity of NBRO.

Source: JICA Survey Team

**Figure 3-13 Rain Fall Gauge (Real Time)**

### (4) Types of Countermeasures Against Sediment-related Disasters

In Sri Lanka, activities for response were conducted in past serious road slope disasters. Drainages of surface water and ground water have mainly been implemented in landslides as one road slope disaster, and in some landslides, observations have conducted continuously after implementation of countermeasures.

However, countermeasures for landslides have not been adopted except for drainage works and simple retaining walls due to budget limitations and technical issues, and the type of countermeasure is also limited due to capacity of equipment and materials available in the country.

In road construction, countermeasures have been implemented slowly, but the countermeasures have been limited to such as things removal of landslide mass and simple retaining walls with gabions.

Actually, countermeasures for response have been implemented for all types of disasters, proactive approaches such as addressing landslide prone areas, but proactive actions and issuing public information have not been implemented.

Countermeasures adopted in the country are shown below.

- Surface water drainage
- Horizontal drilling
- Under drainage

- Drainage well

In these days, following countermeasures have also been adopted.

- Slope cutting
- Surface water channel
- Concrete retaining wall
- Shot Crete
- Slope vegetation

Prevention works such as steel pile works and anchors have not been installed in the country.

On the other hand, hazard maps using topographical maps with a scale of 1/50,000 or 1/10,000 have been generated as one of the non-structural measures.

Source: JICA Survey Team

**Figure 3-14 Mitigation Site by NBRO (Padiyapelella)**

### 3.3.2 Future Vision

The future vision for sediment-related disasters in Sri Lanka is as follows.

- Mitigation of existing risks ( in 5 years)
  - Capacity of mitigation against existing sediment-related disasters is enhanced.
  - Appropriate mitigation works are conducted.
- Mitigation of potential risks ( in 10 years)
  - Capacity of mitigation against potential sediment-related disasters is enhanced.
  - Potential risks are identified and mitigated using appropriate measures.

### 3.3.3 Major Gaps

Major Gaps for sediment-related disasters in Sri Lanka are as follows.

- Increase in occurrence
  - Occurrence of sediment-related disasters has been increasing due to severe rainfall, uncontrolled development and adverse land use.
- Risk assessment
  - All types of sediment-related disasters are indicated as landslides in hazard maps.
  - Existing hazard maps have been developed based on base maps developed 30 years ago.
- Early warning
  - Real time observation and early warning systems are insufficient.
  - Information network systems between related organizations are insufficient.
- Mitigation works
  - Insufficient experience for mitigation works against sediment-related disasters.
  - Technical standards including design, supervision and maintenance for sediment-related disasters are required.
- Potential risks
  - Sediment-related disasters have been occurring along important roads due to widening/improvement of roads.

#### (1) Legal Systems/Land Use Regulation

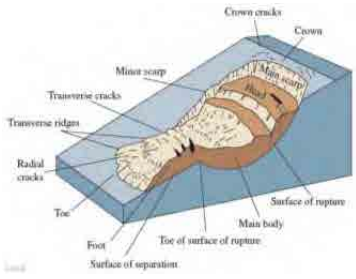
In "The Data Collection Survey on Road Protection against Natural Disaster", a survey was conducted for the current status of main national highways in seven (7) provinces. However, national high-ways are not the only target to be protected from disasters. There are other targets, for example public infrastructures (such as public facilities, electric power facilities, etc.), houses, agricultural lands, forest, etc. Therefore, a survey of the current status for these targets will be conducted as well as legal systems related to the targets and the current status of regulation of land use.

#### (2) Classification of Sediment-related Disaster

As described above, mass movements which cause disasters are generally classified into three (3) types, debris flow, landslide and collapse as shown in Table 3-10. However, in Sri Lanka, these disasters have not been distinguished as mentioned earlier. These disasters have different mechanisms and different types of movement. Therefore, the types of countermeasures are also different.

The type of disaster should be classified properly. Data should also be collected, analyzed and validated based on the classification in order to formulate appropriate programs/projects for sediment-related disasters. In formulating programs/projects, not only structural measures but also non-structural measures such as an early warning system will be included.

**Table 3-10 Classification of Sediment-related Disaster (General Classification in Japan)**

| | ① Debris flow | ②Landslide | ③Slope collapse |
|---|---|---|---|
| Conceptual Diagram |  |  |  |
| Feature of the phenomena | [Type of movement]<br>Debris flows are moving fast, liquefied landslides of mixed and unconsolidated water and debris that look like flowing concrete. | [Type of movement]<br>Landslides are generally moving slowly, mainly caused by rising of groundwater level. The phenomenon is subject to particular geological conditions. | [Type of movement]<br>A slope failure is a phenomenon that a slope collapses abruptly due to weakening and retainability of the earth under the influence of rainfall or an earthquake. |
| Countermeasures | [Structural measures]<br>Erosion control works, Check dams, bridges, etc.<br><br>[Non-structural measures] Resettlement, detour, traffic control | [Structural measures]<br>Horizontal drainage drilling, embankment, drainage well、pile work, anchor, etc.<br><br>[Non-structural measures]<br>Resettlement, detour, traffic control | [Structural measures]<br>Crib work, rock bolt reinforcement, anchor, etc.<br><br>[Non-structural measures]<br>Resettelment, detour, traffic control |

Source: Web-site of Ministry of Land, Infrastructure and Transport, modified

### (3) Design and Construction

Capacity of design/ construction of countermeasure work for sediment-related disasters depend on accumulation of capacity of staffs, equipment, and technical capacity (such as technical guidelines/ standards, experience, etc.). Especially, capacity of construction works by the private sector is one of the most important items. Therefore, experience and capacity of construction by the private sector should be improved through the experience of

countermeasure works.

#### (4) Monitoring

The amount of precipitation is the most important information for forecasting and prediction of sediment-related disasters. Various assistance projects regarding meteorology sectors have been implemented so far. The capacity development for monitoring technology of slope movements has been included in the activities of the DiMCEP.

Therefore, a survey for the current status of monitoring regarding the projects above is to be conducted. In addition, traffic control based on the amount of precipitation is used, as one of the non-structural measures for sediment-related disasters in Japan. Therefore, a survey on applicability of the traffic control above is also to be conducted.

### 3.3.4 Required Actions and Projects

Required actions for sediment related disaster management in the following areas, which are classified in the Hyogo Framework for Action (HFA), were examined based on the present conditions, Vision and major gaps for disaster management.

Consequently, Annex 9-1 shows the required actions for sediment related disaster management with a proposed time frame implementation. Candidate projects with an approximate time frame and budget are also summarized in Annex 9-2.

### 3.3.5 Selection of the Projects

In order to formulate effective programs/ projects for sediment-related countermeasures, it is necessary to analyze the items below:

- Current status of classification of sediment-related disasters,
- Applicability of Japanese technology,
- Needs of countermeasures for sediment-related disasters in order to protect important infrastructures.

Capability Enhancement for sediment-related disaster (especially design / construction technology of countermeasure works) is immediately required because sediment-related disaster in main national highways have had serious influence on the road traffic network which is moreover the foundation of the economic development of Sri Lanka country.

According to the selection, four (4) projects on sediment-related disasters are recommended as follows in Table 3-11.

**Table 3-11 List of Proposed Projects (Sediment related Disaster Management)**

| Outline of Proposed Projects |
|---|
| (a) Project of Capacity Enhancement for Sediment-related Disaster Mitigation -Phase 1<br>(i) Purpose<br>－To identify the high‐risk landslide locations from among the reported landslides and select the most critical ones needing urgent mitigation<br>－To plan and implement appropriate and cost effective mitigation measures to eliminate/ minimize future landslide risks<br>－To promote coordination and collaboration of all stakeholders towards landslide mitigation and strengthen them through education and training<br>－To enhance capacity of NBRO to effectively deal with landslide mitigation efforts<br>－To conduct research to improve the systems and methods developed for; landslide hazard zone mapping, updating these maps incorporating the land use maps and land use changes and landslide forecasting using the hazard zone maps, rainfall and ground movement thresholds.<br>(ii) Outputs<br>－Technical standards of landslides<br>－Network of early warning system for sediment-related disasters (combination of automatic rain fall gauge)<br>－Enhancement of NBRO's capacity for landslide mitigation |
| (b) Project of Capacity Enhancement for Potential Sediment-related Disaster Mitigation -Phase 2<br>(i) Purpose<br>－To support implementation of appropriate mitigation measures to minimize potential landslide risks<br>－To support capacity enhancement of NBRO for mitigation works for potential landslide risks<br>－To establish laws and regulations for landslides including control of development activities and land use in landslide prone areas<br>(ii) Outputs<br>－Laws and regulations for landslides including control of development activities and land use in landslide prone areas<br>－Updated landslide hazard zone map (scale1:10,000)<br>－Enhancement of NBRO's capacity for potential landslide mitigation |
| (c) Project of Road Protection against Sediment-related Disaster for Priority Areas-Phase1<br>(i) Purpose<br>－To design and conduct countermeasure works for slopes along major national highways in the selected landslide prone areas with the highest priorities. (model of countermeasure works)<br>－To support design and construction of countermeasure works of slopes along major national highways in the selected landslide prone areas with higher priorities.<br>－To introduce early warning system for landslides along major national roads.<br>－Consulting services for geological surveys, detailed designs, bidding assistance, supervision, |

| |
|---|
| etc.<br>(ii) Outputs<br>− Improvement of road slope safety (priority areas)<br>− Network of early warning system for landslides in road sector<br>− Enhancement of capacity of RDA and NBRO for landslide mitigation |
| (d) Project of Road Slope Disaster Mitigation for Road Widening Areas-Phase2<br>(i) Purpose<br>− To support design and conduct countermeasure works for road widening areas in major national highways (in high risk areas of landslide)<br>− To support prediction, investigation, monitoring, design, countermeasure works and maintenance of road widening areas in high risk areas of landslides.<br>− To support operation of early warning system for road widening areas.<br>(ii) Outputs<br>− Improvement of road widening slope safety<br>− Improvement of operation of early warning system for landslides in road widening areas<br>− Enhancement of capacity of RDA and NBRO for landslides caused by road widening |

Source: JICA Survey Team

## 3.4 Meteorological Observation/Early Warning

### 3.4.1 Present Condition

The Department of Meteorology (DOM) was established on 1st October 1948 and was one of the oldest government Departments in Sri Lanka. The DOM was placed under the MDM (2007). It is the mandated national provider of meteorological and climatological services and Early Warning information with regard to weather hazards and tsunami in Sri Lanka. It provides weather and climatological services in conformity with the World Meteorological Organization (WMO) and International Civil Aviation Organization (ICAO) regulations and is the Focal Point in Sri Lanka for the Intergovernmental Panel on Climate Change (IPCC).

Some of the Major services provided by the DOM are:

- Provision of meteorological and climatological services to the general public and to agriculture, energy, fishery, shipping, etc.
- Provision of warnings and advisories on bad weather (including Cyclones, Heavy rain, Lightning, High winds, etc.) and Tsunami.
- Provision of aviation meteorological services.
- Organize and contribute to educational and training programs and workshops.

JICA carried out Improvement Projects for the Meteorological and Hydrological Observation System, Early Warning System, Communication System, etc. (See Table 3-12).

In “The project for improvement of Meteorological and Disaster Information Network-2007”, Automatic Weather Observation System, Real Time Data Transmitting System, Computerized Weather Analysis System and group communication system among the Disaster Management Organizations were included. And technical support, such as on the job training and special training in Japan, were carried out.

**Table 3-12 JICA project for Meteorological Observation and Early Warning**

| Project | Introduced System | Organization | Operational Status |
|---|---|---|---|
| Comprehensive Study on Disaster Management in Sri Lanka（2006-2009） | Hydrological Observation System for 4 south-western rivers | ID | Suspended: ID is not responsible for the system |
| | Communication network for 14 organization | DMC | Suspended: Communication fee is not available |
| The project for improvement of | AWS and Satellite communication | DOM | Partially suspended: Some parts of |

| Project | Introduced System | Organization | Operational Status |
|---|---|---|---|
| Meteorological and Disaster Information Network-2007 | system for 38 local observatories | | Satellite system are not working |
| Disaster Management Capacity Enhancement Project Adaptable to Climate Change（2010-2012） | Land slide Monitoring System | NBRO | Undergoing |

Source: JICA Survey Team

### (1) Weather Observation

#### (a) Synoptic Observation

There are 22 weather observation stations in Sri Lanka. Observers at the station are conducting 3-hourly observations (wind speed/direction, barometric pressure, temperature, humidity, rainfall and solar radiation). This manually observed data is sent to the Central Station (DOM) via public telephone line. This data is also officially sent to New Delhi via GTS.

In 2009, 36 automatic weather observation stations (AWS) were introduced. Two more AWS will be installed – Jaffna, Trincomalee.

The location map of the observation stations is shown in Figure 3-16.

#### (b) Upper air Observation

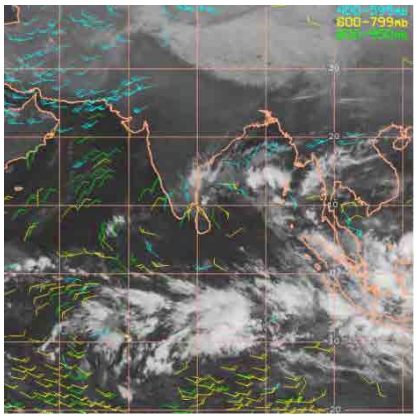
There are 4 upper air observation stations. (Manner, Colombo, Polonnaruwa, Hambantota) Only the Colombo station is operating GPS Radiosonde, twice a week. 3 other stations operate pilot balloons, 3 times a day.

#### (c) Meteorological Satellite Observation

Three kinds of meteorological satellite data are received, such as the Chinese Meteorological Satellite, European Meteorological Satellite and Korean Meteorological Satellite.

The current operational situation of the observations is:

- Two more AWSs are under construction
- Manuals for operation, maintenance and troubleshooting have been prepared
- Regular maintenance activities are being planned

| | |
|---|---|
|  |  |
| **Automatic Weather Station (AWS)** | **AWS Data** |
|  |  |
| **Pilot Balloon Observation** | **Satellite Imagery** |

Source: JICA Survey Team

**Figure 3-15 Meteorological Observation Equipments and Implementation Situation**

### (2) Weather Forecast

The headquarters of DOM is collecting necessary data and information using AWS, GTS, and Meteorological Satellite for weather analysis. The Chief forecaster checks this data and analyzes, it then informs of the weather information, advice and warnings.

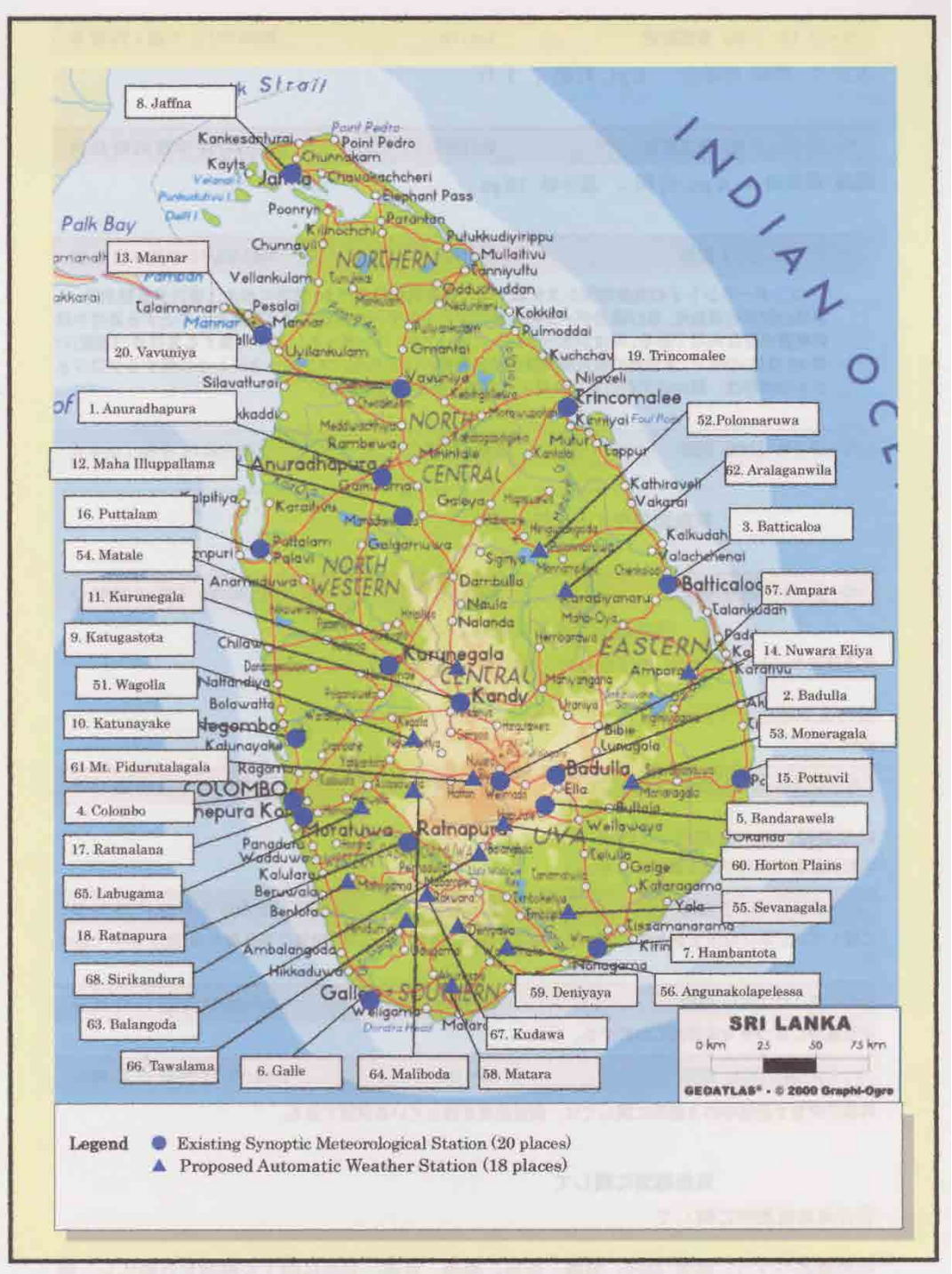
The weather information, advice and warnings are submitted to the related Government Organizations via Intra Government Network and also to the Mass Media via FAX.

DOM's forecast system is operated based on Subjective Weather analysis and Forecast.

In 2011 JICA assisted in introducing the Numerical Weather Prediction Model. The objective of this project was to develop the Objective Weather Analysis and Forecast. This is the World Research Forecast Center (USA) Model and is operated as a trial once a day. Figure 3-17 shows the DOM Operating System

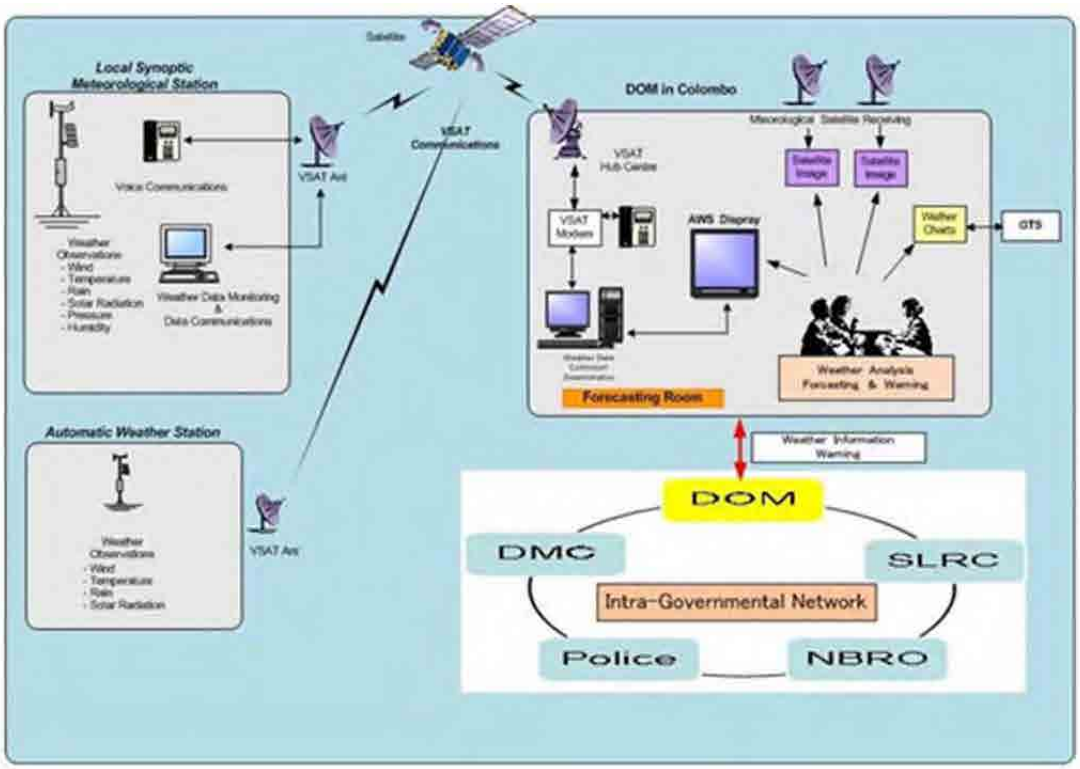
### (3) Early Warning

DOM is providing warnings on bad weather, such as Cyclones, Heavy rain, Lightning, High wind, etc. and Tsunami. The warnings, which are related to meteorological phenomena, are issued based on the weather analysis. Warnings of Tsunami are issued based the Tsunami information from the Pacific Tsunami Warning Center, Japan Meteorological Agency and Indian Ocean Tsunami Warning System. These warnings are transmitted via Intra – Governmental Network and FAX.




Source: The Project for Improvement of Meteorological and Disaster Information Network Basic Study Report (JICA, 2007)

**Figure 3-16 Location Map of Observation Station**




Source: The Project for Improvement of Meteorological and Disaster Information Network Basic Study Report (JICA, 2007), modified

**Figure 3-17 Current DOM Operation System**

### 3.4.2 Future Vision

As disasters cannot be avoided or stopped, it is vital to be proactive, by providing more accurate and timely weather forecasts and warnings to allow relevant parties to mitigate losses and damages. To realize these requirements, DOM has to develop accurate "Nowcasting", "Very Short range Forecast". (Annex 7). To improve the weather information 2-3days before bad weather, DOM is required to improve "Short Range Forecast" and "Medium Range Forecast". (Annex 7)

To realize these short term forecast following items are requested:

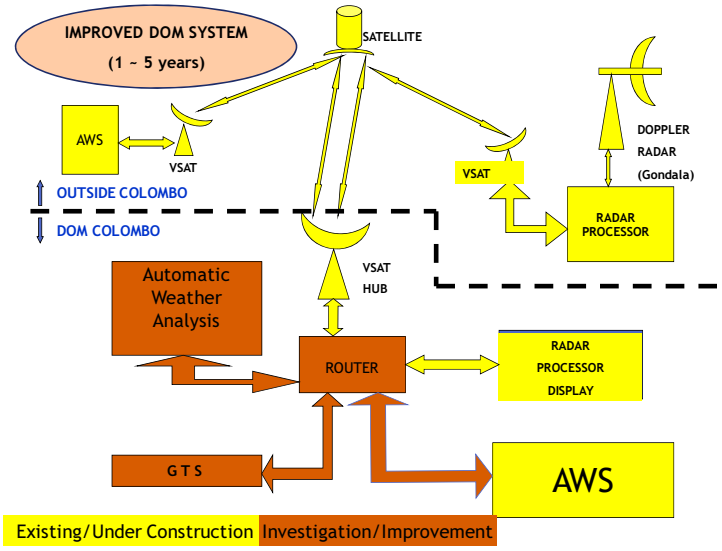
- Practical/effective use of international/domestic meteorological data

Data collecting systems, such as AWS and GTS, are to be operated without trouble

- Development of Automatic Weather Analysis System for timely forecast and warning
- Development of Warning standard for all over the country
- Precise rainfall analysis using Doppler Radar

To realize medium term forecast following items are requested:

- Development of short range forecast based on the implemented NWP (Meso Scale Model)




Source: JICA Survey Team

**Figure 3-18 A Plan of Automatic Weather System**

### 3.4.3 Major Gaps

There are Gaps between the Present Condition and the future vision. DOM recognizes that even if early warnings of exceptionally heavy rainfalls are issued, nevertheless the making of better and more accurate weather warnings with information on the quantity of rainfall expected is beyond the present capabilities of the Department.

Major gaps between the present condition and future vision are as follows.

#### (1) Weather Observation

- Two more AWSs are under construction
- Stable VSAT system operation is required
- Insufficient maintenance
  - ➢ Calibration tools for observation instruments have not been prepared
  - ➢ Spare parts for observation instruments are insufficient
  - ➢ Doppler Radar for the southern part of the island is under construction, rainfall analysis technique is not acquired

### (2) Weather forecast/Early warning

- Subjective Forecast is still underway
- Statistical survey/analysis are not optionally applied
- Warning standard is under development
- AWS data is not officially used for Nowcast
- NWP products are on trial output

## 3.4.4 Required Actions and Projects

The survey team accessed the current difficulties of DOM to find issues and actions to be taken according to the HFA. WMO's Disaster Risk Reduction Program is also developing its project according to the HFA.

The items of required actions and projects are shown in Annex 10-1.

## 3.4.5 Selection of the Projects

Based on governmental and also international support to develop policy, legislative and institutional frameworks for disaster risk reduction, DOM will be able to develop and improve the Weather information/Early warning.

DOM is required to realize the "requires actions and projects" described above they include wide-ranging issues, it should be considered as a step-by-step development/improvement plan to get fruitful results.

The progress situation and outputs of each project phase will be assessed at appropriate stage of each project. If the achievement of any project was recognized, next new project would be considered to carry out earlier than the original project plan. When the plan of Project will be settled on, the assessment plan will be simultaneously introduced.

- Are the introduced infrastructures well maintained to keep their functions and performance?
- Are the introduced infrastructures and technical cooperation effectively operated to contribute the improvement of meteorological information/early warning?
- Are the enhancement of human capacity and DOM's organization carried out and kept going?

Considering the priority and execution period, Candidate projects are selected based on the screening flow and the execution period as divided into three phases.

The proposed projects are listed in the table below.

During phase-1, enhancement/improvement projects for the existing system will be executed to improve weather forecasting.

To maintain the stable operation of AWS, following items will be conducted based on technical cooperation. Calibration and maintenance facilities will be equipped to keep the required reliability (based on the WMO standard) of the observation instruments. And also technical cooperation will be put into effect to keep stable VSAT operation. During this period, the rain fall data, which are observed by related disaster management organization, will also be effectively used to introduce exact warning standard. The data utilization technique of the Doppler Radar (which is under construction) will be transferred and enhanced for precise weather analysis. Doppler Radar analysis is essential for early warning.

The development of Automatic Weather Analysis System and the improvement of GTS will be carried out during this period. In these system many meteorological data, such as synoptic data, upper air, aeronautical data, satellite data etc, are processed. These perishable meteorological data are not only supplied based on WMO standard but also required sophisticated process. The products of Automatic Weather Analysis System will contribute to issue the exact Early Warning. Sri Lanka meteorologists and meteorological advisers are required to participate the design of Automatic weather analysis system and GTS system.

During phase-2, capacity enhancement for forecast/early warning based on the newly improved system, will be continued under technical cooperation.

During phase-3, Based on the NWP improvement technique, capacity enhancement to introduce “NWP Guidance” will be continued.

The list of the proposed projects is shown in Table 3-13.

The candidate projects are shown in Annex 10-2. Outlines of the proposed projects are shown in Annex 10-4.

**Table 3-13 List of Proposed Projects (Meteorological Observation/Early Warning)**

| Outline of the Proposed Projects |
|---|
| (a) Project for effective improvement of current weather infrastructure – Phase 1<br>(i) Purpose<br>− To enhance stable operation of Automatic Weather observation System (AWS)<br>− To enhance data sharing network system between related organizations<br>− To develop Automatic Weather Analysis System<br>− To improve Global Telecommunication System(GTS)<br>− To develop warning standard, especially for heavy rain<br>− To improve Numerical Weather Prediction (NWP) |

| |
|---|
| − To improve capacity for data analysis and utilization of the Doppler Radar<br>(ii) Outputs<br>− Stable and regular observation data<br>− Precise rainfall analysis all over Sri Lanka<br>− Improvement of Nowcast and Early Warning |
| (b) Project for enhancement of weather forecasting - Phase 2<br>(i) Purpose<br>− To increase number of AWSs and keep stable operation<br>− To expand monitoring areas to entire island with new Doppler Radar<br>− To improve NWP<br>− To set warning standard to entire island<br>(ii) Outputs<br>− Improvement of Nowcast and Early Warning<br>− Improvement of Short Range Forecast<br>− Provision of weather information and warning for small area |
| (c) Project for enhancement of weather forecasting – Phase 3<br>(i) Purpose<br>− To enhance capacity of weather forecasting aiming at 7days forecasting<br>− To set warning standards for strong wind, thunder storm, etc.<br>− To strengthen EWS<br>(ii) Outputs<br>− Seven (7) days forecasting<br>− Warning standards for other issues<br>− Well-coordinated EWS system with 7 days forecasting and warning standards with other |

Source: JICA Survey Team

## 3.5 Overall Disaster Management

### 3.5.1 Present Condition

#### (1) Institutional Aspects of DMC

As pointed out in section 2.3.1, until 2012, more than half of DMC staff was contracted employee, including some managerial position staff, and a total number of staff was merely 60% of what is needed to fully function as disaster management center indicated in the original establishment plan. UNDP's report in 2011 identifies that one of issues that DMC should immediately need to overcome is to solve its high rate of personnel turnover, including managerial position staff. In the annual reports of 2011 and 2012, DMC reveals that its vital issue is to convert from contracted to permanent status of its staff. In 2012, it succeeded to obtain necessary budget from the government administration, and has been converting managerial position and technical staff to permanent status, which is about 60 staff members in 2012. It plans to convert all staff to permanent status and strives to be a more solid organization, in terms of institutional structure wise. NGOs, working with DMC, also raise similar concern about the high rate of staff turnover of DMC. They commented that it has an impact on business continuity and efficiency, and it must be one of the challenges that DMC is encountering since its establishment. The high rate of staff turnover consequently affects the competence of perpetual newly-employed personnel, since trainings for those who newly-employed are not implemented as needed due mainly to financial constraint.

DMC headquarters is trying to hire more full-time staff; yet at district level, the drive is not that prominence and it does not have any prospect of solving that challenge. DMC regional offices encounter the same personnel issues, i.e. high rate personnel turnover, low public administration competence, and insufficient expertise in disaster management because of a lack of training opportunity for newly hired personnel, who are often appointed to regions without proper training.

As for CBDRM, DMC is planning to nurture trainers who will be capable to train regional staff to be a facilitator for CBDRM activities in villages. Once it trains enough number of facilitators, it can deploy its CBDRM activities countrywide to be ready for any natural disasters. DMC expressed the Survey Team that it expects one of donor agencies to support it to appoint master trainers for such training to trainers of training, to design and structure training programs, to provide necessary training equipment and materials, and to operate the training programs until it can do it by itself. Considering the institutional capability of DMC, however, it is essential to rebuild from the ground of the organization by reviewing its various aspects, such as human resource development, personnel evaluation system, personnel interchange with other

governmental agencies concerned to complement the deficiency of experts at DMC, to develop proper standard operation procedure (SOP), and to introduce an executive advisory engineer who oversees all institutional development and technical matters of all divisions in DMC. It is also essential that DMC will strengthen its coordination and guidance capacities to work efficiently and effectively with related state and non-state institutions.

In terms of institutional aspects, one of the imperative challenges is to review and revise existing laws and regulations associated to the Disaster Management Act. It was pointed out during the survey that some of existing laws and regulations are enacted right after the colonization era and there has been no update or revision, and there are some contradictions and sometimes do not comply with the Act, or the Act does not fully encompass the preceding laws in it. It was also revealed that roles and functions among related state agencies were not clearly demarcated, and project execution plans were not quite coordinated among related state agencies. In order to effectively implement disaster management plan and emergency response plan, it is inevitable to periodically monitor and provide feedbacks to executing agencies which operate the activities of plans, and if it is necessary, amending laws, regulations or technical standards should be carried out for strengthening disaster management administration. In particular, DMC has overlooked the monitoring and evaluation of the Road Map, which indicated the establishment of a steering committee for those purposes, but so far it is not set out to properly evaluate the outputs of the activities. Although there are brief evaluations in the corporate plan and reports produced by other donor agencies, they do not distinctly reveal the degree of achievement, specific recommendations, or lessons learned from the activities. Considering all abovementioned aspects, it is suggested that an executive advisory engineer or administrator shall be appointed to strengthen overall administration of DMC, and to facilitate coordination among vertically-segmented state agencies' administrative system.

### (2) CBDRM and Public Awareness Components in Disaster Management Policy

CBDRM and Public Awareness (PA) are two major, out of seven, thematic components focused in the Road Map, a framework of a holistic disaster management strategy until 2015. Two components are indicated in it as follows*[4]:

- Community-based Disaster Risk Management (CBDRM): communities are the first line of defense against disasters if they are well educated for preparedness and response. Possible interventions include mobilization of community teams, creation of a local network of trained volunteers, establishing resource centers and small grants to fund priority projects by community teams.

- Public Awareness, Education and Training: this component focuses on empowering the public through various channels to mitigate potential disasters' impact, including national awareness campaign, designating 'National Disaster Safety Day,' promoting disaster awareness to professional, children and disaster prone communities.

### (3) CBDRM

CBDRM is not only considered, in the Road Map, as a risk identification and reduction strategy, but also as a part of national and sub-national level action plans for poverty alleviation and infrastructure development, considering the poor habitually live in less environmentally-sound areas will impact to people's livings enormously, once they are affected by disasters.

Another key issue identified in the Road Map is insufficient coordination for formulating action planning and interventions among stakeholders at district and divisional level. As the number of divisions and villages is quite extensive, 14,016 GN divisions and about 40,000 villages, sound coordination among governmental agencies, NGOs, CBOs and local people is imperative factor to carry out CBDRM activities.

More than half of 40,000 villages are identified as prone to one or more natural hazard risks and need disaster risk management, preparedness and response plans against those potential risks. CBDRM component in the Road Map aims to establish a sustained national program to build the resilience and community level capacity for natural disaster risk management in vulnerable communities. Major proposed actions are listed below.

1) Community DRM teams in 20,000 villages over 2,500 GN divisions
2) An effect national network of local level volunteers for DRM
3) Effective coordination mechanisms between Government and NGOs at the national, provincial, district and GN division levels
4) CBDRM resource centers in 25 districts
5) Shared methodologies for CBDRM implementation and training
6) Small grants program for community teams to support community level DRM projects
7) Development of micro-finance scheme for vulnerability reduction and mitigation
8) Applied research grants for community level program
9) Training of key state and non-state actors at the local level in mediation
10) Promoting mechanisms for communities to seek accountability and express grievances
11) Empower local administration to assume greater responsibility for disaster management

Activities reaching out to communities require enormous efforts and well-structured

implementation plans with extensive coordination among state, non-state institutions, and NGOs and CBOs in particular. Local authorities and CBOs are the prime focal points and assume primary responsibility for supporting the establishment of community DRM teams, and implementing CBDRM. SLRCS is also taking a part of responsibility and will be the national and local vehicle to support the activity.

Table 3-14 shows the current status of activities under CBDRM component. The status is based on reviewing most recent reports available, such as UNDP's report on outcome evaluation, NDMP by the MDM, and hearings from DMC and other related organizations.

**Table 3-14 Activity Progress Projects (Overall Disaster Management)**

| | Activity Title | Status |
|---|---|---|
| CBDM-01 | Promotion of CBDRM Volunteerism | B |
| CBDM-02 | Establishing CBDM Resource Centers | D |
| CBDM-03 | Preparedness and Mitigation through Small Grants Programs | B |
| CBDM-04 | Development and Implementation of Micro-Finance Schemes | D |
| CBDM-05 | National CBDRM Program | A |
| CBDM-06 | Applied Research Grant Scheme for CBDRM | D |
| CBDM-07 | Land mines and Unexploded Ordnances (UXO) | - |
| CBDM-08 | Alternative and Informal Dispute Resolution Mechanisms and Improving Services from State Actors | B |
| CBDM-09 | Facilitation of the creation of local citizens committees | B |
| CBDM-10 | Strengthening Participatory Democracy-local Government | B |
| CBDM-11 | Creating a Special Disaster Response Ombudsman | D |
| CBDM-12 | Issues of Subsidiarity in Situations of Emergency | B |
| CBDM-13 | Strengthening Human Rights in Tsunami Recovery | B |

Note: A – completed, B – completed to some extent, C – ongoing and scheduled in NDMP 2013-2017 to be carried out, D – not yet being carried out.

Source: JICA Survey Team

The CBDRM component does not show much progress as scheduled. Community DRM teams were not organized as scheduled, or to be more precise, DMC does not have detailed information about the figure of DRM teams organized at villages, since it does not have a document control system to monitor the activities. CBDRM volunteerism was partially carried out by the SLRCS. According to the SLRCS, it has extended its CBDRM program, in line with the Road Map and in close cooperation with DMC, have organized village people to set up community based disaster risk management and preparedness teams, consisting of volunteers; yet, the detail, such as number, area coverage and distribution of teams are unknown.

Some other NGOs and UN agencies also support the CBDRM initiative in line with the DMC action plan; yet, the overall information about their activities is not collected nor documented at

DMC, which are ones of challenges that the agency needs to overcome.

Effective coordination mechanisms among state and non-state institutions at national level were fairly well established, according to the UNDP report. The National Disaster Management Coordination Committee (NDMMC), a form for government, civil society, UN agencies, academia, media and private sector establishments, is recognized by the UNISDR as the Sri Lankan national platform and is being considered one of the most vibrant and successful national platforms.*[7] Effective coordination mechanism, however, at sub-national level is not fully institutionalized due mainly to limited coordination capacity and commitment from local authorities, and dragged interventions in DRM from the local authorities.

One of the key sub-components, yet not achieved is establishing a resource center in each district, which will be the center for CBDRM activities, providing technical support to communities, supporting District Secretaries in keeping up various database and disseminate CBDRM experience. CBDRM resource center at the national level was set up in DMC, and one person will be appointed to oversee the tasks. According to the Education and Awareness division of DMC, a proposal for establishing district resource centers is underway and will be finalized by March 2013.

In this sub-component, DMC assumes the responsibility to provide necessary display materials and equipment, technical support, and capacity building training for state and non-state agencies, such as universities, technical institutions, NGOs and divisional secretary's offices. DMC does not, however, construct a building, which will be arranged by the local authorities.

Other sub-components that are not fulfilled are small grants program, micro-finance scheme, and applied research grants. The remaining four sub-components are mostly under other agencies' responsibilities, so DMC has not fully paid attention to comprehend the objectives and carried out those activities.

BOX Sri Lanka Red Cross Society (SLRCS)

SLRCS has a countrywide network in all 25 districts. Each district unit has sub-units with local staff and registered volunteers. It has some 100,000 members and 6,500 active volunteers who received first aid, search and rescue and skill training of disaster management.*[7] SLRCS

*[7] Final Report on Outcome Evaluation of Disaster Risk Management Programme of UNDP, Sri Lanka. UNDP. June 2011.

implemented risk reduction work in 275 at risk communities in 16 districts and is currently implementing the integrated disaster risk reduction program.*[8]

SLRCS is a member of NDMCC and its role is clearly specified in the Road Map. It has implemented CBDRM projects in 14 districts reaching 285 communities and 289 schools covering around 161 thousand households. It also engaged disaster management school material development program with GIZ, who developed "Disaster Safety Education Booklet," under the Ministry of Education. SLRCS also organized Red cross circles in schools and youth clubs.*[7]

UNDAC points out in its report that SLRCS is well placed to play a vital role in disaster management, yet, it lacks a stronger formal recognition in national legal and policy framework. It is also echoed by the SLRCS in the hearing, and it is now undergoing discussions with DMC to agree with functions and roles shall be taken by the SLRCS under more legal framework.*[7]

A small grant program does not see much progress in past years, which aims to support CBDRM activities financially to implement preparedness and mitigation activities at community level, and to encourage CBOs and residents to be involved in CBDRM activities. It targeted 1,250 pilot projects to carry out in five years, up to 2010, but due mainly to funding constraints, little action was taken and completed. Rationale of implementing the sub-component is still valid and affirmative in DMC and it is willing to pursue its objective, i.e. to promote disaster resistant sustainable livelihood options to encourage development, to overcome the issues that many vulnerable communities persistently encounter.

Applied research grant scheme encounters the same issue, indicated by officers interviewed by the evaluation team of UNDP. Their request on research assistance was turned down on the basis of non-availability of funds.*[8] An ombudsman is not appointed yet nor are institutional design and regulatory framework determined.

### (4) Public Awareness, Education and Training

Public awareness, education and training (PAET) focus on empowering the public through various channels to make them ready for potential disasters, response in times, and develop capacities to cope in their aftermath. As the Road Map indicates, many government institutions, international and domestic NGOs have been conducting DRM related training.

The Road Map pointed out that duplication had been observed in training delivery, and training

[8] SLRCS. A hearing at SLRCS in January 2013.

materials were not properly developed. However, significant progresses were made recently, i.e. a coordinating body for disaster management education was organized under the Ministry of Education, and not only the government agencies, but also NGOs are the core members to contribute their efforts to carry out disaster management education to schools.

Another key issue illustrated in the Road Map is that a needs assessment and customized training based on needs, were carried out partially, so they still remains as key focus issues in PAET component. The Road Map highlights the necessity for needs assessment, systematic target segmentation and customized training for communities, and capacity enhancement initiative for DRM trainers locally. NDMP, consequently, gives emphasis on customized training programs by government administration structure, i.e. by central government agencies, sub-national government agencies and respective bodies, such as provincial councils, GN level committee, private sector, schools, communities and NGOs.

The strategies for PAET are summarized as follows:

1) DMC formulates a policy for DRM trainings and coordinates all DRM related trainings at state agencies, central and local levels;
2) Develop a mechanism for quality assurance of DRM trainings and evaluation;
3) Develop partnerships with regional institutions and universities to upgrade training materials and human resources, with emphasis on cadre of trainers and professionals, as well as institutionalize those regional institutions;
4) Develop manuals and guidelines under technical subject areas, such as construction in hazard prone areas, land-use planning and so on, and utilized the developed materials for trainings and public awareness activities.

Major proposed actions in the Road Map are listed as follows;

1) Promote public awareness at national level, designating Disaster Safety Day;
2) National public awareness program;
3) Promote awareness among school children;
4) Promote awareness and train university graduates through integration of DRR in university curriculum;
5) Promote awareness among professional groups and key decision makers;
6) Training for emergency preparedness and response;
7) Enhancing training capacities;
8) Special awareness programs; and
9) Nationwide awareness campaign on public safety.

PAET component was carried out almost as scheduled, in particular, in public awareness sub-component; yet other two sub-components need further efforts to achieve the objectives.

In cooperation with the Ministry of Education and National Institute of Education, school curricula and disaster safety education booklet for primary and junior secondary schools were developed by GIZ and distributed to all schools by SLRCS. As for the school awareness program, UNICEF and the Ministry of Education are taking the initiative to run it. GIZ is also conducting school disaster safety program under education for social cohesion program in close collaboration with the Ministry of Education and the National Institute of Education. The two agencies along with GIZ work closely with the Training and Awareness division in DMC. GIZ carried out school disaster safety program to about 200 schools by 2012, and DMC has been conducting the same program to 100 schools per year by its own funding. GIZ is going to expand its program nationwide, covering more than 9,000 schools in next five years. In the program, GIZ is also planning to facilitate schools and the residents to make school emergency response plan.

Another important contribution from GIZ is "disaster safety education resource kit for national colleges of education," for university students to learn about disaster management. Disaster management is taught in geology, science and civics education from grade 6 to 11, and teacher's manuals for those subjects are also developed and taught at teacher's colleges, as well as periodical refresher training for teachers.

Regarding to the integration of DM in graduate and post-graduate curriculum in university education, three universities are now offering DM courses in graduate and post-graduate courses, i.e. University of Columbia, University of Moratuwa and University of Peradeniya*[9], while other universities are offering diploma and short-courses for students and professionals.

Major challenges identified for public awareness, education and training sub-components in the UN reports and hearings are;

- As schools are the best venue to build a culture of disaster prevention, more attention is needed to raise awareness among school communities;
- Empowering local authorities for undertaking activities related to DRR should be more

*[9] University of Moratuwa has master degree's and master of philosophy on disaster management and University of Peradenia has master of science on disaster management. Both universities offer PhD courses for disaster management, and in addition to that, University of Moratuwa offers master of philosophy and PhD programs on disaster management systems.

taken into account as the center piece of the DRR strategy;

- Good practices and lessons learned in various areas of community based efforts towards disaster preparedness should be documented and used for education and training;
- Inadequate skilled staff at district level and lack of multilingual skills, particularly Tamil language encumber smooth communications and better understanding;
- Various state agencies have conducted trainings related to disaster management, but the quality of trainings was not consistent, and they were not delivered regularly to keep and update the knowledge and skills; and
- Although it is recognized and understood by all stakeholders that the local authorities' functions and capacities toward disaster management is crucial, the capacity building intervention for local authorities' was not sufficiently carried out.

Table 3-15 indicates the progress of PAET activities in the Road Map. Most of awareness activities were carried out fully or to some extent, except training for emergency preparedness and response, and special awareness programs which show little progress. Training for emergency preparedness and response aims at institutional capacity enhancement by establishing a multi-disciplinary search and rescue training center, and training national state and sub-state officials in emergency preparedness and response. The latter program aims at collating information on various aspects of infrequent potential high consequence events[10], and to increase awareness on those events. MDM and DMC recently emphasize the importance of having a training center for emergency search and rescue, in particular, for professionals, such as fire brigade, police and special rescue unit in the army, as well as for communities.

Awareness by integrating DM training in continuing education is the only one area that there was no progress in the past years. The activity aims at creating awareness on DRM issues in different professional groups and reviewing training materials developed by CHPB and SLIDA, developing courses and organizing training programs by utilizing these agencies with proper monitoring system by DMC. This activity is correlated to closely with special awareness programs, since the activity utilized the materials developed in the program.

**Table 3-15 Activity Progress in the Road Map**

| | Activity Title | Status |
|---|---|---|
| PA-01 | Awareness through Disaster Safety Day | A |

[10] Forest fires, oil spills, radiological emergencies, nuclear disasters, air and maritime hazards, pandemics and epidemics.

| | | |
|---|---|---|
| PA-02 | National Public Awareness Program | B |
| PA-03 | Awareness through Schools and School Children | |
| PA-03.1 | Integration of DRM into School Curriculum | A |
| PA-03.2 | School Children Awareness Program | B |
| PA-04 | Awareness through University Curriculum and Continuing Education | |
| PA-04.1 | Integration of DM in Graduate and Post-graduate Curriculum in University Education | A |
| PA-04.2 | Awareness by Integrating DM Training in Continuing Education | D |
| PA-05 | Training for Government Employees | A |
| PA-06 | Training for Emergency Preparedness and Response | C |
| PA-07 | Enhancing Training Capacities | B |
| PA-08 | Special Awareness Program | C |
| PA-09 | Nationwide Awareness Campaign on Public Safety | B |

Note: A – completed, B – completed to some extent, C – ongoing and scheduled in NDMP 2013-2017 to be carried out, D – not yet being carried out.

Source: JICA Survey Team

### 3.5.2 Future Vision

Vision, strategies and actions for CBDRM and public awareness, education and training are set as follows;

#### (1) Future Vision

All stakeholders are aware of disaster risks, have proper knowledge and skills about disaster risk management, and communities become resilient to natural disasters

#### (2) Strategy

- Establish a sustained national program to build the resilience and community level capacity for natural disaster risk management for all vulnerable communities at disaster risks.
- Develop instruments for public awareness and preparedness education for all stakeholders to improve their knowledge and skills.
- Enhance the capacity of search and rescue at all levels. (giving special attention to professional search and rescue units).
- Strengthen institutional and human resource capabilities of DMC.

#### (3) Action

- Strengthening district DMCs' functions.
- Capacity building for sustainable CBDRM, preparedness and response, and public

awareness.

- Strengthening a technical advisory system DMC (technical advisor)

### 3.5.3 Major Gaps

Major gaps identified referring to the Road Map are as follows;

#### (1) CBDRM component

- 25 district resource centers are not yet established.
- Lack of CBDRM facilitator in regions.
- Insignificant institutional set-up for education and training for CBDRM at DMC.
- Micro finance scheme for communities are not developed.
- Applied research grant scheme for CBDRM is not carried out yet.

#### (2) Public Awareness, Education and Training component

- Awareness via continuing education and professional training are not fully carried out yet.
- Structural and technical training for government employees are not sufficiently implemented.

#### (3) Cross-cutting gaps

- CBDRM, public awareness, education and training have not reached all targeted communities yet.
- Lack of capacity enhancement initiative for DRM trainers to uphold their capacities (skills & knowledge)
- Knowledge and skills of search and rescue at all levels are not fully prevalent, in particular, there are a lack of professionals' capacities

### 3.5.4 Required Actions and Projects

Several actions to fill the gaps for CBDRM, and public awareness, education and training component are identified and classified by HFA categories.

HFA2: Risk Identification, Assessment, Monitoring and Early Warning

- Complete district disaster preparedness plans for response
- Complete "Grama Niladhari" level preparedness plans for response

- Complete disaster impact assessment and development of future action plan for CBDRM

HFA3: Use knowledge, innovation, and education, and build a culture of safety and resilience at all levels

- Planning training course for CBDRM, public awareness and education.
- Enhancing awareness through curriculum and school activities
- Integration of DM in higher, professional and continuing education curriculum.

HFA5: Strengthen disaster preparedness for effective response at all levels

- Capacity building for sustainable CBDRM activities toward all disaster types.
- Training all stakeholders for emergency response, by emphasizing search and rescue trainings for communities and professionals.

### 3.5.5 Selection of the Projects

Required actions are combined into two programs, namely 1) Strengthening district DMCs' functions and 2) Capacity building for sustainable CBDRM, preparedness and response, and public awareness. The first program covers required actions in HFA 2 and 3 and the latter covers a part of HFA 2 and all of HFA5.

Profiles of the proposed programs are shown in Annex 11-4.

**Table 3-16 List of Proposed Projects (Overall Disaster Management)**

| Outline of the Proposed Projects |
|---|
| (a) Strengthening District Disaster Risk Management Centers' Functions<br>(i) Purpose<br>− Set up a District Disaster Management Center in each district, functioning as CBDM Resource Center, Emergency Operation Center, Emergency Supply Storage and Emergency Shelter.<br>(ii) Outputs<br>− District Disaster Risk Management Centers are established in 25 districts with intended functions, trained staff, necessary resources, and the median center of community outreach and the DMC. |
| (b) Capacity Building for Sustainable CBDRM, including Preparedness, and Response, and Public Awareness activities<br>(i) Purpose<br>− Enhance the capacity of stakeholders in different tiers, national, sub-national and community to uphold sustainable CBDRM and public awareness activities, concurrently to strengthen disaster resilient society<br>(ii) Outputs |

| |
|---|
| − Establishment of training course with several modules, including preparedness, DIA method, mapping, local evacuate unit, search & rescue, recovery, education, and campaign and event for awareness.<br>− 50 trainers for CBDRM will be trained at DMC; at least two trainers for each districts, by 2015, |

Source: JICA Survey Team

# Annex


| | |
|---|---|
| Annex 1-1 | Progress Activities in the “Road Map” |
| Annex 1-2 | Road Map Matrix Corresponding to HFA |
| Annex 2 | List of Projects assisted by JICA and other Donors |
| Annex 3 | Matrix of Projects assisted by JICA and other Donors corresponding to HFA |
| Annex 4 | Impacts of Disasters |
| Annex 5 | Summary of Disaster Management |
| Annex 6-1 | Spatial Distribution of Flood Damage |
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| Annex 6-4 | Major Dams Managed by Irrigation Department |
| Annex 6-5 | Legal Framework on Water Resources Management |
| Annex 6-6 | Flood Inundation Area in Eastern Region |
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| Annex 8-1 | Action to be Taken (Flood Management) |
| Annex 8-2 | List of Candidate Projects (Flood Management) |
| Annex 8-3 | Criteria of Future Program (Flood Management) |
| Annex 8-4 | Program Sheet (Flood Management) |
| Annex 9-1 | Action to be Taken (Sediment-related Disaster Management) |
| Annex 9-2 | List of Candidate Projects (Sediment-related Disaster Management) |
| Annex 9-3 | Criteria of Future Program (Sediment-related Disaster Management) |
| Annex 9-4 | Program Sheet (Sediment-related Disaster Management) |
| Annex 10-1 | Action to be Taken (Meteorological Observation/Early Warning) |
| Annex 10-2 | List of Candidate Projects (Meteorological Observation/Early Warning) |
| Annex 10-3 | Criteria of Future Program (Meteorological Observation/Early Warning) |
| Annex 10-4 | Program Sheet (Meteorological Observation/Early Warning) |
| Annex 11-1 | Action to be Taken (Overall Disaster Management) |
| Annex 11-2 | List of Candidate Projects (Overall Disaster Management) |
| Annex 11-3 | Criteria of Future Program (Overall Disaster management) |
| Annex 11-4 | Program Sheet (Overall Disaster Management) |
| Annex 12 | Project Location Map Assisted by International Agencies |
| Annex 13 | Survey Schedule |
| Annex 14 | List of People Met by the Mission |

# Annex 1-1: Progress Activiteies in th "Road Map"

| Vol. 2 | Component | Disaster Type | | | | | | | | | | | | HFA | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Flood | Landslide | Drought | Tsunami | Earthquake | Cyclones | Tornado/Strong Wind | Coastal Erosion | Lightening | Forest Fires | Epidemics | Others | Unclassifiable | |
| **Policy, Institutional Mandates and Institutional Development** | | | | | | | | | | | | | | | |
| P-01 | Implementation of Provisions of DMAct | x | x | x | x | x | x | x | x | x | x | x | x | | 1-(i) | A |
| P-02 | Institutional Mandates Reviewed | | | | | | | | | | | | | | | |
| P-02.1 | For Provincial Councils & Local Government Agencies to Perform Disaster Related Activities | x | x | x | x | x | x | x | x | x | x | x | x | | 1-(i) | B |
| P-02.2 | For Line Agencies to Perform Disaster Related Activities | x | x | x | x | x | x | x | x | x | x | x | x | | 1-(i) | B |
| P-03 | Developing Institutional Mandates & Capacities | x | x | x | x | x | x | x | x | x | x | x | x | | 1-(ii) | B |
| P-04 | Formulation of CBDRM Policy | x | x | x | x | | | | | | | | x | | 1-(iii) | D |
| P-05 | Enforcement of Policies | x | x | x | x | | | | | | | | x | | 1-(i) | B |
| P-06 | Establishment of the National Centre building | x | x | x | x | | | | | | | | x | | 1-(ii) | A |
| P-07 | Facilitating the Reconciliation Process | | | | | | | | | | | | | x | | C |
| P-08 | Good Governance and the Law-Making Process | | | | | | | | | | | | | x | | C |
| P-09 | Strengthening Human Rights: Constitutional Reform | | | | | | | | | | | | | x | | N/A |
| P-10 | Strengthening Human Rights: Making Laws More Effective | | | | | | | | | | | | | x | | B |
| P-11 | Strengthening Women's Rights | | | | | | | | | | | | | x | | - |
| P-12 | Voting Rights of Migrant Works | | | | | | | | | | | | | x | | N/A |
| P-13 | Issues Pertaining to a Durable Peace in Sri Lanka | | | | | | | | | | | | | x | | N/A |
| P-14 | Encouraging Good Governance within the Ministry | | | | | | | | | | | | | x | | C |
| **Hazard, Vulnerability and Risk Assessment** | | | | | | | | | | | | | | | |
| HVR-01 | Landslide Hazard Zonation Mapping | | x | | | | | | | | | | | | 2-(i) | B |
| HVR-02 | Establishment of DRM Information System at DMC | x | x | x | x | | | | | | | | x | | 3-(i) | C |
| HVR-03 | Flood Risk Assessment | x | | | | | | | | | | | | | 2-(i) | B |
| HVR-04 | Coastal Vulnerability Assessment & Risk Analysis | | | | | | | | x | | | | | | 2-(i) | A |
| HVR-05 | Development of Drought-prone Area Maps of LGA | | | x | | | | | | | | | | | 2-(i) | B |
| HVR-06 | Dam Safety & Risk Assessment | | | | | | | | | | | | x | | 2-(i) | C |
| HVR-07 | Vulnerability & Risk Assessment for LGA | x | x | x | x | | | | | | | | x | | 2-(i) | C |
| HVR-08 | Vulnerability Atlas | x | x | x | x | | | | | | | | x | | 2-(i) | B |
| HVR-09 | Development of Wind Zoning & Storm Surge Maps | | | | | | | x | | | | | | | 2-(i) | A |
| HVR-10 | Seismic Zonation Maps | | | | | x | | | | | | | | | 2-(i) | C |
| HVR-11 | Integrated Epidemic Risk Assessment | | | | | | | | | | | x | | | 2-(i) | D |
| HVR-12 | Major Transportation Accidents | | | | | | | | | | | | x | | 2-(i) | D |
| HVR-13 | Major Industrial Accidents | | | | | | | | | | | | x | | 2-(i) | B |
| HVR-14 | Terrorism & Human-made Disasters | | | | | | | | | | | | x | | 2-(i) | D |
| HVR-15 | Reintegration of Ex-combatants | | | | | | | | | | | | | x | - | D |
| **Tsunami and Multi-hazard Early Warning System** | | | | | | | | | | | | | | | |
| E-01 | Establishment of the National Early Warning Centre of Sri Lanka | x | x | | x | | x | x | | | x | | x | | 2-(ii) | A |
| E-02 | Improvement of Meteorological Observation and Prediction Capabilities | x | x | x | | | x | x | | | | | x | | 2-(iii) | B |
| E-03 | Improvement of Hydrometric Network for Enhancing Flood Monitoring and Forecasting Capabilities | x | | | | | | | | | | | | | 2-(iii) | B |
| E-04 | Improvement of Landslide Prediction and Early Warning Capabilities | | x | | | | | | | | | | | | 2-(ii) | B |
| E-05 | Development of Long and Medium Term Drought Forecasting and Monitoring System for Agriculture and Associated Sectors | | | x | | | | | | | | | | | 2-(iii) | D |
| E-06 | Development of an Effective Cyclone Tracking, Storm Surge Warning System | | | | | | x | x | | | | | | | 2-(ii) | B |
| E-07 | Development of a Unified Seismic Monitoring and Data | | | | | x | | | | | | | | | 2-(iii) | A |
| E-08 | Early Warning for Hazards Associated with Major Dams | | | | | | | | | | | | x | | 2-(ii) | B |
| E-09 | Development of Oceanographic Monitoring System | | | | | | | | x | | | | | | 2-(iii) | D |
| E-10 | Establishment of an EWS for Nuclear Accidents and Monitoring of Environmental Radiation | | | | | | | | | | | | x | | 2-(ii) | D |
| E-11 | Erecting Tsunami Warning Towers in Selected Coastal Areas | | | | x | | | | | | | | | | 2-(ii) | A |
| **Preparedness and Response Plans** | | | | | | | | | | | | | | | |
| PR-01 | Hazard Specific Response Plans | | | | | | | | | | | | | | | |
| PR-01.1 | Cyclone and Tornado Response Plan | | | | | | x | x | | | | | | | 5 | D |
| PR-01.2 | Drought Response Plan | | | x | | | | | | | | | | | 5 | D |
| PR-01.3 | Flood Response Plan | x | | | | | | | | | | | | | 5 | C |
| PR-01.4 | Tsunami Response Plan | | | | x | | | | | | | | | | 5 | A |
| PR-01.5 | Landslides Response Plan | | x | | | | | | | | | | | | 5 | B |
| PR-01.6 | Lightning and Thunderstorms Response Plan | | | | | | | | | x | | | | | 5 | D |
| PR-02 | National Rapid Response Team | | | | | | | | | | | | x | | 5 | A |
| PR-03 | Emergency Operation Centres (EOCs) | x | x | x | x | | | | | | | | x | | 5 | A |
| PR-04 | Hazard Specific Contingency Plans | x | x | x | x | | | | | | | | x | | 5 | D |
| PR-05 | Emergency Service Networks (ESNs) | x | x | x | x | | | | | | | | x | | 5 | A |
| PR-06 | Knowledge Management Systems | x | x | x | x | | | | | | | | x | | 5 | D |
| PR-07 | Health Sector Preparedness and Response Mechanism | x | x | x | x | | | | | | | | x | | 5 | C |
| PR-08 | Private Sector Preparedness for Disaster Response | x | x | x | x | | | | | | | | x | | 5 | C |
| PR-09 | National Radiological and Nuclear Emergency Management Plan | | | | | | | | | | | | x | | 5 | C |
| PR-10 | Capacity Building of Local Authorities for Emergency Response | x | x | x | x | | | | | | | | x | | 5 | C |
| PR-11 | Provision of Facilities for Storage of Emergency Reserves and Resource Needs | x | x | x | x | | | | | | | | x | | 5 | C |
| PR-12 | Construction of Multi-purpose Buildings for use as Tsunami Safe Shelters and Other Purposes along the Coastal Zone | | | | x | | | | | | | | | | 5 | C |
| PR-13 | Improvement of Mortuaries in Government Hospitals | | | | | | | | | | | | x | | 5 | D |
| PR-14 | Establishment of Nationwide Emergency Communication System | | | | x | | | | | | | | x | | 5 | A |
| PR-15 | Search and Rescue in Disasters by Sri Lanka Army | x | x | | x | x | x | x | x | | x | | x | | 5 | A |
| PR-16 | Strengthening Responses to Oil Pollution, Flood Relief Operations and Enhancing SAR capabilities at | x | | | | | | | | | | | x | | 5 | C |
| PR-17 | Provision of Aircraft for Disaster Management Operations | x | x | | x | x | x | x | x | | x | | x | | 5 | B |
| **Mitigation and Integration of Disaster Risk Reduction into Development Planning** | | | | | | | | | | | | | | | |
| M-01 | Mitigation and Stabilization of Slopes in High Risk Landslide and Rock Fall Sites | | x | | | | | | | | | | | | 4-(i) | A |
| M-02 | Flood Protection of Major Cities in Kalu Ganga Basin | x | | | | | | | | | | | | | 4-(i) | A |
| M-03 | Disaster Mitigation Action Plans | x | x | x | x | x | x | x | x | x | x | x | x | | 4-(iii) | 0 |
| M-04 | Integrating DIA into All Development Plans | | | | | | | | | | | | | | | |
| M-04.1 | Integration of Disaster Impact Assessment (DIA) in the Approval Process of Development Projects | x | x | x | x | | | | | | | | x | | 4-(iii) | B |
| M-04.2 | Structural Provisions for Mainstreaming DRM as a Component of Development | x | x | x | x | | | | | | | | x | | 4-(iii) | B |
| M-05 | National Land Use & Physical Planning Policy | x | x | x | x | | | | | | | | x | | 4-(iii) | B |
| M-06 | Coastal Zone Management | | | | | | | | | | | | | | | |
| M-06.1 | Integration of Disaster Risk Considerations in Coastal Zone Management (CZM) policy | | | | | | | | x | | | | | | 4-(iii) | A |
| M-06.2 | Natural Barrier along the Coast | | | | | | | | x | | | | | | 4-(iii) | A |
| M-07 | Development Controls, Building Bye-laws | | | | | | | | | | | | x | | 4-(iii) | B |
| M-08 | Housing, Education, Tourism, Infrastructure Facilities | | | | | | | | | | | | | | | |
| M-08.1 | Mitigation Measures in Housing Schemes, Industrial Estates, Tourist Hotels | x | x | | x | x | x | x | x | | | | x | | 4-(iii) | B |
| M-08.2 | Reducing Disaster Risk Vulnerability of High Voltage Towers, Communication Towers | x | x | | x | x | x | x | x | | | | x | | 4-(iii) | B |
| M-08.3 | Planning and Construction of Schools and Hospitals in Hazard Prone Areas to Higher Standards of Hazard Resilience | x | x | | x | x | x | x | x | | | | x | | 4-(iii) | B |
| M-08.4 | Reducing Disaster Risk Vulnerability around Gas, Fuel and Chemical Storage Facilities | | | | | | | | | | | | x | | 4-(iii) | B |
| M-08.5 | Providing Safer Critical Infrastructure in Hazard Prone Areas | x | x | | x | x | x | x | x | | | | x | | 4-(iii) | B |
| M-09 | Drought Mitigation in Selected Districts | | | x | | | | | | | | | | | 4-(i) | B |
| M-10 | Enhancing Dam Safety | | | | | | | | | | | | x | | 4-(i) | B |
| M-11 | Risk Transfer Mechanisms | x | x | x | x | x | x | x | x | | | | x | | 4-(ii) | B |

# Annex 1-1: Progress Activiteies in th "Road Map"

| Vol. 2 | Component | Disaster Type | | | | | | | | | | | | HFA | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Flood | Landslide | Drought | Tsunami | Earthquake | Cyclones | Tornado/Strong Wind | Coastal Erosion | Lightening | Forest Fires | Epidemics | Others | Unclassifiable | |
| M-12 | Research and Development in Disaster Risk Reduction | x | x | x | x | x | x | x | x | x | x | x | x | | 4-(ii) | B |
| M-13 | Reducing Health Risk due to Polluted Groundwater | | | | | | | | | | | | x | | 4-(i) | B |
| M-14 | Construction of By-pass Road Down-stream of Kantale Dam | | | | | | | | | | | | x | | 4-(i) | C |
| M-15 | Drinking Water for Drought Affected Divisions of Hambantota and other Districts through Desalinization | | | | | | | | | | | | x | | 4-(i) | B |
| M-16 | Provision of Incinerators as a Solution to Solid Waste Disposal | | | | | | | | | | | | x | | 4-(i) | B |
| Community-based Disaster Risk Management | | | | | | | | | | | | | | | | |
| CBDM-01 | Promotion of CBDRM Volunteerism | x | x | x | x | x | x | x | x | x | x | x | x | | 1-(iii) | B |
| CBDM-02 | Establishing CBDM Resource Centres | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(i) | D |
| CBDM-03 | Preparedness and Mitigation through Small Grants Programmes | x | x | x | x | x | x | x | x | x | x | x | x | | 5 | B |
| CBDM-04 | Development and Implementation of Micro-Finance Schemes | x | x | x | x | x | x | x | x | x | x | x | x | | 5 | D |
| CBDM-05 | National CBDRM Programme | x | x | x | x | x | x | x | x | x | x | x | x | | 1-(iii) | A |
| CBDM-06 | Applied Research Grant Scheme for CBDRM | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(iii) | D |
| CBDM-07 | Land mines and Unexploded Ordnances (UXO) | | | | | | | | | | | | | x | - | - |
| CBDM-08 | Alternative and Informal Dispute Resolution Mechanisms and Improving Services from State Actors | | | | | | | | | | | | | x | - | B |
| CBDM-09 | Facilitation of the creation of local citizens committees | x | x | x | x | x | x | x | x | x | x | x | x | | 1-(iii) | B |
| CBDM-10 | Strengthening Participatory Democracy-local Government | | | | | | | | | | | | | x | - | B |
| CBDM-11 | Creating a Special Disaster Response Ombudsmen | x | x | x | x | x | x | x | x | x | x | x | x | | 1-(i) | D |
| CBDM-12 | Issues of Subsidiarity in Situations of Emergency | | | | x | | | | | | | | | | 3-(iii) | B |
| CBDM-13 | Strengthening Human Rights in Tsunami Recovery | | | | x | | | | | | | | | | 4-(ii) | B |
| Public Awareness, Education and Training | | | | | | | | | | | | | | | | |
| PA-01 | Awareness through Disaster Safety Day | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(iv) | A |
| PA-02 | National Public Awareness Programme | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(iv) | B |
| PA-03 | Awareness through Schools and School Children | | | | | | | | | | | | | | | |
| PA-03.1 | Integration of DRM into School Curriculum | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(ii) | A |
| PA-03.2 | School Children Awareness Programme | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(ii) | B |
| PA-04 | Awareness through University Curriculum and Continuing Education | | | | | | | | | | | | | | | |
| PA-04.1 | Integration of DM in Graduate and Post-graduate Curriculum in University Education | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(ii) | A |
| PA-04.2 | Awareness by Integrating DM Training in Continuing Education | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(ii) | D |
| PA-05 | Training for Government Employees | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(ii) | A |
| PA-06 | Training for Emergency Preparedness and Response | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(ii) | C |
| PA-07 | Enhancing Training Capacities | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(ii) | B |
| PA-08 | Special Awareness Programmes | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(ii) | C |
| PA-09 | Nationwide Awareness Campaign on Public Safety | x | x | x | x | x | x | x | x | x | x | x | x | | 3-(iv) | B |

| | |
|---|---|
| A | completed |
| D | Not yet |
| B | To some extent completed |
| C | Ongoing |
| N/A | Not applicable anymore |

**Annex1-2: Road Map Matrix**

| Priority Actions | Key Activities | Flood | Landslide | Drought | Tsunami | Others |
|---|---|---|---|---|---|---|
| HFA-1 | (i) National institutional and legislative frameworks | P-1, 2.1, 2.2, 5, 14 CBDM-11 | P-1, 2.1, 2.2, 5, 14 CBDM-11 | P-1, 2.1, 2.2, 5, 14 CBDM-11 | P-1, 2.1, 2.2, 5, 14 CBDM-11 | P-1, 2.1, 2.2, 5, 14 CBDM-11 |
| | (ii) Resources | P-3, 6 | P-3, 6 | P-3, 6 | P-3, 6 | P-3, 6 |
| | (iii) Community participation | P-4, CBDM-1, 5, 8, 9, 10 | P-4, CBDM-1, 5, 8, 9, 10 | P-4, CBDM-1, 5, 8, 9, 10 | P-4, CBDM-1, 5, 8, 9, 10 | P-4, CBDM-1, 5, 8, 9, 10 |
| HFA-2 | (i) National and local risk assessments | HVR-3, 7, 8 | HVR-1, 7, 8 | HVR-5, 7, 8 | HVR-7, 8 | HVR-4, 6, 7, 8, 9, 10 HVR-11, 12, 13, 14 |
| | (ii) Early warning | E-1 | E-1, 4 | | E-1, 11 | E-1, 6, 8, E-10 |
| | (iii) Capacity | E-2, 3 | E-2 | E-2, E-5 | | E-2, 7, E-9 |
| | (iv) Regional and emerging risks | | | | | |
| HFA-3 | (i) Information management and exchange | HVR-2 CBDM-2 | HVR-2 CBDM-2 | HVR-2 CBDM-2 | HVR-2 CBDM-2 | HVR-2 CBDM-2 |
| | (ii) Education and training | PA-3.1, 3.2, 4.1, 4.2 PA-5, 6, 7, 8 | PA-3.1, 3.2, 4.1, 4.2 PA-5, 6, 7, 8 | PA-3.1, 3.2, 4.1, 4.2 PA-5, 6, 7, 8 | PA-3.1, 3.2, 4.1, 4.2 PA-5, 6, 7, 8 | PA-3.1, 3.2, 4.1, 4.2 PA-5, 6, 7, 8 |
| | (iii) Research | CBDM-6 | CBDM-6 | CBDM-6 | CBDM-6, 12 | CBDM-6 |
| | (iv) Public awareness | PA-1, 2, 9 | PA-1, 2, 9 | PA-1, 2, 9 | PA-1, 2, 9 | PA-1, 2, 9 |
| HFA-4 | (i) Environmental and natural resource management | M-2 | M-1 | M-9 | | M-10, 13, 14, 15, 16 |
| | (ii) Social and economic development practices | M-11, 12 | M-11, 12 | M-11, 12 | M-11, 12 CBDM-13 | M-11, 12 |
| | (iii) Land-use planning and other technical measures | M-3, 4.1, 4.2, 5, 8.5 | M-3, 4.1, 4.2, 5, 8.5 | M-3, 4.1, 4.2, 5 | M-3, 4.1, 4.2, 5, 8.5 | M-3, 4.1, 4.2, 5, 6.1, M-6.2, 7, 8.1, 8.2, M-8.3, 8.4, 8.5 |
| HFA-5 | Strengthen disaster preparedness for effective response at all levels | PR-1.3, 3, 4, 5, 6, 7, PR-8, 10, 11,15, 16, PR-17 CBDM-3, CBDM-4 | PR-1.5, 3, 4, 5, 6, 7, PR-8, 10, 11,15, 17 CBDM-3, CBDM-4 | PR-1.2, 3, 4, 5, 6, 7, PR-8, 10, 11 CBDM-3, CBDM-4 | PR-1.4, 3, 4, 5, 6, 7, PR-8, 10, 11,12, 14, PR-15, 17 CBDM-3, CBDM-4 | PR-1.1, 1.6, 2, 3, 4, PR-5, 6, 7, 8, 9, 10, PR-11, 13, 14, 15, PR-16 17 CBDM-3, CBDM-4 |

Note: Unclassifiable P-7, 8, 9, 10, 11, 12, 13, 14, HVR-15, & CBDM-7

Highlighted in blue indicates that an activity is not implemented.

**Annex 2: List of Projects assisted by JICA and other Donors**

| Donor | No. | Project | Components | HFA | Target Areas |
|---|---|---|---|---|---|
| Japan | | | | | |
| | J-1 | The Study on storm water drainage plan for the Colombo metropolitan region | - Master Plan of flood control for Colombo metropolitan region<br>- F/S for prioritized project<br>- Technical transfer | 2-iii<br>3-ii | |
| | J-2 | Recovery, Rehabilitation and Development Project for Tsunami Affected Area of Northern and Eastern Region | - Rehabilitation, recovery and development plan for tsunami affected areas<br>- Support and monitor grant aid projects of GoJ<br>- Share disaster experiences in Japan through the project | 4-i | |
| | J-3 | Recovery, Rehabilitation and Development Project for Tsunami Affected Area of Southern Region | - Rehabilitation, recovery and development plan for tsunami affected areas of southern region<br>- Support and monitor grant aid projects of GoJ<br>- Share disaster experiences in Japan through the project | 4-i | |
| | J-4 | Recovery, Rehabilitation and Development Project for Tsunami Affected Trunk Roads on the East Coast | - B/D for 4 causeways destroyed by tsunami<br>- F/S for trunk road on the east coast<br>- B/D for new Kalladi bridge | 4-i | |
| | J-5 | Comprehensive Study on Disaster Management | - comprehensive flood control plan for Kerani, Kal, Gin and Nilwara river<br>- Early warning system and pilot projects<br>- CBDRM<br>- Strengthening of capacity of related organizations | 2-ii<br>1-iii<br>2-iii | |
| | J-6 | Preparatory Study for Flood Risk Management and Climate Change Adaptation in South Western Sri Lanka | - F/S for structural measures and non-structural measures in Kal river basin<br>- Flood control facilities in Kerani river basin and rehabilitation plan for drainage systems in Gin and Nilwara River basin<br>- Strengthning capacity for flood control of related organzations | 2-iii | |
| | J-7 | Data Collection Survey on Road Protection against Natural Disasters (Landslide-disaster) | - Assesment of landslide damages to road infrastructures<br>- Identify issues for strengthening slope disaster management for national roads | 2-i | Uva Province, Central Province, Sabaragamuwa Province, Western Province |
| | J-8 | Tsunami and Conflict Affected Communities Upliftment Project in the North East Region | - Obtain techniques for livelihood<br>- Strengthen local community<br>- Promote social inclusion of inhabitant<br>- Improve capacity of administrative officers and NGOs for participatory development | 1-iii<br>2-iii<br>2-iii | |
| | J-9 | Disaster Management Capacity Enhancement Project Adaptable to Climate Change | - Strengthen capacity for cordination of DMC<br>- Improve capacity for monitoring, analysis and forecasting of DOM<br>- Improve capacity for measures against landslides of NBRO<br>- Adequate function for early warning system from DMC to pilot areas<br>- Improve capacity for disaster management of all levels of ptocinces, districts and communities in pilot areas | 2-iii<br>2-iii<br>2-iii<br>2-ii<br>2-iii | |
| | J-10 | Practical Community countermeasure for earthquake and tsunami disaster mitigation though PTA(Participatory Technology Assessment) | - Training in Japan<br>- Workshop<br>- Visit tsunami affected areas | 1-iii<br>3-ii | |

**Annex 2: List of Projects assisted by JICA and other Donors**

| Donor | No. | Project | Components | HFA | Target Areas |
|---|---|---|---|---|---|
| | J-11 | Project on Promotion of Sustainable Disaster Mitigation Education and Trauma Counseling | - Education | 3-ii | |
| | J-12 | Sri Lanka Tsunami Affected Area Recovery and Takeoff (STAART) Project | - Recovery and rehabilitation and improvement of infrastructures affected by tsunami | 4-i | |
| | J-13 | Emergency Natural Disaster Rehabilitation Project | - Recovery , rehabilitation and improvement of national roads, provincial roads and irrigation facilities affected by torrential rain from December 2010 to February 2011 | 4-i | |
| | J-14 | Greater Colombo Flood Control and Environmental Improvement Project | - Improvement of rivers in greater Colombo<br>- Ressettlement of shanty<br>- Procurement of equipments for operation and maintenance<br>- Consulting services | 4-i<br>4-iii | |
| | J-15 | The Project for Improvement of Meteorological and Disaster Information Network | - AWS System<br>- VSAT system<br>- Central Operation System | 2-ii<br>2-iii<br>3-iii | |
| | J-16 | Emergency Aid for Flood Disaster | | 4-i | |
| | J-17 | Emergency Aid for the 2004 Indian Ocean earthquake and tsunami disaster | | 4-i | |
| | J-18 | Non Project Type Grant Aid (the 2004 Indian Ocean earthquake and tsunami disaster) | | 4-i | |
| | J-19 | Emergency Aid for Flood Disaster (through IFRC) | | 4-i | |
| | J-20 | Emergency Aid for Flood Disaster (through UNICEF) | | 4-i | |
| | J-21 | The Digital Topographic mapping Project for Reconstruction of Northern Region | - Aerial photography of the entire Northern Region of Sri Lanka.<br>- Production of 1:10,000-scale topographic maps of Mannar and Jaffna Districts of Sri Lanka.<br>- Technology transfers for production of digital topographic maps through implementation of items above. | 2-i<br>2-i<br>2-iii | |

**Annex 2: List of Projects assisted by JICA and other Donors**

| Donor | No. | Project | Components | HFA | Target Areas |
|---|---|---|---|---|---|
| WB | | | | | |
| | WB-1 | Metro Colombo Urban Development Project | Component 1: Flood and Drainage Management<br>Component 2: Urban development, infrastructure rehabilitation and capacity building for Metro Colombo local authorities<br>Component 3: Implementation Support | 4-i<br>2-ii<br>4-iii | |
| | WB-2 | Dam Safety and Water Resources Planning Project | Component 1. Dam Safety and Operational Efficiency Improvement (Project cost $53.14 million, of which IDA Credit $47.36million)<br>Component 2. Hydro-meteorological Information System Improvement (Project cost $8.48 million, ofwhich IDA Credit $8.48 million)<br>Component 3. Multi-sectoral Water Resources Planning (project cost $6.49 million, of which IDA Credit $6.49 million)<br>Component 4. Project Management, Monitoring and Evaluation (Project cost $3.05 million, of which IDA Credit 3.00 million) | 4-i<br>2-ii<br>4-i | |
| | WB-3 | ARF Training on Developing a Common Framework for PDNA, Recovery and Reconstruction in Asia (Bangkok) | The ARF Training on Developing a Common Framework for Post-Disaster Needs Assessment, Recovery and Reconstruction will be organized by the European Union and Thailand in close cooperation with the World Bank and the United Nations Development Programme in the framework of the EC-UN-WB Joint Declaration on Post-crisis Assessments and Recovery Planning.<br><br>The training will focus on introducing main principles to undertake government-led Post-Disaster Needs Assessment (PDNAs) to assess the socio-economic impacts and identify the needs for recovery and reconstruction in the aftermath of a disaster. It will illustrate how to assess human/social needs using the UN Human Recovery Needs Assessment methodology (HRNA) and the impact and recovery/reconstruction needs using the methodology for damage and loss assessments (DaLA). Practical case studies will be presented, based on past PDNAs undertaken by the EC, WB/GFDRR (Global facility for Disaster Reduction and Recovery) and UN/UNDP-BCPR in the framework of the cooperation on PDNA and recovery planning to support disaster-stricken countries both in Asia and in other regions of the world. | 3-ii<br>5 | |
| | WB-4 | DRR technical assistance to priority countries in South Asia | Technical assistance for the preparation and implementation of DRR activities in focus countries identified and prioritized in the approved Country Plans. Country specific TORs have been prepared. | 3-ii | |

**Annex 2: List of Projects assisted by JICA and other Donors**

| Donor | No. | Project | Components | HFA | Target Areas |
|---|---|---|---|---|---|
| | WB-5 | Improving Sri Lanka's response and recovery in the aftermath of natural disaster | The objective of the proposed activity is to improve the capacity of the country?s disaster management system to improve the response and recovery activities in the aftermath of disasters. This would contribute to an improved response to the social protection and livelihoods needs of poor people affected by natural disasters.<br><br>The proposed activity will seek to achieve these objectives by (i) assessing the institutional capacity and the needs of those affected; and (ii) providing training and capacity building of the safety net programs of the Ministry of Resettlement and Disaster Management, Ministry of Disaster Management and Human Rights and other relevant ministries designated by the GoSL to offer disaster relief and recovery services. | 5<br>3-ii<br>2-iii | |
| | WB-6 | Mainstreaming Disaster Risk Management in Sri Lanka | The primary objective of the proposed activity is to build the technical capacity of the Sri Lankan government to assess and quantify particular flood risk, and to formulate appropriate policy and operational responses to this risk.<br>Given the urgency for the completion of Component One - Preparatory studies for Metro Colombo Urban Development Project (MC request from the DMC to organize a PDNA training during the last week of July 2011 | 2-iii<br>4-iii | |
| | WB-7 | Emergency Northern Recovery Project | The Project Development Objective (PDO) is to support Government of Sri Lanka#s efforts to rapidly resettle the IDPs in the Northern Province by creating an enabling environment#. It will be achieved through: (A) Emergency Assistance to IDPs; (B) a Work-fare Program; (C) Rehabilitation and Reconstruction of Essential Public and Economic Infrastructure; and (D) Project Management Support. | 4-i | |
| UNDP | | | | | |
| | UNDP-1 | 2003-2008: Transitional Recovery Support to Flood Disaster in Southwest Sri Lanka (TRSFD) | - To provide assistance to reconstruct the damaged infrastructure facilities in affected areas.<br>- To develop the capacity of National Disaster Management Centre (NDMC)<br>- To provide opportunities for establishing and strengthening DM coordination mechanisms at national and district level to respond to emergencies.<br>- To provide the assistance to rebuild life lines of the social fabric on priority basis who are worst affected due to flood. | 4-i<br>2-iii<br>5<br>4-i | flood and landslide prone areas of Kalutara, Galle, Matara and Hambantota districts |
| | UNDP-2 | 2006-2008 Capacity Building in Disaster Risk Management (CBDRM) | - Institutional strengthening - To implement DRM Framework/Roadmap developed by DMC for “safer Sri Lanka”.<br>- Provisions of Physical (Hardware and software) and human resource to establish National Emergency Operation Room at DMC and provincial EOC.<br>- To develop disaster preparedness and response plans for National Ministies, Departments and authorities.<br>- To develop Multi Hazards Community contingency Plans at Villages/GN levels<br>- To Carryout and develop Capacity Building of DM teams at various levels.<br>- To integrate hazard mapping into development process at the local levels.<br>- Training and awareness creations – To promote partnership with academic and Research institutions and private sector for engaging in DRM. (R & D)<br>- To carryout awareness campaign on Disaster Mitigation and preparedness for all stakeholders, professional institutions, school and community. | 1-i<br>1-i<br>5<br>5<br>2-iii<br>2-i<br>3-i<br>3-ii<br>3-iv | |

**Annex 2: List of Projects assisted by JICA and other Donors**

| Donor | No. | Project | Components | HFA | Target Areas |
|---|---|---|---|---|---|
| | UNDP-3 | 2005-2008: Preparatory assistance for Establishing Disaster Management Framework and Disaster Management Centre in Sri Lanka ( PAEDF) | - Technical support (Consultancy) for the establishment and functioning of the DMC.<br>- Support to DMC to develop a DRM Road Map.<br>- Training and Capacity building for staff of the Disaster management Centre<br>- Support for development of 'initial' communication material for DMC.<br>- Assistance with initial stake holder's workshops, consultation meetings and coordination of donor and international agencies.<br>- Training/capacity building of intermediate level staff and volunteers.<br>- Provide technical assistance in the preparation of Disaster preparedness and response plan at intermediate and GN levels<br>- Provide physical and technical assistance in establishing operation centers and websites at intermediate level.<br>- Technical assistance on appropriate disaster resistant construction technologies form mason and engineers.D36 | 2-iii<br>1-i<br>2-iii<br>1-I<br>1-ii<br>3-i<br>2-iii<br>5<br>2-iii<br>4-iii | |
| | UNDP-4 | Jan 2009 – April 2009 Disaster Risk Management through partnerships (DRM-P) in Sri Lanka(DRMP)<br>Budget =US$ 699035 | - Key stake holders to participate at national and provincial risk reduction forums<br>- Support most vulnerable community centres, Health centres and Schools in Uva and eastern provinces to draft infrastructure development plans with disaster risk reduction main streamed.<br>- Provide materials to DMC for community level training and advocacy activities. | 3-i<br>4-iii<br>1-iii<br>3-ii | |
| | UNDP-5 | 2005-2007 Strengthening Early warning system in Sri Lanka (EWSS) | - Establishment of community based flood level monitoring network along vulnerable river basins<br>- Establishment of a pilot, integrated model for real-time land slide monitoring based on real-time precipitation measurements.<br>- Strengthening of capacity of institutions involved in early warning systems to improve amongst others forecast for multi hazards and ensure appropriate actions to avoid their adverse impact.<br>- Strengthening dissemination mechanism of early warning to communities.<br>- Development guideline s for evacuation.<br>- Establishment of local warning systems such as sirens and loudspeakers.<br>- Mock drills. | 1-iii<br>2-ii<br>2-ii<br>2-ii<br>2-ii<br>1-iii<br>5<br>2-ii<br>2-iii | implemented primarily in the landslide prone areas of Ratnapura district |
| | UNDP-6 | 2006-2008: Sustainable Recovery of Natural Resources of Tsunami Affected Coastal Areas of Sri Lanka with People' s Participation (SRNRTA) | - Development of environment plans and implemented with the participation of the community<br>- Ecosystems are managed by people affected by the tsunami whose livelihoods depend on the sustainability of ecosystem.<br>- Raised awareness amongst selected communities and the district committee on the linkages between environment and disaster risk reduction | 1-iii<br>4-i<br><br>3-iv | implemented in Hambantota, Matara, Ampara, Baticaloa, Trincomalee districts |
| | UNDP-7 | 2008-2012 Strategic Support to "Operationalize the Road Map Towards Safer Sri Lanka" (SSORM)<br>Budget $ 2,100,000 | - Development of Hazard, Vulnerability and Risk Report for Sri Lanka.<br>- Establishment of tsunami and multi-hazard warning systems at district level.<br>- Sustainable Disaster Risk reduction approaches mainstreamed into Development Planning.<br>- Promotion of climate risk management at the community level.<br>- Promotion of DRR as a subject of study in research institutions and schools.<br>- Support Ministry of Disaster Management in project implementation and management | 1-i<br>2-ii<br>4-iii<br>1-iii<br>4-i<br>3-ii<br>2-iii | |
| Korea | K-1 | COMS Project | - System for receiving images from Korean weather satellite | 2-ii<br>3-iii | |

**Annex 2: List of Projects assisted by JICA and other Donors**

| Donor | No. | Project | Components | HFA | Target Areas |
|---|---|---|---|---|---|
| China | C-1 | CMAcast Project | - System for receiving images from Chinese weather satellite | 2-ii<br>3-iii | |
| USA | USA-1 | GTS Project | - System for transmission and reception to world climate information system | 2-ii<br>3-iii | |
| Italia | Ita-1 | Hyper DEM Project | - LIDAR survey along the coast with 2km width | 2-i | |
| GIZ | GIZ-1 | Education for Social Cohesion | - Curriculum and teacher's manual development on disaster risk management<br>- In-service training for teachers at 17 teacher colleges and 92 local centers at province level<br>- National standards for school safety have been drawn up and are being implemented in schools through the country. (school disaster safety activity at selected 200 pilot schools by 2012) (Phase 2 starts from 2013, targeting all primary/junior secondary schools in the country) | 2-ii | Countrywide |

| Priority Area | Key Activities | | Flood | Landslide | Drought | Tsunami | Others(including Meteorology) |
|---|---|---|---|---|---|---|---|
| HFA-1 | (i) | National institutional and legislative frameworks | UNDP-2, 3, 7 | UNDP-2, 3, 7 | UNDP-2, 3, 7 | UNDP-2, 3, 7 | UNDP-2, 3, 7 |
| | (ii) | Resources | UNDP-3 | UNDP-3 | UNDP-3 | UNDP-3 | UNDP-3 |
| | (iii) | Community participation | **J-5**<br>UNDP-4,5,7 | UNDP-4, 5, 7 | UNDP-4, 5, 7 | **J-8, 10**<br>**UNDP-6** | UNDP-4, 5, 7 |
| HFA-2 | (i) | National and local risk assessments | UNDP-2 | **J-7**<br>UNDP-2 | UNDP-2 | UNDP-2 | **J-21**<br>UNDP-2<br>**Ita-1** |
| | (ii) | Early warning | **J-5, *9***<br>***WB-2***<br>**UNDP-5,** 7<br>K-1<br>C-1<br>USA-1 | **J-*9***<br>**UNDP-5,** 7<br>K-1<br>C-1<br>USA-1 | UNDP-5, 7<br>K-1<br>C-1<br>USA-1 | UNDP-7 | **J-15**<br>***WB-2***<br>UNDP-5,7<br>**K-1**<br>**C-1**<br>**USA-1** |
| | (iii) | Capacity | **J-1, 5, 6,** 9<br>***WB-1,*** 5, 6<br>UNDP-1, 2, 3, 5, 7 | **J-**5, ***9***<br>WB-5, 6<br>UNDP-1, 2, 3, 5, 7 | J-5, 9<br>WB-5, 6<br>UNDP-1, 2, 3, 5, 7 | **J-**5, **8,** 9<br>WB-5, 6<br>UNDP-1, 2, 3, 5, 7 | **J-**5, ***9*****, J-15**<br>WB-5, 6<br>UNDP-1, 2, 3, 5, 7 |
| | (iv) | Regional and emerging risks | | | | | |
| HFA-3 | (i) | Information management and exchange | UNDP-2, 3, 4 | UNDP-2, 3, 4 | UNDP-2, 3, 4 | UNDP-2, 3, 4 | UNDP-2, 3, 4 |
| | (ii) | Education and training | **J-1**<br>WB-3, 4, 5<br>UNDP-2, 4, 7<br>GIZ-1 | WB-3, 4, 5<br>UNDP-2, 4, 7<br>GIZ-1 | WB-3, 4, 5<br>UNDP-2, 4, 7<br>GIZ-1 | **J-10, 11**<br>UNDP-2, 4, 7<br>GIZ-1 | WB-3, 4, 5<br>UNDP-2, 4, 7<br>GIZ-1 |
| | (iii) | Research | J-15<br>K-1<br>C-1<br>USA-1 | J-15<br>K-1<br>C-1<br>USA-1 | J-15<br>K-1<br>C-1<br>USA-1 | | **J-15**<br>**K-1**<br>**C-1**<br>**USA-1** |
| | (iv) | Public awareness | UNDP-2 | UNDP-2 | UNDP-2 | UNDP-2**, 6** | UNDP-2 |
| HFA-4 | (i) | Environmental and natural resource management | UNDP-7 | UNDP-7 | UNDP-1,7 | UNDP-**1, 6,** 7 | UNDP-1, 7 |
| | (ii) | Social and economic development practices | | | | | |
| | (iii) | Land-use planning and other technical measures | **J-14**<br>***WB-1,*** 6<br>UNDP-3, 4, 7 | WB-6<br>UNDP-3, 4, 7 | WB-6<br>UNDP-3, 4, 7 | WB-6<br>UNDP-3, 4, 7 | WB-6<br>UNDP-3, 4, 7 |
| HFA-5 | Strengthen disaster preparedness for effective response at all levels | | WB-3, 5<br>UNDP-1, 2, 3, 5 | WB-3, 5<br>UNDP-1, 2, 3, 5 | WB-3, 5<br>UNDP-1, 2, 3, 5 | WB-3, 5<br>UNDP-1, 2, 3, 5 | WB-3, 5<br>UNDP-1, 2, 3, 5 |
| Structural Measures | | | **J-14**<br>***WB-1, 2***<br>***C-2*** | | ***WB-2*** | | |
| Emergency Measures | | | **J-13, 16, 19, 20**<br>***WB-8***<br>**UNDP-1** | **UNDP-1** | | **J-2, 3, 4, 12, 17, 18** | **WB-7** |

***J-1, etc.: Project Number shown in Annex 1**

**Italic with underline: on-going or proposed projects.**

**No bold type: Not specific projects for specific type of disasters, Overall projects such as disaster management, meteorological management**

***Highlighted in yellow indicates great discrepancy, and light yellow indicates small discrepancy.**

**ANNEX 4: Impacts of Disasters**

**Damage and Impacts of Natural Hazaeds**

| No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Natural Disaster | Landslide | Flood | Drought | Earthquake | Tsunami | Cyclones | Tornado/ Strong Wind | Coastal erosion | Lightning | Forest fires | Epidemics |
| No. of records | 2,483 | 9,080 | 1,997 | 82 | 89 | 192 | 3,864 | 78 | 446 | 149 | 88,833 |
| No. of deaths | 896 | 519 | 2 | 0 | 30,959 | 855 | 88 | 0 | 374 | 1 | 368 |
| No. of injured | 302 | 322 | 0 | 0 | 19,611 | 600 | 416 | 1 | 389 | 0 | 0 |
| No. of missing | 39 | 19 | 1 | 0 | 1,908 | 21 | 15 | 0 | 3 | 0 | 0 |
| No. of houses destroyed | 2,239 | 49,176 | 10 | 1 | 57,085 | 31,324 | 3,834 | 135 | 21 | 16 | 0 |
| No of houses damaged | 10,152 | 157,435 | 78 | 103 | 48,208 | 148,408 | 36,728 | 386 | 183 | 17 | 0 |
| No. of peoples affected | 120,384 | 13,900,794 | 12,922,514 | 70 | 1,076,240 | 1,690,930 | 278,469 | 3,223 | 1,629 | 187 | 588,797 |
| No. of peoples relocated | 348 | 33 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 |
| No. of peoples evacuated | 2,798 | 74,093 | 600 | 0 | 0 | 3,941 | 1,375 | 646 | 3 | 10 | 0 |
| No. of lost cattle | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4,149,120 |

Note, Data from DesInventar Sri Lanka, Recording Period from Jan/1974 to Sep/2012

**Disaster Impact Score based on Damage and Impacts of Natural Hazards**

| No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Natural Disaster | Landslide | Flood | Drought | Earthquake | Tsunami | Cyclones | Tornado/ Strong Wind | Coastal erosion | Lightning | Forest fires | Epidemics |
| No. of records | 8 | 10 | 7 | 2 | 3 | 5 | 9 | 1 | 6 | 4 | 11 |
| No. of deaths | 10 | 7 | 4 | 1 | 11 | 9 | 5 | 1 | 6 | 3 | 8 |
| No. of injured | 6 | 7 | 1 | 1 | 11 | 10 | 9 | 5 | 8 | 1 | 1 |
| No. of missing | 10 | 8 | 5 | 1 | 11 | 9 | 7 | 1 | 6 | 1 | 1 |
| No. of houses destroyed | 7 | 10 | 3 | 2 | 11 | 9 | 8 | 6 | 5 | 4 | 1 |
| No of houses damaged | 7 | 11 | 3 | 4 | 9 | 10 | 8 | 6 | 5 | 2 | 1 |
| No. of peoples affected | 5 | 11 | 10 | 1 | 8 | 9 | 6 | 4 | 3 | 2 | 7 |
| No. of peoples relocated | 11 | 10 | 1 | 1 | 1 | 1 | 9 | 1 | 1 | 1 | 1 |
| No. of peoples evacuated | 9 | 11 | 6 | 1 | 1 | 10 | 8 | 7 | 4 | 5 | 1 |
| No. of lost cattle | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 |
| Total Score | 74 | 86 | 41 | 15 | 67 | 73 | 70 | 33 | 45 | 24 | 43 |

* Score given based on the order of each item above; No.1 of the item can be given 11 points. If data is 0, score is 1 point.

: Top 3 types of natural hazards in each item.

| **No.** | **1** |
|---|---|
| **Kind of Natural Disaster** | **Landslide** |
| 1. Damages in historical record *1 | |
| No. of records | 2,483 |
| No. of deaths | 896 |
| No. of injured | 302 |
| No. of missing | 39 |
| No. of houses destroyed | 2,239 |
| No of houses damaged | 10,152 |
| No. of peoples affected | 120,384 |
| No. of peoples relocated | 348 |
| No. of peoples evacuated | 2,798 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Very high |
| Area spread | High |
| Loss and damages | High |
| Impact on population | High |
| 3. Present efforts of DM | |
| Management framework | - NBRO is recognized as the leading agency in the technical aspect.<br>- NBRO is preparing the draft act related to the landslide. |
| Risk assessment | - 1:50,000 scale hazard map have been developed in the hillside landslide prone areas.<br>- 1:10,000 scale hazard maps is being prepared. |
| Early warning | - NBRO is conducting the early warning for the landslide prone districts based on the rainfall data from DOM.<br>- 36 AWS (DOM) and the pilot early warning system in Galaboda and Mahawewa installed by DiMCEP. |
| Response | - National and district level DMCCs have been established.<br>- District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - Small scale emergency works have been implemented by DMC and the district secretariats.<br>- 4 mitigation works are being conducted by NBRO.<br>- New regulation concerning the land suitability certificate or recommendation by NBRO has been issued for the new development/construction activities in the hillside landslide prone areas.<br>- The school disaster safety plan are being prepared.<br>- Land use plan in the central fragile areas are being prepared by the NPPD in association with NBRO. |
| Awareness/education | - The pilot projects of school education and CBDRM are being implemented.<br>- Material for awareness were prepared. |
| 4. Future prospect of DM | |
| Management frame work | - The landslide act shall be ratified. |
| Risk assessment | - Revised landslide zoning maps shall be prepared in order to clarify the potential areas of the sediment related disasters based on the new base maps in cooperation with Survey Department. |
| Early warning | - The early warning system for the districts shall be improved by NBRO in corporation with DOM.<br>- The early warning at the respective landslide sites shall be installed. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - Capacity to mitigate the sediment related disasters shall be enhanced in NBRO and the implementing agencies.<br>- Appropriate countermeasures of the landslide sites shall be conducted, considering the national physical plan. |
| Awareness/education | - Present activities shall be systemized and continued, considering the national physical plan. |
| 5. Discrepancy between the present condition and the future prospect | Great |
| Management frame work | Great |
| Risk assessment | Great |
| Early warning | Great |
| Response | Small (training) |
| Mitigation works | Great |
| Awareness/education | Great |

| **No.** | **2** |
|---|---|
| **Kind of Natural Disaster** | **Flood** |
| 1. Damages in historical record *1 | |
| No. of records | 9,080 |
| No. of deaths | 519 |
| No. of injured | 322 |
| No. of missing | 19 |
| No. of houses destroyed | 49,176 |
| No of houses damaged | 157,435 |
| No. of peoples affected | 13,900,794 |
| No. of peoples relocated | 33 |
| No. of peoples evacuated | 74,093 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Extremely high |
| Area spread | Very high |
| Loss and damages | Very high |
| Impact on population | Very high |
| 3. Present efforts of DM | |
| Management framework | - There are many responsible agencies for the flood: ID, MASL, CEB, NWS&DB, the district secretariats, municipal councils/local authorities, SLLRDC, Agrarian Services Department and CC&CRMD in their jurisdictional areas.<br>- ID has the flood protection ordinance of the rivers, but the responsibility is limited. |
| Risk assessment | The event base flood hazard maps for 4 river basins has been prepared. |
| Early warning | - Two (2) early warning systems in place (Kelani, Kalu)<br>- 36 AWS in operation (DOM)<br>- Hydro-meteorological data collection network and information system are being updated (DSWRPP) |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - Aging and critical infrastructure facilities are being rehabilitated /improved (DMC, District Secretariats).<br>- Large dams are being rehabilitated (DSWRPP).<br>- Desilting works of the tanks are being done (ID, MASL)<br>- Urban flood measures are being studied and implemented: Metro Colombo (SLLR&DC-WB), Batticaloa (ID)<br>- Integrated flood management master plans in the south western Sri Lanka were prepared. However, the master plans are not authorized by the residents in the basins. |
| Awareness/education | - The pilot projects of school education and CBDRM are being implemented.<br>- Material for awareness were prepared. |
| 4. Future prospect of DM | |
| Management frame work | - The basin-wide coordination framework shall be made, based on the existing water management coordination framework. |
| Risk assessment | - The flood hazard maps for the respective river basins shall be prepared by the ID in cooperation with Survey Department. |
| Early warning | - The early warning systems for respective flood prone areas shall be installed. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - The flood management policies and master plans of respective basins shall be prepared under the condition of public participation.<br>- Appropriate flood mitigation works shall be conducted in accordance with the master plan. |
| Awareness/education | - Present activities shall be systemized and continued. |
| 5. Discrepancy between the present condition and the future prospect | Great |
| Management frame work | Great |
| Risk assessment | Great |
| Early warning | Great |
| Response | Small (training) |
| Mitigation works | Great |
| Awareness/education | Great |

| **No.** | **3** |
|---|---|
| **Kind of Natural Disaster** | **Drought** |
| 1. Damages in historical record *1 | |
| No. of records | 1,997 |
| No. of deaths | 2 |
| No. of injured | 0 |
| No. of missing | 1 |
| No. of houses destroyed | 10 |
| No of houses damaged | 78 |
| No. of peoples affected | 12,922,514 |
| No. of peoples relocated | 0 |
| No. of peoples evacuated | 600 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Very high |
| Area spread | Very high |
| Loss and damages | High |
| Impact on population | Very high |
| 3. Present efforts of DM | |
| Management framework | -There are many responsible agencies related to the water and agriculture, such as WRB, DOM, ID, MASL, DOA, Agrarian Services Department, HART, FOs, etc. |
| Risk assessment | - The hazard map of the country has been developed based on the weather records, under coordination by DMC and UNDP. |
| Early warning | - DOM issues the season weather forecast. |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised. |
| Mitigation works | - Rehabilitation of capacities of the existing storage facilities is being done by ID and MASL under MI&WRM.<br>- Ground water development are being done by WRB.<br>- DOA is studying the countermeasures against drought, such as the crop changeover, etc.<br>- National plan for drought mitigation was prepared.<br>- Small scale emergency works have been implemented by DMC and the district secretariats. |
| Awareness/education | - Awareness is implemented through FOs. |
| 4. Future prospect of DM | |
| Management frame work | - DMC shall be lead coordination agency of the drought. |
| Risk assessment | - Risk assessment under the condition of climate change shall be under taken. |
| Early warning | - DOM shall enhance the forecast accuracy. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - Present activities should be continued. |
| Awareness/education | - Present activities should be continued and accelerated. |
| 5. Discrepancy between the present condition and the future prospect | Small |
| Management frame work | Small |
| Risk assessment | No |
| Early warning | Great (meteorology) |
| Response | Small (training) |
| Mitigation works | No |
| Awareness/education | Small |

| **No.** | **4** |
|---|---|
| **Kind of Natural Disaster** | **Earthquake** |
| 1. Damages in historical record *1 | |
| No. of records | 82 |
| No. of deaths | 0 |
| No. of injured | 0 |
| No. of missing | 0 |
| No. of houses destroyed | 1 |
| No of houses damaged | 103 |
| No. of peoples affected | 70 |
| No. of peoples relocated | 0 |
| No. of peoples evacuated | 0 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Rare |
| Area spread | Significant |
| Loss and damages | Significant |
| Impact on population | Significant |
| 3. Present efforts of DM | |
| Management framework | - GSMB is recognized as the lead agency of earth quake.<br>- There is no significant earth quake in Sri Lanka, except small tremors in the eastern part. |
| Risk assessment | - No risk assessment is done. |
| Early warning | - Global seismic activities including the observation in Sri Lanka are monitored by GSMB through GSN, and the warning is issued, |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - The Construction Guideline Committee of the National DM Advisory Committee has issued a Construction guideline.<br>- The school disaster safety plan are being prepared. |
| Awareness/education | - Awareness activities of the construction guideline are being done. |
| 4. Future prospect of DM | |
| Management frame work | - Present framework shall be maintained. |
| Risk assessment | - Observation and research of the tremor/earthquake shall be continued. |
| Early warning | - Present activities shall be maintained. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - Enforcement of the construction guideline shall be done not only for the earthquake but also for the other disasters. |
| Awareness/education | - Awareness activities for the construction guidelines shall be strengthened. |
| 5. Discrepancy between the present condition and the future prospect | Small |
| Management frame work | No |
| Risk assessment | No |
| Early warning | No |
| Response | Small (training) |
| Mitigation works | No |
| Awareness/education | Small |

| **No.** | **5** |
|---|---|
| **Kind of Natural Disaster** | **Tsunami** |
| 1. Damages in historical record *1 | |
| No. of records | 89 |
| No. of deaths | 30,959 |
| No. of injured | 19,611 |
| No. of missing | 1,908 |
| No. of houses destroyed | 57,085 |
| No of houses damaged | 48,208 |
| No. of peoples affected | 1,076,240 |
| No. of peoples relocated | 0 |
| No. of peoples evacuated | 0 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Rare |
| Area spread | High |
| Loss and damages | Very high |
| Impact on population | Extremely High |
| 3. Present efforts of DM | |
| Management framework | - CC&CRMD is in charge of the coast area conservation except the national park areas.<br>- Tsunami Early Warning Committee consisting of secretary of MDM, heads of NARA, DMC, DOM and CC&CRMD was established. |
| Risk assessment | - Tsunami hazard maps along the coastline of the country have been prepared by CC&CRMD, EDC of University of Paradeniya, DMC and UNDP. |
| Early warning | - Based on the GSN information, the Tsunami Early Warning Committee will issue the warning.<br>- Dissemination system of the warning, including warning towers, were established by DMC through the various measures. |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - New coastal zone management plan are being developed by CC&CRMD, based on the National Physical Plan and the Urban Development Plan.<br>- Coastal area construction permit and land use regulation, such as setback, buffer zone, etc., are being implemented by CC&CRMD.<br>- Planting for the shelter belt along the coastal line is being implemented.<br>- The school disaster safety plan are being prepared. |
| Awareness/education | - Awareness activities of the communities are being implemented. |
| 4. Future prospect of DM | |
| Management frame work | - Present framework shall be maintained. |
| Risk assessment | - Research activities for Tsunami shall be continued. |
| Early warning | - Present system shall be maintained and improved. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - Present system shall be maintained and improved. |
| Awareness/education | - Present system shall be maintained and improved in order to make a culture against Tsunami. |
| 5. Discrepancy between the present condition and the future prospect | Small |
| Management frame work | No |
| Risk assessment | No |
| Early warning | No |
| Response | Small (training) |
| Mitigation works | No |
| Awareness/education | Small |

| **No.** | **6** |
|---|---|
| **Kind of Natural Disaster** | **Cyclones** |
| 1. Damages in historical record *1 | |
| No. of records | 192 |
| No. of deaths | 855 |
| No. of injured | 600 |
| No. of missing | 21 |
| No. of houses destroyed | 31,324 |
| No of houses damaged | 148,408 |
| No. of peoples affected | 1,690,930 |
| No. of peoples relocated | 0 |
| No. of peoples evacuated | 3,941 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Rare |
| Area spread | High |
| Loss and damages | Very high |
| Impact on population | Very high |
| 3. Present efforts of DM | |
| Management framework | - DOM is in charge of observation of the cyclone/ storm.<br>- DMC is in charge of coordination of the disaster response. |
| Risk assessment | - Based on the observed data from 1958 to 2009, track of the storms and cyclones, average and maximum wind speed distributions in the country were developed, under coordination by DMC and UNDP. |
| Early warning | - DOM issues the warning and DMC disseminates the warning to the public. |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - The Construction Guideline Committee of the National DM Advisory Committee has issued a Construction guideline.<br>- The school disaster safety plan are being prepared. |
| Awareness/education | - Awareness activities of the construction guideline are being done. |
| 4. Future prospect of DM | |
| Management frame work | - Present framework shall be maintained. |
| Risk assessment | - Research activities for the cyclones/storms shall be continued. |
| Early warning | - Present system shall be maintained and improved. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - Enforcement of the construction guideline shall be done.<br>- Public facilities, such as the government offices, schools, hospitals, etc., shall be strengthened in accordance with the construction guideline. |
| Awareness/education | - Awareness activities for the construction guidelines shall be strengthened. |
| 5. Discrepancy between the present condition and the future prospect | Small |
| Management frame work | No |
| Risk assessment | No |
| Early warning | Great (Meteorology) |
| Response | Small (training) |
| Mitigation works | No |
| Awareness/education | Small |

| **No.** | **7** |
|---|---|
| **Kind of Natural Disaster** | **Tornado/ Strong Wind** |
| 1. Damages in historical record *1 | |
| No. of records | 3,864 |
| No. of deaths | 88 |
| No. of injured | 416 |
| No. of missing | 15 |
| No. of houses destroyed | 3,834 |
| No of houses damaged | 36,728 |
| No. of peoples affected | 278,469 |
| No. of peoples relocated | 16 |
| No. of peoples evacuated | 1,375 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Very high |
| Area spread | High |
| Loss and damages | High |
| Impact on population | High |
| 3. Present efforts of DM | |
| Management framework | - DOM is in charge of observation of the cyclone/ storm.<br>- DMC is in charge of coordination of the disaster response. |
| Risk assessment | - Based on the observed data from 1958 to 2009, track of the storms and cyclones, average and maximum wind speed distributions in the country were developed, under coordination by DMC and UNDP. |
| Early warning | - DOM issues the warning and DMC disseminates the warning to the public. |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - The Construction Guideline Committee of The National DM Advisory Committee has been issued a Construction guideline.<br>- The school disaster safety plan are being prepared. |
| Awareness/education | - Awareness activities of the construction guideline are being done. |
| 4. Future prospect of DM | |
| Management frame work | - Present framework shall be maintained. |
| Risk assessment | - Research activities for the cyclones/storms shall be continued. |
| Early warning | - Present system shall be maintained and improved. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - Enforcement of the construction guideline shall be done.<br>- Public facilities, such as the government offices, schools, hospitals, etc., shall be strengthened in accordance with the construction guideline. |
| Awareness/education | - Awareness activities for the construction guidelines shall be strengthened. |
| 5. Discrepancy between the present condition and the future prospect | Small |
| Management frame work | No |
| Risk assessment | No |
| Early warning | Great (meteorology) |
| Response | Small (training) |
| Mitigation works | No |
| Awareness/education | Small |

| **No.** | **8** |
|---|---|
| **Kind of Natural Disaster** | **Coastal erosion** |
| 1. Damages in historical record *1 | |
| No. of records | 78 |
| No. of deaths | 0 |
| No. of injured | 1 |
| No. of missing | 0 |
| No. of houses destroyed | 135 |
| No of houses damaged | 386 |
| No. of peoples affected | 3,223 |
| No. of peoples relocated | 0 |
| No. of peoples evacuated | 646 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Rare |
| Area spread | Significant |
| Loss and damages | Significant |
| Impact on population | Significant |
| 3. Present efforts of DM | |
| Management framework | - CC&CRMD is in charge of the coast area conservation except the national park areas. |
| Risk assessment | - Tendency maps of erosion along the coast line of the country was prepared by CC&CRMD, EDC of University of Paradeniya, DMC and UNDP. |
| Early warning | - No early warning is done. |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - New coastal zone management plan are being developed by CC&CRMD, based on the National Physical Plan and the Urban Development Plan.<br>- Countermeasures of the coastal erosion are implemented by CC&CRMD. |
| Awareness/education | - No awareness activity is done. |
| 4. Future prospect of DM | |
| Management frame work | - Present framework shall be maintained. |
| Risk assessment | - Research activities for the coast erosion shall be continued. |
| Early warning | - Warning method shall be established based on the research results. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - Present system shall be maintained and improved. |
| Awareness/education | - Awareness for conservation of the coast line shall be strengthened. |
| 5. Discrepancy between the present condition and the future prospect | Small |
| Management frame work | No |
| Risk assessment | No |
| Early warning | No |
| Response | Small (training) |
| Mitigation works | No |
| Awareness/education | Small |

| **No.** | **9** |
|---|---|
| **Kind of Natural Disaster** | **Lightning** |
| 1. Damages in historical record *1 | |
| No. of records | 446 |
| No. of deaths | 374 |
| No. of injured | 389 |
| No. of missing | 3 |
| No. of houses destroyed | 21 |
| No of houses damaged | 183 |
| No. of peoples affected | 1,629 |
| No. of peoples relocated | 0 |
| No. of peoples evacuated | 3 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | High |
| Area spread | High |
| Loss and damages | Significant |
| Impact on population | Significant |
| 3. Present efforts of DM | |
| Management framework | - DOM is in charge of the forecasting and warning. |
| Risk assessment | - Based on the data for 1961 to 1990 at the 20 meteorological stations, distribution Maps of the average thunder days in months and in a year was prepared. |
| Early warning | - No warning is done. |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - there is no mitigation work done. |
| Awareness/education | - Awareness creation has been implemented by use of the prepared material. |
| 4. Future prospect of DM | |
| Management frame work | - Present framework shall be maintained. |
| Risk assessment | - Research activities for the thunder and weather shall be continued. |
| Early warning | - Based on the research activities, the warning method for lightening shall be established.<br>- The warning of the lightening shall be done. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - The lightning conductor shall be widely used. |
| Awareness/education | - Awareness creation shall be continued. |
| 5. Discrepancy between the present condition and the future prospect | Small |
| Management frame work | No |
| Risk assessment | No |
| Early warning | Small (meteorology) |
| Response | Small (training) |
| Mitigation works | No |
| Awareness/education | Small |

| **No.** | **10** |
|---|---|
| **Kind of Natural Disaster** | **Forest fires** |
| 1. Damages in historical record *1 | |
| No. of records | 149 |
| No. of deaths | 1 |
| No. of injured | 0 |
| No. of missing | 0 |
| No. of houses destroyed | 16 |
| No of houses damaged | 17 |
| No. of peoples affected | 187 |
| No. of peoples relocated | 0 |
| No. of peoples evacuated | 10 |
| No. of lost cattle | 0 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Rare |
| Area spread | Significant |
| Loss and damages | Significant |
| Impact on population | Significant |
| 3. Present efforts of DM | |
| Management framework | - Department of Forest and Department of Wildlife conservation are in charge of the warning in corporation with DOM. |
| Risk assessment | - No risk assessment is done. |
| Early warning | - No early warning issued. |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - No mitigation work done. |
| Awareness/education | - Awareness of manmade fire has been implemented. |
| 4. Future prospect of DM | |
| Management frame work | - Present framework shall be maintained. |
| Risk assessment | - Research activities for the forest fire and weather shall be continued. |
| Early warning | - Warning method shall be developed. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | No work proposed. |
| Awareness/education | - Awareness of manmade fire shall be continued. |
| 5. Discrepancy between the present condition and the future prospect | Small |
| Management frame work | No |
| Risk assessment | No |
| Early warning | Small (meteorology) |
| Response | Small (training) |
| Mitigation works | No |
| Awareness/education | Small |

| **No.** | **11** |
|---|---|
| **Kind of Natural Disaster** | **Epidemics** |
| 1. Damages in historical record *1 | |
| No. of records | 88,833 |
| No. of deaths | 368 |
| No. of injured | 0 |
| No. of missing | 0 |
| No. of houses destroyed | 0 |
| No of houses damaged | 0 |
| No. of peoples affected | 588,797 |
| No. of peoples relocated | 0 |
| No. of peoples evacuated | 0 |
| No. of lost cattle | 4,149,120 |
| 2. Degree of impact to country | |
| Frequency of occurrence | Extremely high |
| Area spread | Very high |
| Loss and damages | High |
| Impact on population | High |
| 3. Present efforts of DM | |
| Management framework | - Ministry of Health and Department of Health Services are in charge of management. |
| Risk assessment | - No risk assessment in public. |
| Early warning | - Warning by Ministry of Health and dissemination by DMC. |
| Response | - National and district level DMCC were established.<br>- National and District level disaster management and response plans were prepared or are being revised.<br>- District level search and rescue teams were established. |
| Mitigation works | - No mitigation work done |
| Awareness/education | - Awareness of health has been implemented. |
| 4. Future prospect of DM | |
| Management frame work | - Present framework shall be maintained. |
| Risk assessment | - Research activities shall be continued. |
| Early warning | - Present system shall be maintained and improved. |
| Response | - Present system shall be maintained and improved through the continuous training. |
| Mitigation works | - No work proposed. |
| Awareness/education | - Awareness of health shall be strengthened. |
| 5. Discrepancy between the present condition and the future prospect | Small |
| Management frame work | No |
| Risk assessment | No |
| Early warning | No |
| Response | Small (training) |
| Mitigation works | No |
| Awareness/education | Small |

# Spatial distribution of Flood Damage

Data Source:

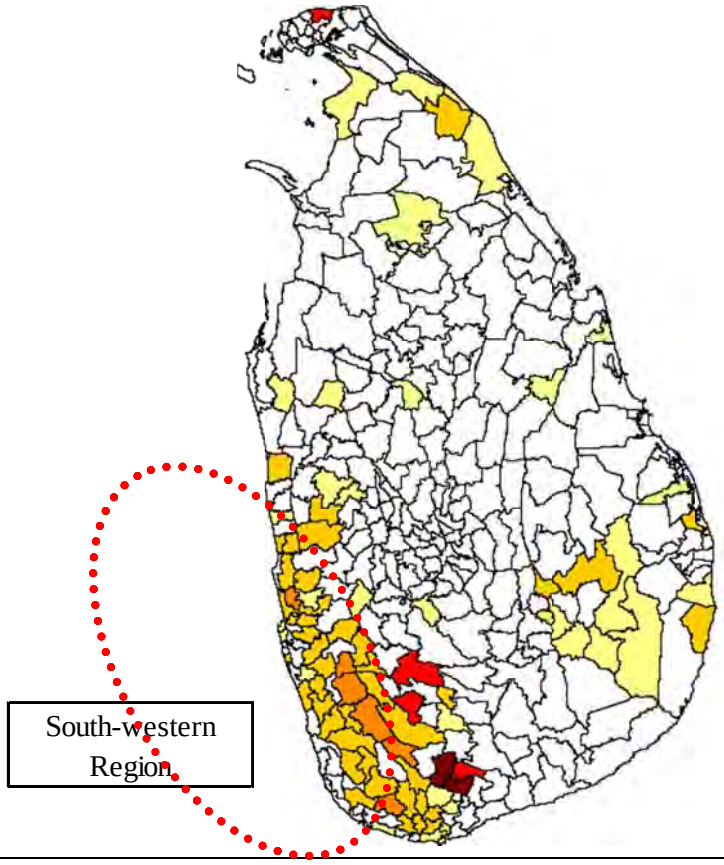
Disaster Information Management System in Sri Lanka (www.desinventar.lk/)

Disaster Type: Flood

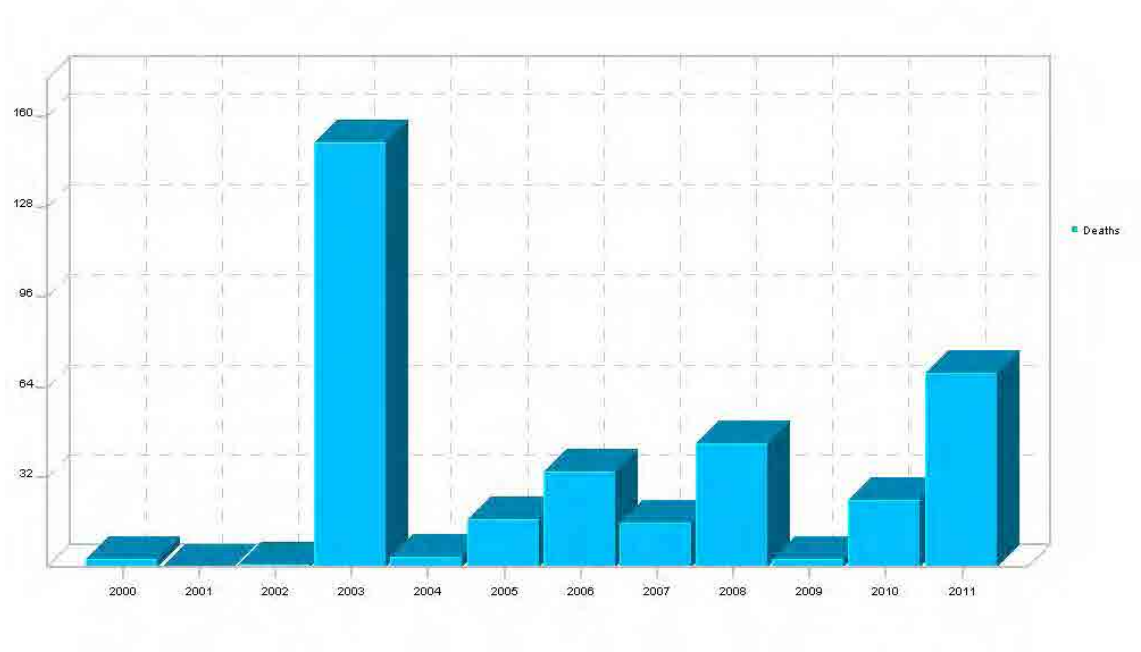
Period: 2000/01/01～2011/12/31

Record size: 5,175 (5,095 with division information)

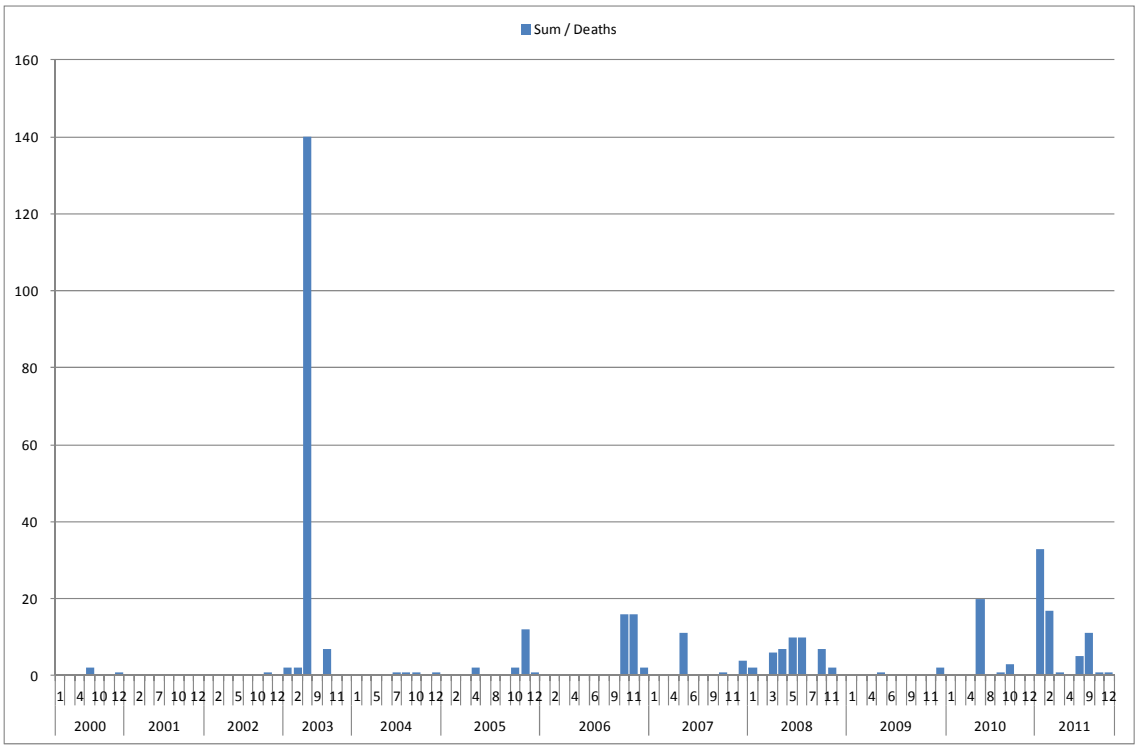
## Deaths



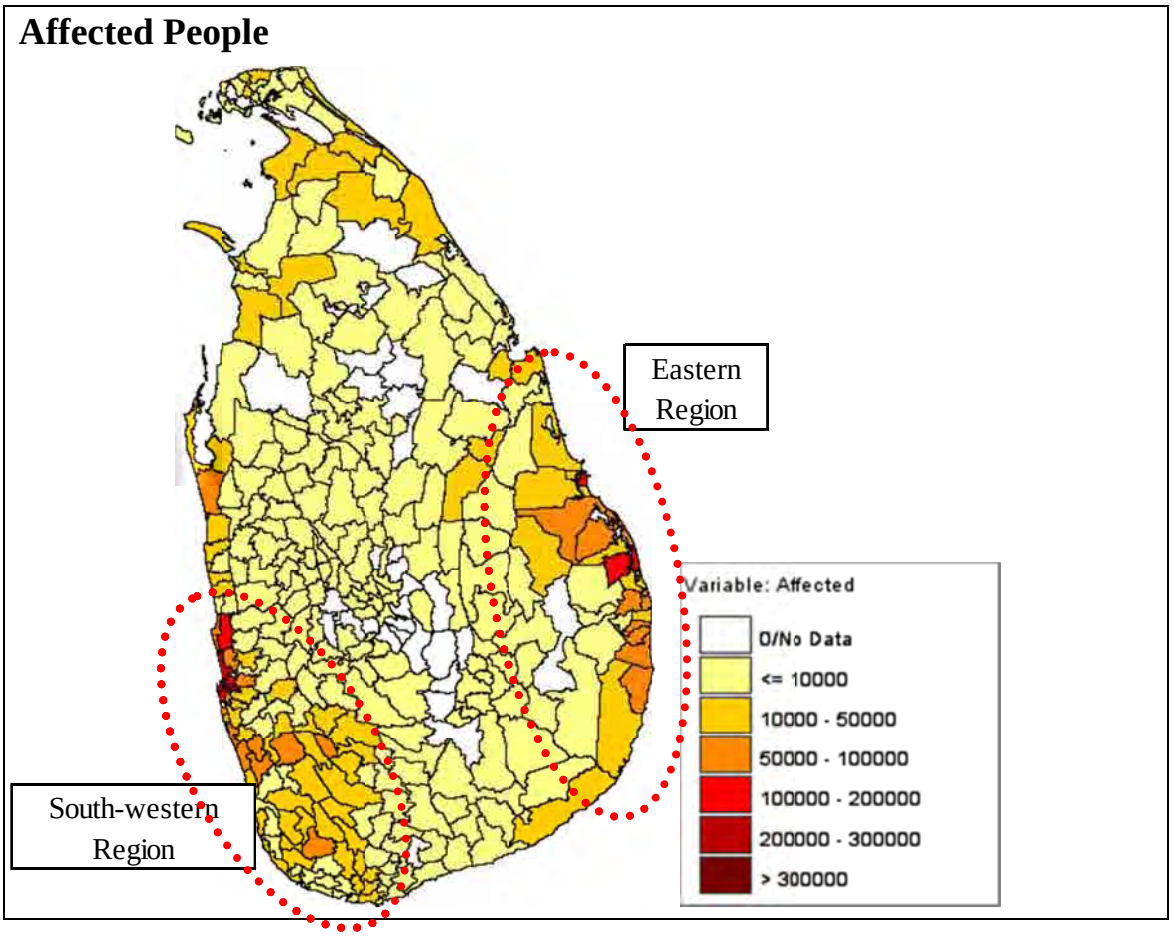
## Deaths



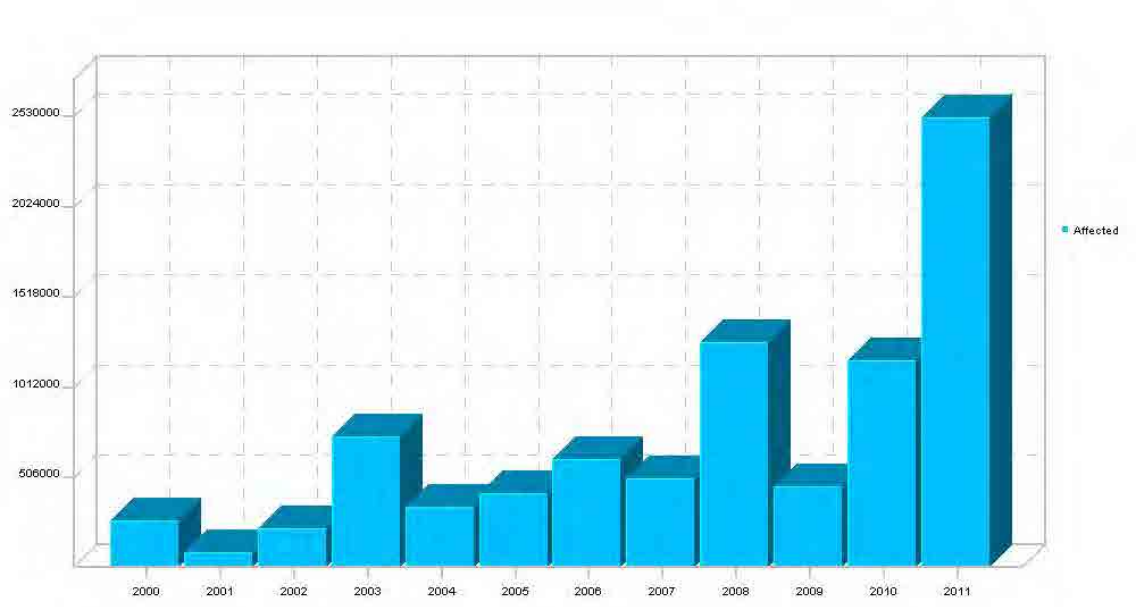

## Deaths



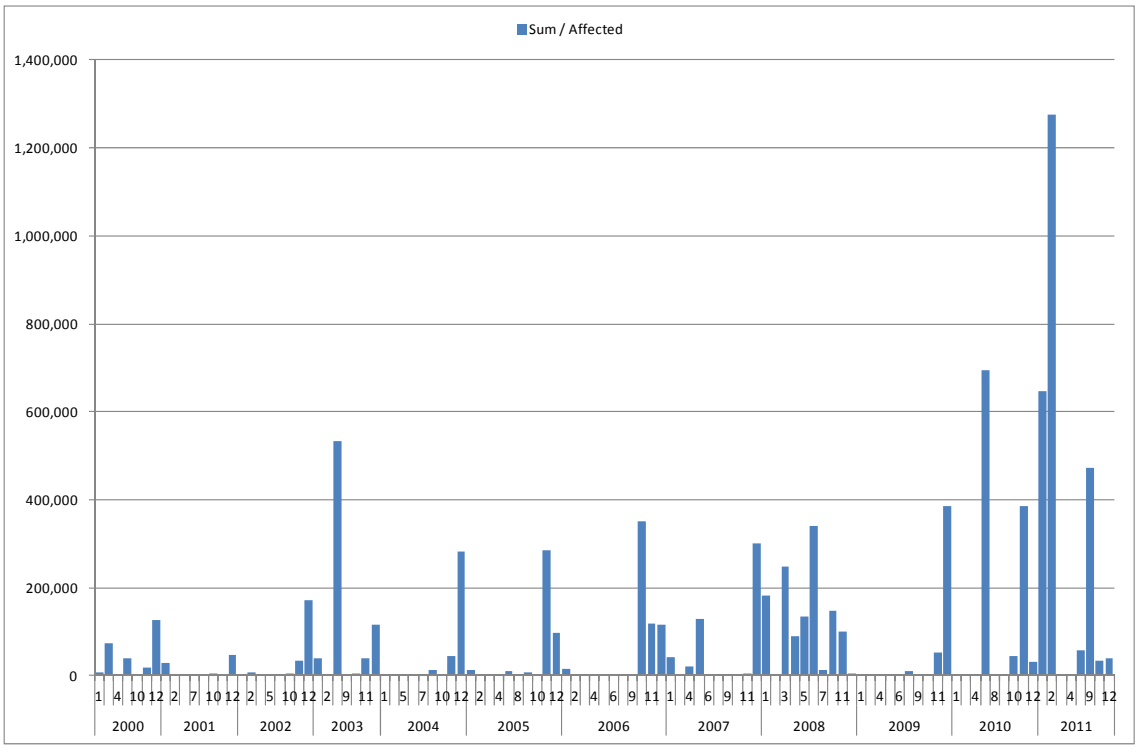
**Annex 6-1: Spatial Distribution of Flood Damage**



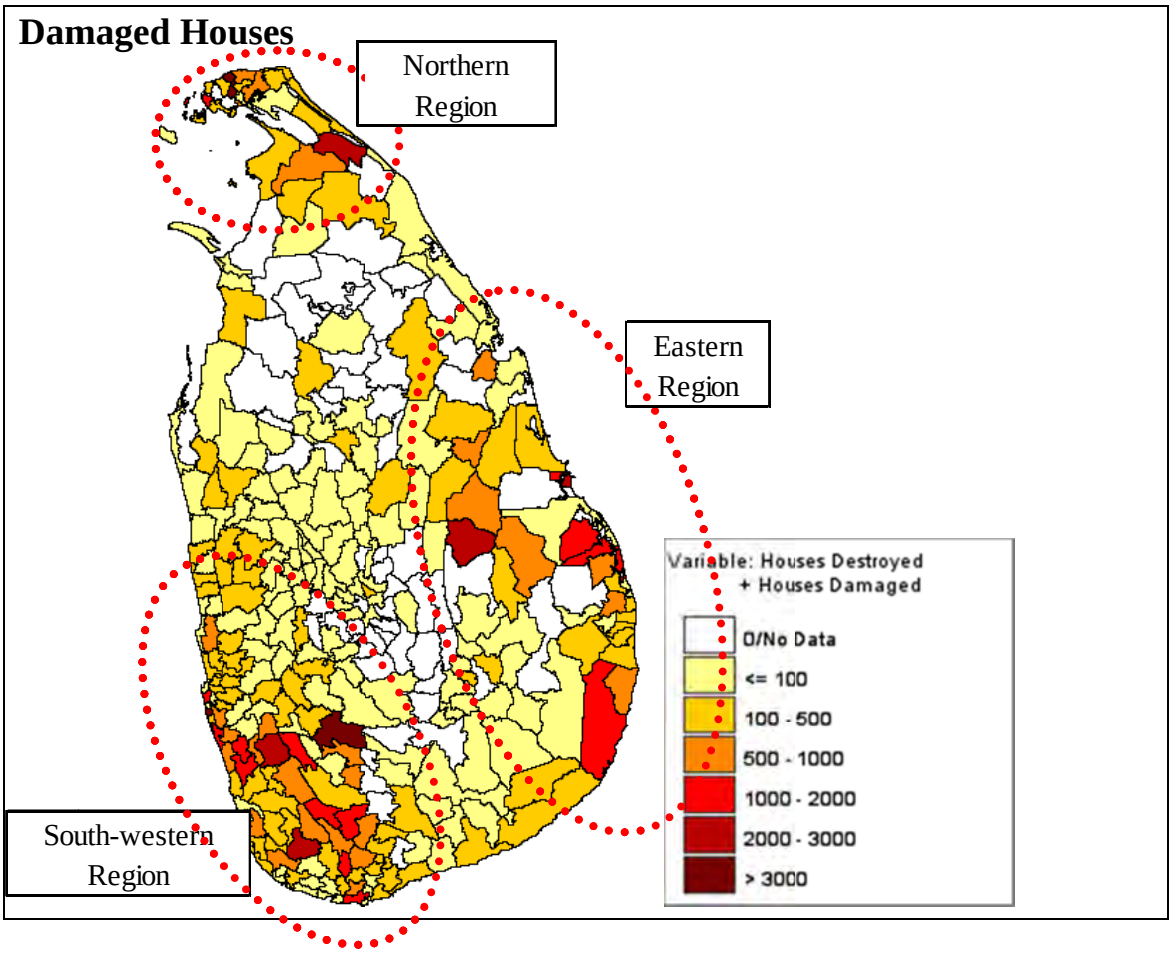
## Affected People



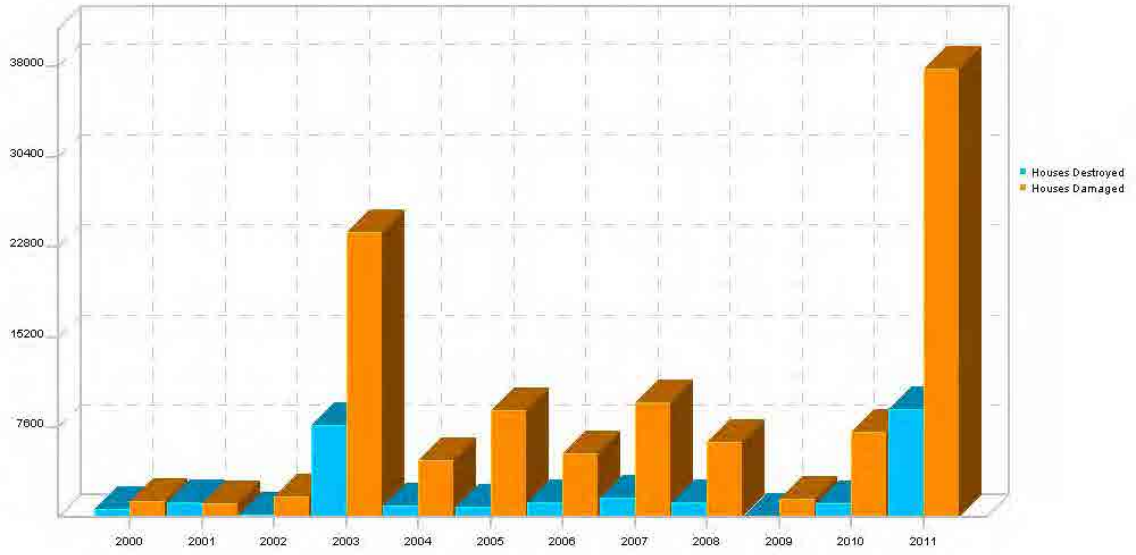

## Affected People



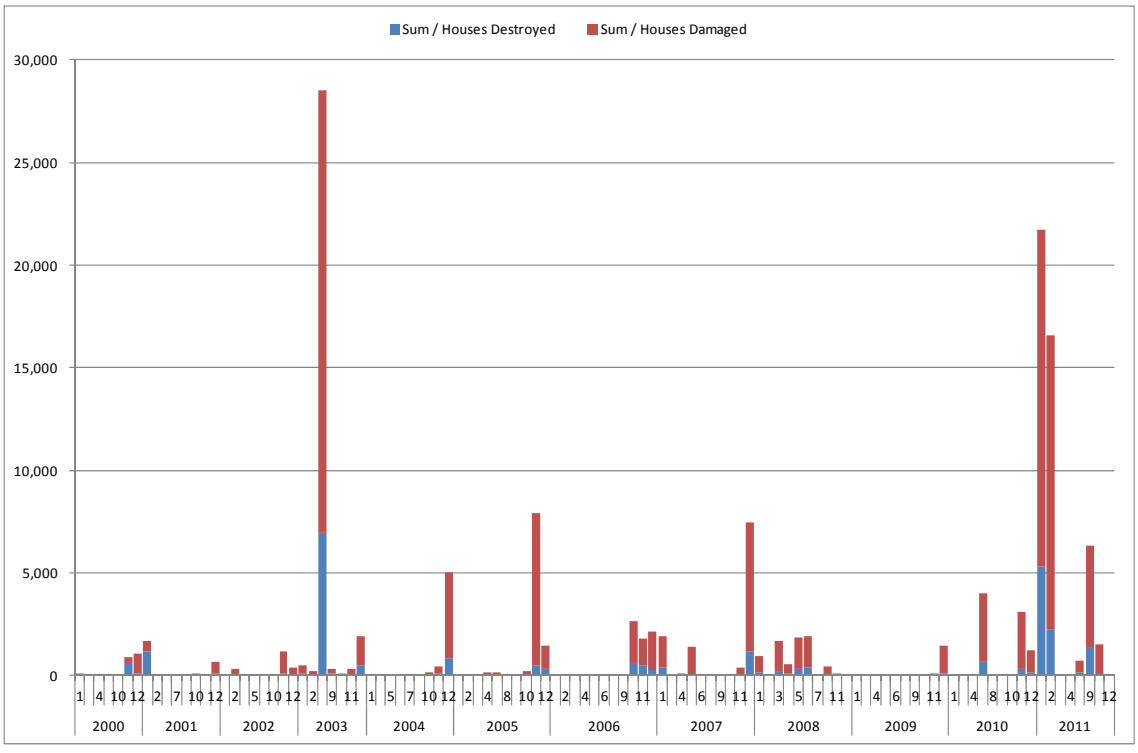
**Annex 6-1: Spatial Distribution of Flood Damage**



## Damaged Houses

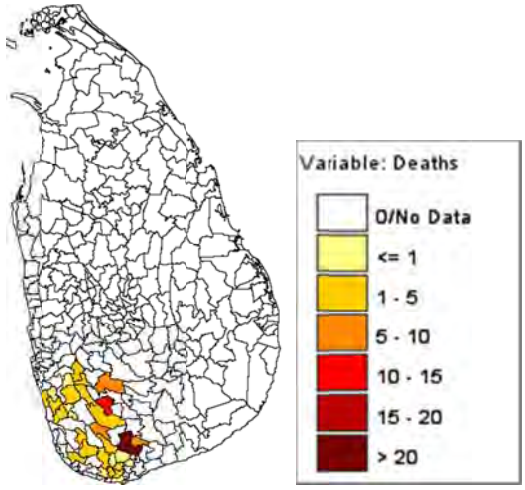



## Damaged Houses

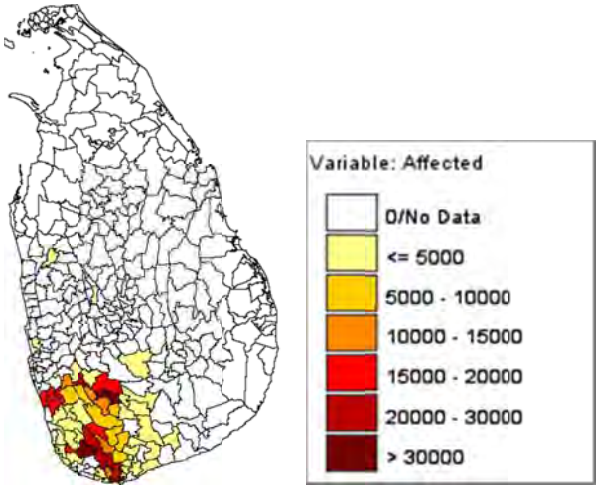


## Flood in May 2003
## (Severe Flood in South-western Region)

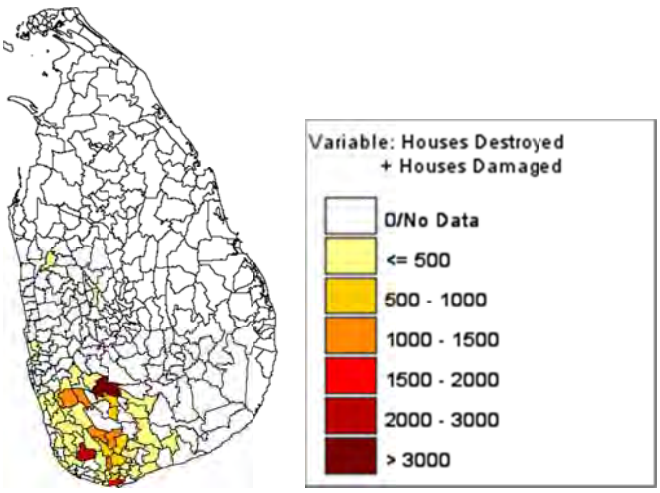
### Deaths




### Affected People

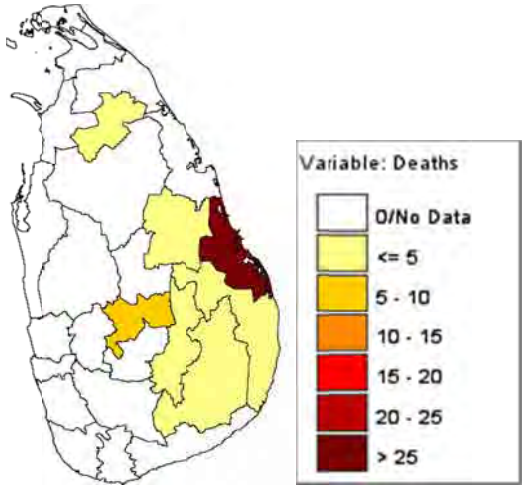



### Damaged Houses

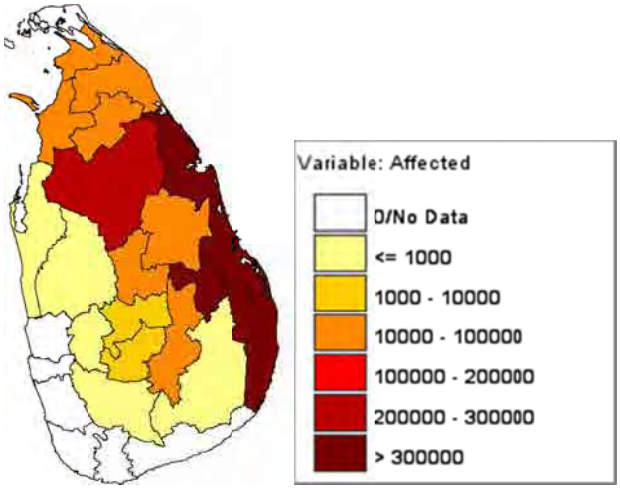


## Flood in Jan & Feb 2011
## (Severe Flood in whole Sri Lanka, Especially in Eastern Region)

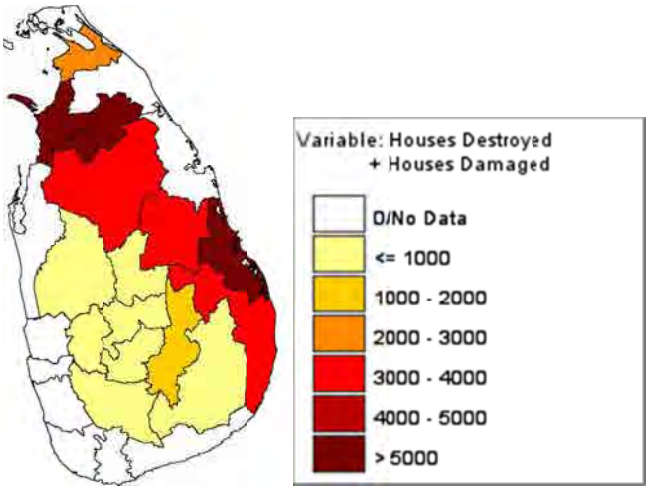
### Deaths



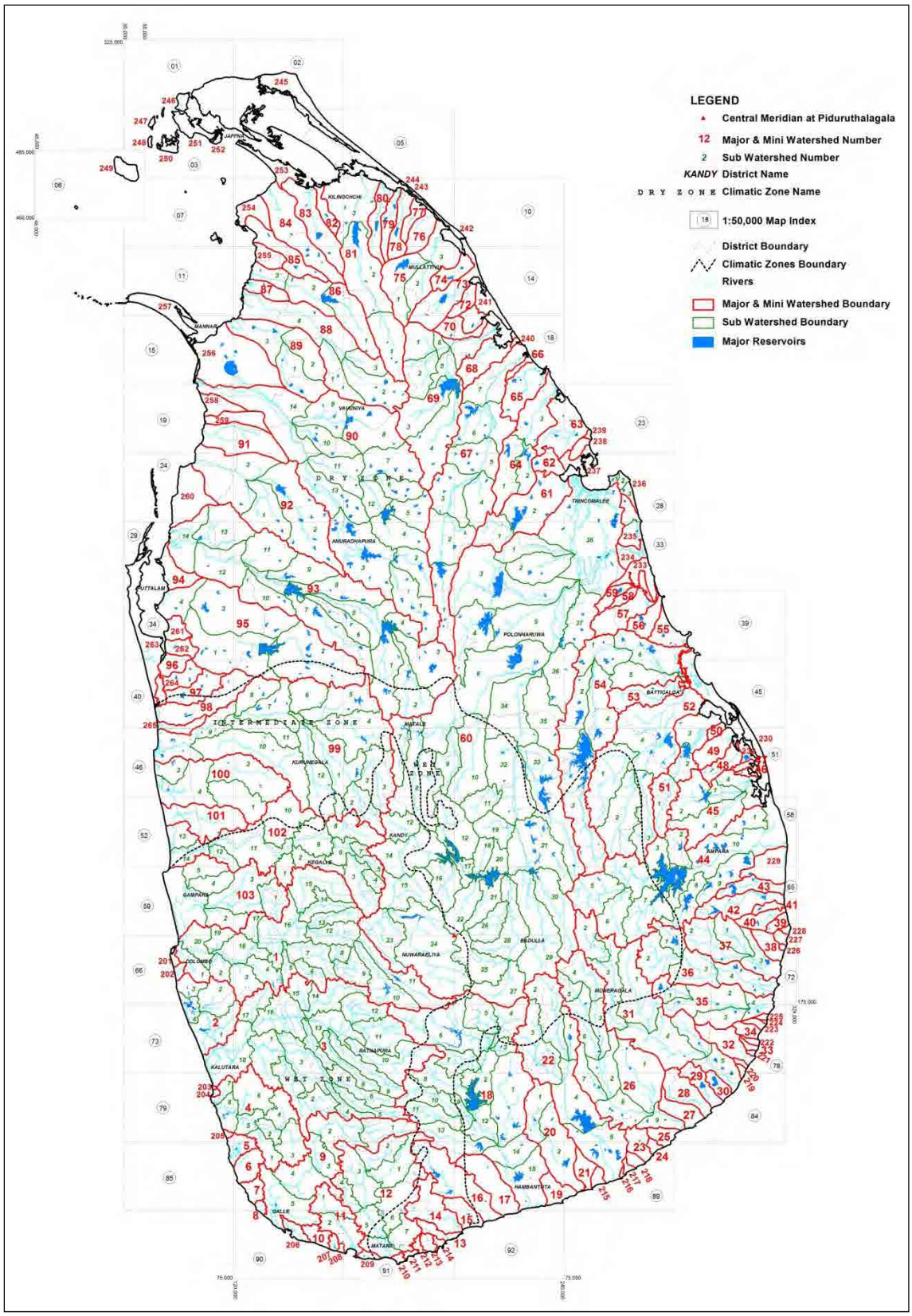

### Affected People




### Damaged Houses



# 103 River Basins



**Annex 6-2: 103 River Basins**

List of 103 River Basins

| Watershed No. | Watershed Name | Area ($km^2$) | Watershed No. | Watershed Name | Area ($km^2$) |
|---|---|---|---|---|---|
| 1 | Kelani Ganga | 2,321 | 53 | Miyangolla Ela | 185 |
| 2 | Bolgoda Ganga | 433 | 54 | Maduru Oya | 1,487 |
| 3 | Kalu Ganga | 2,784 | 55 | Pulliyanpota Aru | 104 |
| 4 | Benthota Ganga | 729 | 56 | Kirimechchi Odai | 95 |
| 5 | Madu Ganga | 73 | 57 | Bodigoda Aru | 175 |
| 6 | Madampe Lake | 95 | 58 | Mandan Aru | 34 |
| 7 | Telwatta Ganga | 53 | 59 | Makarachchi Aru | 56 |
| 8 | Ratgama Lake | 16 | 60 | Mahaweli Ganga | 10,372 |
| 9 | Gin Ganga | 924 | 61 | Kantalai Aru | 459 |
| 10 | Koggala Lake | 55 | 62 | Palampotta Aru | 78 |
| 11 | Polwatta Ganga | 239 | 63 | Panna Oya | 236 |
| 12 | Nilwala Ganga | 1,024 | 64 | Pankulam Aru | 499 |
| 13 | Seenimodara Oya | 49 | 65 | Kunchikumban Aru | 200 |
| 14 | Kirama Oya | 209 | 66 | Palakutti Aru | 22 |
| 15 | Rekawa Oya | 93 | 67 | Yan Oya | 1,529 |
| 16 | Urubokka Oya | 348 | 68 | Mee Oya | 158 |
| 17 | Kachigala | 226 | 69 | Ma Oya | 1,063 |
| 18 | Walawe Ganga | 2,538 | 70 | Churiyan Aru | 88 |
| 19 | Karagan Oya | 86 | 71 | Chavar Aru | 58 |
| 20 | Malala Oya | 427 | 72 | Palladi Aru | 59 |
| 21 | Embilikala Oya | 70 | 73 | Mannal Aru (Munadal Aru) | 241 |
| 22 | Kirindi Oya | 1,176 | 74 | Kodalikallu Aru | 94 |
| 23 | Bambawe Aru | 84 | 75 | Per Aru | 479 |
| 24 | Mahasiliwa Oya | 19 | 76 | Kalmaduru Aru (Pali Aru) | 107 |
| 25 | Butawa Oya | 54 | 77 | Maruthapillay Aru | 60 |
| 26 | Menik Ganga | 1,278 | 78 | Theravil Aru | 111 |
| 27 | Katupila Aru | 101 | 79 | Piramenthal Aru | 91 |
| 28 | Kuranda Aru | 148 | 80 | Nethali Aru | 124 |
| 29 | Nabadagas Aru | 96 | 81 | Kanakarayan Aru | 905 |
| 30 | Karambe Aru | 54 | 82 | Kalawalappu Aru | 64 |
| 31 | Kumbukkan Oya | 1,211 | 83 | Akkarayan Aru | 260 |
| 32 | Baguru Oya | 142 | 84 | Mandekal Aru | 336 |
| 33 | Girikula Oya | 14 | 85 | Pallavarayan Kadu Aru | 179 |
| 34 | Helawa Aru | 43 | 86 | Pali Aru | 474 |
| 35 | Wila Oya | 500 | 87 | Chappai Aru | 75 |
| 36 | Heda Oya | 609 | 88 | Paranki Aru (Menankaddy) | 875 |
| 37 | Karanda Oya | 435 | 89 | Nay Aru | 537 |
| 38 | Semani Aru | 74 | 90 | Malwathu Oya (Aruvi Aru) | 3,183 |
| 39 | Tandiadi Aru | 36 | 91 | Kal Aru | 277 |
| 40 | Kangikadichi Aru | 79 | 92 | Moderagama Aru | 1,142 |
| 41 | Rufus Kulam | 30 | 93 | Kala Oya | 2,847 |
| 42 | Pannel Oya | 195 | 94 | Moongil Aru | 104 |
| 43 | Ambalam Oya | 107 | 95 | Mi Oya | 1,561 |
| 44 | Gal Oya | 1,877 | 96 | Madurankuli Aru | 66 |
| 45 | Andella Oya | 583 | 97 | Kalagama Oya | 142 |
| 46 | Thumpankeni | 18 | 98 | Rathambala Oya | 260 |
| 47 | Namakada Aru | 18 | 99 | Deduru Oya | 2,687 |
| 48 | Mandipattu Aru | 93 | 100 | Karambalan Oya | 799 |
| 49 | Pathanthoddathne Aru | 114 | 101 | Ratmal Oya | 265 |
| 50 | Vett Aru | 25 | 102 | Maha Oya | 1,517 |
| 51 | Magalavatavan Aru | 386 | 103 | Attanagalu Oya | 889 |
| 52 | Mundeni Aru | 1,355 | Total | | 61,454 |

**Source:** Natural Resource Management Center, Department of Agriculture, Sri Lanka.

# Dam Safety and Water Resources Planning Project

## (DSWRPP)

Outline of DSWRPP

**Component 01 - Dam Safety and Operational Efficiency Improvement**

32 large dams of the country, identified as high risk to the public safety, will be fully rehabilitated.

**Dams to be rehabilitated**

http://www.damsafety.lk/Information/List_of_dams.html

**Department of Irrigation**

1. Parakrama Samudraya
2. Minneriya Wewa
3. Girithale Wewa
4. Kawudulla Wewa
5. Vendrasan Wewa
6. Kanthale Wewa
7. Nachchaduwa Wewa
8. Nuwara Wewa
9. Thisa Wewa
10. Rajanganaya Reservoir
11. Usgala-Siyambalangamuwa
12. Hurulu Wewa
13. Inginimitiya Reservoir
14. Ridiyagama Reservoir
15. Thabbowa Reservoir
16. Nalanda Reservoir

**Mahaweli Authority of Sri Lanka**

1. Bowathenna Reservoir
2. Polgolla Diversion
3. Victoria Reservoir
4. Randenigala Reservoir
5. Rantambe Reservoir
6. Kothmale Reservoir
7. Kala Wewa
8. Kandalama Reservoir
9. Dambulu Oya Reservoir
10. Maduru Oya Reservoir
11. Chandrika Wewa

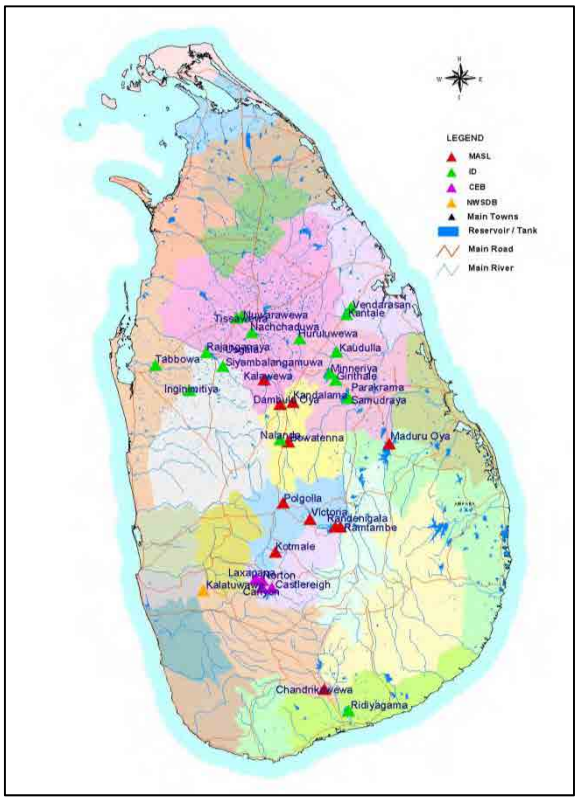
**Ceylon Electricity Board**

1. Canyon
2. Castlereigh
3. Lakshapana
4. Norton

**National Water Supply and Drainage board**

1. Kalatuwawa

**Annex 6-3: Outline of Dam Safety and Water Resources Planning Project (DSWRPP)**




**Reports**

Rerated reports are available in following URL;
http://www.damsafety.lk/ProjectM&E/Reports/ISC_Deliverables.html

**Component 02 - Hydro-Meteorological Information System Improvement**

Upgrade and modernize current Hydro-Meteorological Information System (HMIS)

- Upgrade & modernize 122 hydro-metric stations (40 renovated and 82 newly established)
- Modernize and establish Data Bank at Irrigation Department and Water Management Secretariat of MASL.
- Improve flood protection procedure, tools and training.
- Establish ground water monitoring system.

**Reports**

Rerated reports are available in following URL;
http://www.damsafety.lk/ProjectM&E/Reports/ISC_Deliverables.html

**Component 03 - Multi-Sectoral Water Resources Planning**

The expected outcome of this component would be water resource development plans at national level and for two selected river basins, pre-feasibility and feasibility studies for selected high priority strategic projects, and enhanced institutional capacity and skills for water resources planning and management. This component will comprise:

1. Development of a National Water-use master plan to achieve the country's long-term social, environmental and economic development goals and objectives as expressed in the national development framework (Mahinda Chinthanaya) based on an analysis of updated estimates of present and future water demand and supply in the 103 river basins in the country;.

2. Preparation of an updated Mahaweli Water Resources Development Plan for the Mahaweli Ganga and adjoining connected river basins based on an optimization study of water supply and water demand in all sectors; in addition, pre-feasibility and feasibility studies would be undertaken for the highest priority investment projects recommended in the agreed plan; and

3. Preparation of an integrated and comprehensive water resources development plan for the Mundeni Aru river basin (of the Eastern Province), and pre-feasibility and feasibility studies of priority investment projects.

**Completed tasks under the component 03 (as of Dec. 2012)**

a) Develop Strategic Planning Framework
b) Develop Knowledge Base
c) Develop Modeling/Decision Support System Tools
d) Develop Strategic Environmental and Social Assessments

**On-going tasks under the component 03 (as of Dec. 2012)**

a. Develop Integrated Water Resource Plans
b. Strengthen Institutional Capacity

**Reports**

Rerated reports are available in following URL;
http://www.damsafety.lk/ProjectM&E/Reports/ISC_Deliverables.html

# Major Dams Managed by Irrigation Department

| NO | RESERVOIR | District | GROSS EXTENT | FSD (Full Supply Depth) | | GROSS CAPACITY | | DEAD STORAGE | | 16 Dams to be rehabilitated by DSWRPP |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | (acr) | (ft) | (m) | (ac.ft) | (mcm) | (ac.ft) | (mcm) | |
| 1 | Ambalan Oya | Ampara | 4,520 | 25.5 | 7.8 | 35,950 | 44.344 | 3,500 | 4.32 | |
| 2 | Ekgal Oya | Ampara | 2,500 | 33.0 | 10.1 | 23,500 | 28.987 | 1,200 | 1.48 | |
| 3 | Namal Oya | Ampara | 3,700 | 39.4 | 12.0 | 43,450 | 53.595 | 4,000 | 4.93 | |
| 4 | Pallan Oya | Ampara | 3,500 | 55.0 | 16.8 | 93,000 | 114.714 | 2,250 | 2.78 | |
| 5 | Pannalgama | Ampara | 2,700 | 41.0 | 12.5 | 27,600 | 34.044 | 2,500 | 3.08 | |
| 6 | Rottikulama | Ampara | 1,460 | 15.5 | 4.7 | 5,100 | 6.291 | 0 | 0.00 | |
| 7 | Senanayaka Sam | Ampara | 120,000 | 110.0 | 33.5 | 770,000 | 949.781 | 0 | 0.00 | |
| 8 | Abaya Wewa | Anuradapura | 385 | 15.6 | 4.8 | 1,675 | 2.066 | 0 | 0.00 | |
| 9 | Huruluwewa | Anuradapura | 10,621 | 27.5 | 8.4 | 55,000 | 67.842 | 2,250 | 2.78 | Hurulu Wewa |
| 10 | Mahakandarawa | Anuradapura | 6,240 | 19.0 | 5.8 | 36,250 | 44.714 | 3,800 | 4.69 | |
| 11 | Mahawilachchiya | Anuradapura | 2,700 | 22.2 | 6.8 | 32,500 | 40.088 | 1,000 | 1.23 | |
| 12 | Manankattiya | Anuradapura | 1,500 | 18.0 | 5.5 | 4,928 | 6.079 | 403 | 0.50 | |
| 13 | Nachchaduwa | Anuradapura | 7,000 | 25.0 | 7.6 | 45,100 | 55.630 | 100 | 0.12 | Nachchaduwa Wewa |
| 14 | Nuwara Wewa | Anuradapura | 2,500 | 23.0 | 7.0 | 36,050 | 44.467 | 1,000 | 1.23 | Nuwara Wewa |
| 15 | Padaviya | Anuradapura | 13,800 | 24.0 | 7.3 | 85,000 | 104.846 | 4,000 | 4.93 | |
| 16 | Rajangana | Anuradapura | 17,820 | 35.0 | 10.7 | 81,600 | 100.652 | 4,500 | 5.55 | Rajanganaya Reservoir |
| 17 | Tisa Wewa | Anuradapura | 1,284 | 19.3 | 5.9 | 3,500 | 4.317 | 255 | 0.31 | Thisa Wewa |
| 18 | Wahalkada | Anuradapura | 2,000 | 28.5 | 8.7 | 43,000 | 53.040 | 2,025 | 2.50 | |
| 19 | Ambewela | Badulla | 1,000 | 17.0 | 5.2 | 1,850 | 2.282 | 650 | 0.80 | |
| 20 | Dambarawa | Badulla | 1,507 | 20.0 | 6.1 | 12,910 | 15.924 | 1,835 | 2.26 | |
| 21 | Kande Ela | Badulla | 2,450 | 27.5 | 8.4 | 1,762 | 2.173 | 60 | 0.07 | |
| 22 | Mapakada | Badulla | 1,359 | 27.0 | 8.2 | 7,700 | 9.498 | 180 | 0.22 | |
| 23 | Nagadeepa | Badulla | 4,225 | 41.0 | 12.5 | 23,833 | 29.398 | 1,500 | 1.85 | |
| 24 | Sorabora | Badulla | 2,000 | 19.5 | 5.9 | 14,200 | 17.515 | 150 | 0.19 | |
| 25 | Navakiri | Batticaloa | 17,500 | 31.0 | 9.4 | 53,000 | 65.375 | 1,000 | 1.23 | |
| 26 | Rugam | Batticaloa | 9,752 | 15.6 | 4.8 | 18,600 | 22.943 | 0 | 0.00 | |
| 27 | Unnichchi | Batticaloa | 12,757 | 33.0 | 10.1 | 58,500 | 72.159 | 85 | 0.10 | |
| 28 | Vakaneri | Batticaloa | 9,880 | 19.2 | 5.9 | 13,500 | 16.652 | 0 | 0.00 | |
| 29 | Badagiriya | Hambantota | 1,650 | 14.0 | 4.3 | 9,050 | 11.163 | 250 | 0.31 | |
| 30 | Debarawewa | Hambantota | 945 | 8.0 | 2.4 | 700 | 0.863 | 65 | 0.08 | |
| 31 | Kekiriobada | Hambantota | | 54.2 | 16.5 | 2200 | 2.714 | 45 | 0.06 | |
| 32 | Lunugamwehera | Hambantota | 12,750 | 41.0 | 12.5 | 183,000 | 225.727 | 13,300 | 16.41 | |
| 33 | Mau Ara | Hambantota | 1,811 | 20.0 | 6.1 | 33,300 | 41.075 | 6950 | 8.57 | |
| 34 | Muruthawela | Hambantota | 4,226 | 49.0 | 14.9 | 38,875 | 47.952 | 3,200 | 3.95 | |
| 35 | Ridiyagama | Hambantota | 8,497 | 18.8 | 5.7 | 27,000 | 33.304 | 1,600 | 1.97 | Ridiyagama Reservoir |
| 36 | Tissawewa | Hambantota | 2,750 | 15.6 | 4.8 | 3,516 | 4.337 | 35 | 0.04 | |
| 37 | Weheragala | Hambantota | | 25.4 | 7.7 | 61,000 | 75.242 | 6655 | 8.21 | |
| 38 | Weerawila | Hambantota | 2,300 | 13.0 | 4.0 | 11,450 | 14.123 | 2,015 | 2.49 | |
| 39 | Yodawewa | Hambantota | 3,267 | 12.3 | 3.7 | 8,375 | 10.330 | 100 | 0.12 | |
| 40 | Ellewela | Matara | 1,339 | 32.3 | 9.8 | 850 | 1.048 | 0 | 0.00 | |
| 41 | Kekanadura | Matara | 1,100 | 35.8 | 10.9 | 2,310 | 2.849 | 0 | 0.00 | |
| 42 | Dewahuwa | Matale | 2,342 | 28.5 | 8.7 | 9,700 | 11.965 | 100 | 0.12 | |
| 43 | Nalanda | Matale | 400 | 69.5 | 21.2 | 12,400 | 15.295 | 0 | 0.00 | Nalanda Reservoir |
| 44 | Wemedilla | Matale | 1,800 | 36.0 | 11.0 | 4,594 | 5.667 | 286 | 0.35 | |
| 45 | Ambakolawewa | Kurunegala | 840 | 16.5 | 5.0 | 6,700 | 8.264 | 300 | 0.37 | |
| 46 | Attaragalla | Kurunegala | 1,036 | 15.5 | 4.7 | 3,668 | 4.524 | 0 | 0.00 | |
| 47 | Batalagoda | Kurunegala | 7,634 | 12.8 | 3.9 | 4,840 | 5.970 | 150 | 0.19 | |
| 48 | Hakwatuna | Kurunegala | 6,370 | 27.0 | 8.2 | 19,727 | 24.333 | 3,000 | 3.70 | |
| 49 | Kimbulwana | Kurunegala | 2,224 | 20.0 | 6.1 | 6,900 | 8.511 | 450 | 0.56 | |
| 50 | Mediyawa | Kurunegala | 1,200 | 14.0 | 4.3 | 2,595 | 3.201 | 0 | 0.00 | |
| 51 | Magalla | Kurunegala | 6,000 | 18.0 | 5.5 | 7,440 | 9.177 | 70 | 0.09 | |
| 52 | Palukadawala | Kurunegala | 2,025 | 27.3 | 8.3 | 7,688 | 9.483 | 15 | 0.02 | |
| 53 | Usgala Siyabalan | Kurunegala | 2,100 | 18.4 | 5.6 | 17,350 | 21.401 | 1,665 | 2.05 | Usgala-Siyambalangamuwa |
| 54 | Ethimale | Monaragala | 1,002 | 16.5 | 5.0 | 5,500 | 6.784 | 450 | 0.56 | |
| 55 | Handapanagala | Monaragala | 1,700 | 18.0 | 5.5 | 5,800 | 7.154 | 390 | 0.48 | |
| 56 | Muthukandiya | Monaragala | 2,000 | 37.0 | 11.3 | 24,600 | 30.344 | 1,800 | 2.22 | |
| 57 | Giritale | Polonnaruwa | 7,600 | 42.7 | 13.0 | 18,800 | 23.189 | 500 | 0.62 | Girithale Wewa |
| 58 | Kaudulla | Polonnaruwa | 12,498 | 30.0 | 9.1 | 104,000 | 128.282 | 4,500 | 5.55 | Kawudulla Wewa |
| 59 | Minneriya | Polonnaruwa | 22,475 | 38.1 | 11.6 | 110,000 | 135.683 | 4,000 | 4.93 | Minneriya Wewa |
| 60 | Pss | Polonnaruwa | 24,947 | 25.0 | 7.6 | 109,000 | 134.450 | 15,000 | 18.50 | Parakrama Samudraya |
| 61 | Inginimitiya | Puttalama | 5,335 | 22.0 | 6.7 | 58,835 | 72.572 | 4250 | 5.24 | Inginimitiya Reservoir |
| 62 | Tabbowa | Puttalama | 2,092 | 18.0 | 5.5 | 15,000 | 18.502 | 190 | 0.23 | Thabbowa Reservoir |
| 63 | Kantale | Trincomalee | 21,884 | 38.8 | 11.8 | 114,000 | 140.617 | 0 | 0.00 | Kanthale Wewa |
| 64 | Mahadivul Wewa | Trincomalee | 1,390 | 19.0 | 5.8 | 16,400 | 20.229 | 800 | 0.99 | |
| 65 | Mora Wewa | Trincomalee | 4,000 | 28.0 | 8.5 | 31,000 | 38.238 | 1,700 | 2.10 | |
| 66 | Vendrasan | Trincomalee | 1,750 | 39.5 | 12.0 | 20,200 | 24.916 | 0 | 0.00 | Vendrasan Wewa |
| 67 | Wan Ela | Trincomalee | 1,620 | 13.5 | 4.1 | 2,160 | 2.664 | 55 | 0.07 | |
| 68 | Pavatkulam | Vavuniya | 4,135 | 19.4 | 5.9 | 27,000 | 33.304 | 500 | 0.62 | |
| 69 | Akathimuruppu | Mannar | 6,231 | 9.9 | 3.0 | 7,000 | 8.634 | 0 | 0.00 | |
| 70 | Giants Tank | Mannar | 24,438 | 11.5 | 3.5 | 31,500 | 38.855 | 175 | 0.22 | |
| 71 | Viyathikulam | Mannar | 1,223 | 11.1 | 3.4 | 1,800 | 2.220 | 0 | 0.00 | |

# Legal Framework on Water Resources Management

Table Main Enactments & Authorities Related to Water Resources Conservation & Development

| | **Act** (to read with later Amendments) | **Main Objective/s** | **Responsible Implementation Authority** |
|---|---|---|---|
| 1 | Irrigation Ordinance-1900 (Cap 453) | Irrigation development and maintenance (major works) | Irrigation Department |
| 2 | Mahaweli Authority of Sri Lanka Act 23 of 1979 | Water resources development in the areas declared under the Act | Mahaweli Authority of Sri Lanka |
| 3 | Agrarian Services Act No 58 of 1979 | Development and maintenance of small irrigation works. cons | Department of Agrarian development |
| 4 | National Water Supply and Drainage Board Act of 2 of 1974 | Mainly urban and industrial water supply | National Water Supply and Drainage Board |
| 5 | Water Resources Board Act No 29 of 1964 | Although the Act provides for advisory services covering all aspects of water resources, in practice, confined to groundwater survey and development. | Water Resources Board |
| 6 | Sri Lanka Land Reclamation and Development Corporation Act of 1968 and 1976 | Land reclamation and drainage | Sri Lanka Land Reclamation and Development Corporation |
| 7 | Ceylon Electricity Board Act 17 of 1969 | Hydro Electricity generation and distribution | Ceylon Electricity Board |
| 8 | Sustainable Energy Authority Act No 35 of 2007 | Promote developing indigenous energy sources. Promote small scale hydro power development. | Sustainable Energy Authority |
| 9 | Meteorological Department | Weather data and forecasting | Meteorological Department |
| 10 | National Environment Act No 47 of 1980 | Overall environment conservation | Central Environment Authority |
| 11 | North Western province Environmental Statute No 12 of 1990 | Environment conservation in the NWP | NWP Provincial Council |
| 12 | Forest Ordinance-1907/Cap 453) | Forest conservation | Department of Forest Conservation |
| 13 | Flora and Fauna Protection Ordinance-1937 | Conservation of Forest and Wildlife Resources | Departments of Forest Conservation and Wildlife Conservation. |

| | **Act** (to read with later Amendments) | **Main Objective/s** | **Responsible Implementation Authority** |
|---|---|---|---|
| 14 | Land Development Ordinance of 1935 l | State and alienation for agricultural activity and land development | Land Commissioner's Department |
| 15 | State Lands Ordinance No 8 of 1947 | Alienation and management of state land e excluding land covered by the LDO | Ministry in charge of the subject of lands, through the Divisional Secretaries. |
| 16 | Soil Conservation Act No 1951/ 1996 | Soil conservation | Department of Agriculture |
| 17 | Mines and Minerals Act 33 of 1992 | Surveying and administration of mining of minerals. | Geological Survey and Mines Bureau |
| 18 | 13 Amendment to the Constitution | Provincial Councils with related central departments on devolved and concurrent subjects | Provincial Councils |
| 19 | Land Use Policy Planning Act (*The Department has been established and the enactment is under way) | Mapping of land use and developing land use policy. | Land use Planning Department |

Source: Initial Assessment Report, National Water Use Master Plan Volume I (DSWRPP)

# Flood Inundation Area in Eastern Region


Source: IWMI

**Tools for Weather Forecast (for DOM)**

| Category | | Forecast Range | AWS | Doppler Radar | GMS*1 | POS*2 | NWP | GPS Radiosonde | Lightning Detection | Effective Forecast |
|---|---|---|---|---|---|---|---|---|---|---|
| Meteorological Advisory/ Warning | | to 1 day | A | A | A | B | | | B | - Flood<br>- Landslide<br>- Lightning |
| Forecast | Nowcasting | 0 to 2 hrs | A | A | A | C | | B | B | - Flood<br>- Landslide<br>- Lightning |
| | Very Short Range | 2 to 6 hrs | B | A | B | C | C (MSM*3) | B | | - Flood<br>- Landslide |
| | Short range | 6 to 72 hrs | B | B | B | | A (MSM*3) | B | | - Flood<br>- Landslide |
| | Medium Range | 3 to 7 days | | | | | B (GSM*4) | | | - Flood<br>- Landslide |
| | Extended Medium | 10 to 30 days | | | | | B (GSM*4) | | | |
| | Long Range | 1 to 3 months | | | | | B (GSM*4) | | | - Agriculture<br>- Water resource<br>- Water Sector |

Notes : A; Effective B; Moderate C; Less Effective

*1: Geostationary Meteorological Satellite

*2: Polar Orbiting environmental Satellite( less effective)

*3: Meso Scale Model

*4: Global Spectral Model

**Annex 8-1: Action to be Taken (Flood Management)**

| Action to be Taken | Year | | | | | | | | | | Remarks | No. of Required Action |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| HFA1: Governance | | | | | | | | | | | | |
| - Preparation of coordination frameworks of flood management at central level and basin level (103 river basin). | | | | | | | | | | | Central level<br>1st pilot basins<br>2nd pilot basins<br>Other basins level | F1.1 |
| - Review/re-formulation of legal framework related to the flood management including the urban development and land use. | | | | | | | | | | | | F1.2 |
| - Provision of appropriate funding mechanism of the flood management activities | | | | | | | | | | | | F1.3 |
| HFA2: Risk Identification, Assessment, monitoring and early warning | | | | | | | | | | | | |
| - Preparation of the national hydrological hydro-meteorological data collection network and its' information system, including the FEWS to the public. | | | | | | | | | | | (on going)<br>Upgrading | F2.1 |
| - Update the topographic maps in the flood prone areas, including land use | | | | | | | | | | | | F2.2 |
| - Update flood hazard map of the flood prone basins | | | | | | | | | | | | F2.3 |
| HFA3: Use knowledge, innovation, education, build calture | | | | | | | | | | | | |
| - Promotion of CBDRMPs to the all flood prone areas | | | | | | | | | | | Pilot communities<br>Overall | F3.1 |
| - Prepare the technical guidelines of flood management works | | | | | | | | | | | | F3.2 |
| - Enhancement of capacity of the engineers/officials related to the flood management | | | | | | | | | | | | F3.3 |
| - Promotion of the engagement to the media for the flood | | | | | | | | | | | | F3.4 |
| HFA4: Reduce the underlying risk factors | | | | | | | | | | | | |
| - Rehabilitation of the aged trunk flood mitigation facilities (tank, bund, channel, drainage pump, etc.) | | | | | | | | | | | Priority structures<br>Other selected | F4.1 |
| - Preparation of the flood management master plans in the respective flood prone basins (including urban flood) | | | | | | | | | | | 1st priority basins<br>2nd priority basins<br>Other priority | F4.2 |
| - Implementation of the flood management master plans in the respective flood prone basins (including urban flood) | | | | | | | | | | | 1st priority basins<br>2nd priority basins | F4.3 |
| - Revision of the urban development and land use plans in accordance with the formulated flood management master plan | | | | | | | | | | | Priority area<br>Overall | F4.4 |
| - Operation and maintenance of the flood management facilities, including enforcement of the urban development and land use | | | | | | | | | | | | F4.5 |
| - Promotion of the development of financial risk-sharing and risk transfer mechanism, particularly insurance and reinsurance | | | | | | | | | | | | F4.6 |
| HFA5:Preparedness for effective response and recovery | | | | | | | | | | | | |
| - Preparation/revision/implementation of the national and district emergency response plans. | | | | | | | | | | | Natioal<br>District | F5.1 |
| - Promotion of community based search and rescue teams | | | | | | | | | | | Pilot communities<br>Overall | F5.2 |

**Annex 8-2: List of Candidate Projects (Flood Management)**

List of Candidate Projects

| Kind of Disaster | No. of Required Action | Project No. | Project Title | Time Frame 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Budget (Mill. USD) | Partner (Lead Agency in Bold) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flood | F1.2 | F 01 | Institutional Framework<br>- Review/re-formulation of legal framework related to the flood management including the urban development and land use | | | | | | | | | | | 1.5 | **MoI&WRM** |
| Flood | F1.1, F2.1, F3.1, F3.2, F3.3, F4.1, F4.2, F4.4, F4.5 | F 02 | Comprehensive Flood Management Master Plan for 1st Priority River Basins (tentative priority basins: South-Western Region or Eastern Region) | | | | | | | | | | | 5.0 | **ID, MASL, SLLRDC,** DMC |
| Flood | F1.1, F2.1, F3.1, F3.2, F3.3, F4.1, F4.2, F4.4, F4.5 | F 03 | Comprehensive Flood Management Master Plan for 2nd Priority River Basins | | | | | | | | | | | 5.0 | **ID, MASL, SLLRDC,** DMC |
| Flood | F1.1, F2.1, F3.1, F3.2, F3.3, F4.1, F4.2, F4.4, F4.5 | F 04 | Urban Drainage Improvement Plan in Selected Cities (Priority cities in 1st priority basins) | | | | | | | | | | | 4.0 | **ID, MASL, SLLRDC,** DMC |
| Flood | F4.1, F4.5 | F 05 | Urban Rehabilitation Plan for aged Flood Mitigation Structures (Bund, Tank, Channel, Drainage Pump, etc.) | | | | | | | | | | | 1.5 | **ID, MASL, SLLRDC,** DMC |
| Flood | F2.1, F3.1, F3.4, F5.2 | F 06 | Upgrading and Expanding of Flood Early Warning System and CBDRM | | | | | | | | | | | 5.0 | **DMC, ID, MASL, DOM** |
| Flood | F2.2, F2.3, F5.1 | F 07 | Nationwide Flood Risk Assessment for DM Plans | | | | | | | | | | | 5.0 | **DMC,** ID, MASL |
| Flood | F3.3 | F 08 | Capacity Enhancement for Flood Management in Irrigation Department (Pre-condition: enhancement of sub-department of disaster management) | | | | | | | | | | | 3.5 | **ID** |
| Flood | F3.3, F4.5 | F 09 | Coordinating Dam Operation for Flood Management (Pre-condition: accurate flood prediction is available) | | | | | | | | | | | 3.5 | **DMC, ID, MASL, DOM, CEB, NWSDB** |
| Flood | F3.3, F4.3, F4.5 | F 10 (IP F02) | Detailed Design and Implementation for Priority Project(s) on Comprehensive Flood Management Master Plan for 1st Priority River Basins | | | | | | | | | | | 80.0 | **ID, SLLRDC,** DMC |
| Flood | F3.3, F4.3, F4.5 | F 11 (IP F03) | Detailed Design and Implementation for Priority Project(s) on Comprehensive Flood Management Master Plan for 2nd Priority River Basins | | | | | | | | | | | 80.0 | **ID, MASL, SLLRDC,** DMC |
| Flood | F3.3, F4.3, F4.5 | F 12 (IP F04) | Detailed Design and Implementation for Priority Project(s) on Urban Drainage Improvement Plan in Selected Cities | | | | | | | | | | | 50.0 | **ID, MASL, SLLRDC,** DMC |
| Flood | F3.3, F4.3, F4.5 | F 13 (IP F05) | Detailed Design and Implementation for Priority Project(s) on Urgent Rehabilitation Plan for aged Flood Mitigation Structures | | | | | | | | | | | 30.0 | **ID, MASL, SLLRDC,** DMC |

**Annex 8-3: Criteria of Future program (Flood Management)**

**Necessary Condition**

| | Candidate- Projects | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F 01 | F 02 | F 03 | F 04 | F 05 | F 06 | F 07 | F 08 | F 09 | F 10 | F 11 | F 12 | F 13 |
| (1) Whether the project has a demand from the government? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| (2) Whether the project needs to assist? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| (3) Whether the project is assisted by the other donors? | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (4) Whether JICA can implement the Project? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| (5) Whether there is no issues of social and environmental matters? | ✓ | less | less | less | less | ✓ | ✓ | ✓ | ✓ | less | less | less | less |

**Sufficient Conditions in Detail**

| Screening Level | Criteria | Check point | F 01 | F 02 | F 03 | F 04 | F 05 | F 06 | F 07 | F 08 | F 09 | F 10 | F 11 | F 12 | F 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 1: Feasibility | Feasibility | Whether the project goal can be achieved ? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Maturity | Whether the executive agencies are determined and coordinated? | | ✓ | | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ |
| | | Whether the executive agencies have enough capacities or the project has capacity enhancement aspect? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | Whether EIA is required for the implementation, or EIA is included in the prohect? | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ |
| | | Whether the land acquisition and resettlement are included in the project and there is achievable before the project? | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ |
| | Financial Status | Whether there is any other financial resources other than JICA? | No | No | No | No | No | No | No | No | No | No | No | No | No |
| Level 2: Need/Impact | Effectiveness | Whether the project is effective in term of reduce of the disaster? | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Efficiency | Whether the project is efficient in term of time and/or finance? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Impact | How beneficial is the project to the people of Sri Lanka? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Sustainability | How sustainable is the benefit of the project or whether the project includes the component to secure the sustainability? | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Level 3: Applicability | Japan's experience | Whether the Japan's experiences is applicable to the project in the engineering and managerial | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Time frame | Whether JICA can commit the project with that time frame? | | ✓ | | ✓ | ✓ | | ✓ | | | ✓ | | ✓ | ✓ |

**Program: F 02＋F 05 & F 10 & F 13**
**(Technical cooperation for development planning and Loan Aid)**
Comprehensive Flood Management Master Plan for 1st Priority River Basins
- together with Urgent Rehabilitation Plan for aged Flood Mitigation Structures
(tentative priority basins: South-Western Region or Eastern Region)

**Agencies involved:**
**Irrigation Department (ID)**
**Mahaweli Authority of Sri Lanka (MASL)**
Sri Lanka Land Reclamation and Development Corporation (SLLRDC)
Disaster Management Centre (DMC)

**Background:**
South-western region / eastern region in Sri Lanka is suffering from severe floods every year. Urgent flood mitigation measures are required to ensure the human life and economic activity in the region. On the other hand, water management in Sri Lanka has long history over millenniums. Therefore, consideration of Sri Lankan culture of water-use is also important for flood management planning.

**Objectives:**
- To establish suitable coordination frameworks for flood mitigation at central level and basin level
- To formulate feasible and appropriate flood management master plan together with the coordination bodies
- To formulate urgent rehabilitation plan for aged flood mitigation structures
- Implementation of project(s) based on the
"Comprehensive Flood Management Master Plan" and
"Urgent Rehabilitation Plan for aged Flood Mitigation Structures"

**Time frame of implementation:**
Coordination framework: 2015 ~ 2016
Comprehensive flood management master plan: 2015 ~ 2017
Urgent rehabilitation plan for aged flood mitigation structures: 2015
D/D and Project implementation for comprehensive flood management: 2018 ~ 2022
D/D and Project implementation for Urgent rehabilitation plan: 2016 ~ 2017

**Geographical area of implementation:**
South-western region / eastern region
Selected flood mitigation structures

**Activities:**
- Preparation of coordination frameworks for flood management at central level
- Preparation of coordination frameworks for flood management at basin level
- Policy/consensus making against flood among the residents and local communities such as farmer's organization in the basin
- Formulation of comprehensive flood management master plan
  - for South-western region: Revision of Flood Management Plan for Kelani, Kalu, Gin and Nilwara Rivers
  - for Eastern region: Review of Flood Mitigation in Ampara & Batticaloa Districts of Sri Lanka (DMC/UNDP)
  - Structural measures:
    Proactive/critical structural measures against flood (structural measure)
  - Non-structural measures:
    Provision of FEWS
    Preparation of CBDRMPs for pilot communities

  - Selection of priority project(s)
  - Feasibility study on priority project(s)
  - Preparation of implementation program for priority project(s)
- Formulation of urgent rehabilitation plan for aged flood mitigation structures and implementation program
  - Inventory study on aged flood mitigation structures
  - Review of basic flood management strategies for structures
  - Selection of priority structures for urgent rehabilitation
  - Preparation of implementation program for urgent rehabilitation
  - Detailed Design on selected priority structures for urgent rehabilitation
- Detailed Design and Implementation of Project(s) on "Comprehensive Flood Management Master Plan for 1st Priority River Basins"
- Implementation of "Urgent Rehabilitation Plan for aged Flood Mitigation Structures"

**Outputs:**

- Coordination frameworks for flood mitigation at central, basin and local levels
- Comprehensive flood management master plan 1st priority river basins
- Urgent rehabilitation plan for aged flood mitigation structures
- Flood mitigation structural measures
- FEWS
- CBDRMPs for pilot communities
- Strengthening of existing flood mitigation structures (Rehabilitated structures)

**Budget:**

Planning stage
for comprehensive flood management and urgent rehabilitation: 6.5 million USD
Implementation stage for comprehensive flood management: 30.0 million USD
Implementation stage for urgent rehabilitation: 80.0 million USD

**Funding status:**

Local and International Funding

**Program: F 04 & F 12**
**(Technical cooperation for development planning and Loan Aid)**
Urban Drainage Improvement Plan in Selected Cities
(Priority cities in 1st priority basins)

**Agencies involved:**
**Irrigation Department (ID)**
**Sri Lanka Land Reclamation and Development Corporation (SLLRDC)**
Disaster Management Centre (DMC)

**Background:**
Cities in low lying area in Sri Lanka are suffering from severe flood/inundation by local heavy rainfall every year. Urgent flood/inundation mitigation measures are required to ensure the economic activity in the area.

**Objectives:**
- To formulate feasible and appropriate drainage improvement plan together with the flood mitigation coordination bodies
- Implementation of project(s)

**Time frame of implementation:**
Drainage improvement plan: 2018 ~ 2019
D/D and Project implementation: 2020 ~ 2024

**Geographical area of implementation:**
Selected cities

**Activities:**
- Cooperation with coordination frameworks for flood management at basin level
- Policy/consensus making against flood/inundation among the residents and local communities in the area
- Formulation of drainage improvement plan
  - Review of Flood Management Master Plan for the objective basin
  - Proactive/critical structural measures against flood/inundation
  - Provision of FEWS
  - Preparation of CBDRMPs for pilot communities
- Selection of priority project(s)
- Feasibility study on priority project(s)
- Preparation of implementation program for priority project(s)
- Detailed Design and Implementation of Project(s)

**Outputs:**
- Drainage improvement plan for selected cities
- FEWS
- CBDRMPs for pilot communities
- Flood mitigation structural measures

**Budget:**
Planning stage: 4.0 million USD
Implementation stage: 50.0 million USD

**Funding status:**
Local and International Funding

**Program: F 07 (Technical cooperation project)**
Nationwide Flood Risk Assessment for Disaster Management Plans

**Agencies involved:**
**Disaster Management Centre (DMC)**
**Irrigation Department (ID)**

**Background:**
DMC is preparing the Flood Hazard Map (FHM) working with rerated agencies and flood event map for south-western region was published. This information is helpful for preparation of Flood management strategy and Disaster Management (DM) plan. DMC also prepared revised district DM plan for Matale and Batticaloa based on the vulnerability and risk assessment. It is desired that these activities cover the whole of Sri Lanka.

**Objectives:**
- Update the topographic maps in the flood prone areas, including land use
- Update flood hazard map of the flood prone basins
- Provision of district DM plans

**Time frame of implementation:**
2014 ~ 2016

**Geographical area of implementation:**
Flood Risk Assessment: Nationwide
District DM Plan: Selected districts

**Activities:**
- Review of flood condition in Sri Lanka
- Updating of the existing topographic maps
- Provision of nationwide DEM for simulation model
- Development of preliminary flood simulation model
- Preparation of FHMs and/or Flood Risk Maps
- Study on flood risk assessment
- Preparation district DM plans for selected districts

**Outputs:**
- Nationwide DEM
- Preliminary flood simulation model
- FHMs and/or Flood Risk Maps
- District DM plans for selected districts

**Budget:**
5.0 million USD

**Funding status:**
Local and International Funding

**Annex 9-1: Action to be Taken (Sediment-related Disaster Management)**

| Action to be Taken | Year | | | | | | | | | | Remarks | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| HFA1: Governance | | | | | | | | | | | | |
| - Establish laws and regulations for landslide including control of development activities and land use in landslide prone areas | | | | | ■ | ■ | | | | | 1-i | L-1.1 |
| HFA2: Risk Identification, Assessment, monitoring and early warning | | | | | | | | | | | | |
| - Improve early warning system for sediment-related disaster (increase number of rain fall gauges) | ■ | ■ | ■ | | | | | | | | 2-ii | L-2.1 |
| - Update base maps in landslide prone areas (scale 1:10,000) | | | ■ | ■ | | | | | | | 2-i | L-2.2 |
| - Update the Landslide hazard zonation map (scale1:10,000) | | | | | ■ | ■ | ■ | | | | 2-i | L-2.3 |
| - Identify high-risk landslide locations | ■ | ■ | | | | | | | | | 2-i | L-2.4 |
| HFA3: Use knowledge, innovation, education, build calture | | | | | | | | | | | | |
| - Enhance capacity for identifying high-risk landslide locations (existing landslides) | ■ | ■ | | | | | | | | | 3-ii | L-3.1 |
| - Enhance capacity for identifying potential high-risk landslide locations | | | | | ■ | ■ | | | | | 3-ii | L-3.2 |
| - Enhance capacity for investigations/ surveys of landslide prone areas | ■ | ■ | | | | | | | | | 3-ii | L-3.3 |
| - Enhance capacity for analysis, design, supervision and maintenance for landslide countermeasureworks | | | ■ | ■ | | | | | | | 3-ii | L-3.4 |
| - Prepare technical manuals/ guidelines for investigations/ surveys of landslide prone areas | ■ | ■ | | | | | | | | | 3-ii | L-3.5 |
| - Prepare technical standards of design and supervision for landslide and training | | | ■ | ■ | | | | | | | 3-ii | L-3.6 |
| - Prepare technical standards for inspection and maintenance in landslide prone areas and cutting slopes along main national roads | | | | | | ■ | ■ | | | | 3-ii | L-3.7 |
| - Prepare construction/ development guidelines for landslide prone areas considering land use plan and urban development plan | | | | | | ■ | ■ | | | | 3-ii | L-3.8 |
| - Promote public awareness on landslide mitigation issues | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Pilot areas<br>Entire country | L3.9 |
| HFA4: Reduce the underlying risk factors | | | | | | | | | | | | |
| - Road Protection against Sediment-related Disaster for Priority Areas-Phase1 | ■ | ■ | ■ | ■ | ■ | | | | | | 4-i | L-4.1 |
| - Road Slope Disaster Mitigation for Road Widening Areas-Phase2 | | | | | | ■ | ■ | ■ | ■ | ■ | 4-i | L-4.2 |
| - Mitigation works for landslide prone areas :Phase1(including pilot work of high priority 16 sites) | ■ | ■ | ■ | ■ | | | | | | | 4-i | L-4.3 |
| - Mitigation works for landslide prone areas: Phase2 (other existing 29 sites) | | | | | ■ | ■ | ■ | | | | 4-i | L-4.4 |
| - Mitigation works in landslide prone areas (potential landslide risks): (identified potential landslides) | | | | | | | | ■ | ■ | ■ | 4-i | L-4.5 |
| HFA5:Preparedness for effective response and recovery | | | | | | | | | | | | |
| | | | | | | | | | | | | |

List of Candidate Projects (as of *****)

| Kind of Disaster | No. of Required Action | Project No. | Project Title | Time Frame | | | | | | | | | | Budget (Mill. USD) | Partner (Lead Agency in |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| Sediment-related disaster (landslide) | L-2.1, 2.4, 3.1, 3.3, 3.4, 3.5, 3.6 | L1 | Project of Capacity Enhancement for Sediment-related Disaster Mitigation -Phase 1 | | | | | | | | | | | 5.0 | **NBRO**/(RDA) |
| | L-2.2 | L2 | Project for updating base map in 1:10,000 scale with LIDAR | | | | | | | | | | | 50.0 | **Survey Department**/ NBRO/ (RDA) |
| | L-1.1, 2.3, 3.2, 3.7, 3.8 | L3 | Project of Capacity Enhancement for Potential Sediment-related Disaster Mitigation - Phase 2 (including establishment of laws and regulations for landslide) | | | | | | | | | | | 5.0 | **NBRO**/MLLD/UDA |
| | L-4.1 | L4 | Project of Road Protection against Sediment-related Disaster for Priority Areas-Phase 1 | | | | | | | | | | | 120.0 | **RDA**/(NBRO) |
| | L-4.2 | L5 | Project of Road Slope Disaster Mitigation for Road Widening Areas-Phase2 | | | | | | | | | | | 120.0 | **RDA**/(NBRO) |
| | L-4.3 | L6 | Project of Sediment-related Disaster Mitigation Works : (high priority 16 sites) | | | | | | | | | | | 30.0 | **NBRO** |
| | L-4.4 | L7 | Project of Sediment-related Disaster Mitigation Works : (other existing 29 sites) | | | | | | | | | | | 50.0 | **NBRO** |
| | L-4.5 | L8 | Project of Sediment-related Disaster Mitigation Works : (identified potential sites) | | | | | | | | | | | 30.0 | **NBRO** |
| | L-3.9 | L9 | Project for promotion of public awareness in landslide prone areas | | | | | | | | | | | 2.0 | **DMC/ NBRO** |

**Necessary Condition**

| | Candidate-Projects | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | L-1 | L-2 | L-3 | L-4 | L-5 | L-6 | L-7 | L-8 | L-9 |
| (1) Whether the project has a demand from the government? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| (2) Whether the project needs to assist? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| (3) Whether the project is assisted by the other donors? | | | | | | | | | |
| (4) Whether JICA can implement the Project? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| (5) Whether there is no issues of social and environmental matters? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Sufficient Conditions in Detail**

| Screening Level | Criteria | Check point | L-1 | L-2 | L-3 | L-4 | L-5 | L-6 | L-7 | L-8 | L-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 1: Feasibility | Feasibility | Whether the project goal can be achieved ? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Maturity | Whether the executive agencies are determined and coordinated? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | Whether the executive agencies have enough capacities or the project has capacity enhancement aspect? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | Whether EIA is required for the implementation, or EIA is included in the prohect? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | Whether the land acquisition and resettlement are included in the project and there is achievable before the project? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Financial Status | Whether there is any other financial resources other than JICA? | | | | | | | | | |
| Level 2: Need/Impact | Effectiveness | Whether the project is effective in term of reduce of the disaster? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Efficiency | Whether the project is efficient in term of time and/or finance? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Impact | How beneficial is the project to the people of Sri Lanka? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Sustainability | How sustainable is the benefit of the project or whether the project includes the component to secure the sustainability? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Level 3: Applicability | Japan's experience | Whether the Japan's experiences is applicable to the project in the engineering and managerial | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Time frame | Whether JICA can commit the project with that time frame? | ✓ | | ✓ | ✓ | ✓ | | | | |
| | | New Number of the projects | L-1 | | L-2 | L-3 | L-4 | | | | |

## L1: Project of Capacity Enhancement for Sediment-related Disaster Mitigation -Phase 1

**Agencies involved:**

National Building Research Organisation (NBRO)

**Background and Rationale:**

In Sri Lanka, the number of sediment-related disasters is increasing rapidly caused by heavy rains under the influence of climate change, and increasing development activities in mountainous area.

NBRO mainly has been corresponding to sediment-related disasters with accumulation of technology, however capacity of NBRO for tackling with sediment-related disasters is insufficient.

Therefore, capacity enhancement and technical improvement of NBRO is required, and the expectation for Japanese technical support is high.

**Objectives:**

- to identify the high - risk landslide locations from among the reported landslides and select the most critical ones needing urgent mitigation
- to plan and implement appropriate and cost effective mitigation measures to eliminate/ minimize future landslide risks
- to promote coordination and collaboration of all stakeholders towards landslide mitigation and strengthen them through education and training
- to enhance capacity of NBRO to effectively deal with landslide mitigation efforts
- to conduct research to improve the systems and methods developed for; landslide hazard zonation mapping, updating these maps incorporating the land use maps and land use changes and landslide forecasting using the hazard zonation maps, rainfall and ground movement thresholds etc

**Time frame:**

Year1-4: Short term:

**Geographical Area:**

Landslide prone areas (Mainly Badulla, Kandy, Matale and NuwaraEliya Districts)

**Activities:**

- Improvement of early warning system for sediment-related disaster (increase

number of rain fall gauges)

- Identify high-risk landslide locations
- Enhance capacity for identifying high-risk landslide locations (existing landslides)
- Enhance capacity for investigations/ surveys of landslide prone areas
- Prepare technical manuals/ guidelines for investigations/ surveys of landslide prone areas
- Enhance capacity for analysis, design, supervision and maintenance for landslide countermeasure works
- Prepare technical standards for design and supervision for landslide countermeasure works

**Output:**

Technical standard of landslide

Network of early warning system for sediment-related disaster (combination of automatic rain fall gauge)

Enhancement of NBRO's capacity for landslide mitigation

**Budget**

USD 5.0 million

**Funding status:**

Local and International Funding (technical adviser, equipment, training)

## L2: Project of Capacity Enhancement for Potential Sediment-related Disaster Mitigation -Phase 2

**Agencies involved:**

National Building Research Organisation (NBRO)

**Background and Rationale:**

The "Project of Capacity Enhancement for Sediment-related Disaster Mitigation -Phase 1" aims at capacity enhancement for "existing risks of landslides".

In the Phase -2, capacity enhancement for "potential risks of landslide" is the main purpose of the project.

This project is related to the "Project for road slope disaster mitigation for road widening areas - Phase 2".

Potential landslide risks caused by such as road widening are main targets of the project.

**Objectives:**

- to support implementation of appropriate mitigation measures to minimize potential landslide risks
- to support capacity enhancement of NBRO for mitigation works for potential landslide risks
- to establish laws and regulations for landslide including control of development activities and land use in landslide prone areas

**Time frame:**

Year5-7: Middle term:

**Geographical Area:**

Landslide prone areas (Mainly Badulla, Kandy, Matale and NuwaraEliya Districts)

**Activities:**

- Establish laws and regulations for landslide including control of development activities and land use in landslide prone areas
- Update landslide hazard zonation map (scale1:10,000) using updated base map
- Identify potential high-risk landslide locations
- Prepare technical standards for inspection and maintenance in landslide prone areas and cutting slopes along main national roads

- Prepare construction/ development guidelines for landslide prone areas considering land use plan and urban development plan

**Output:**

Laws and regulations for landslide including control of development activities and land use in landslide prone areas

Updated landslide hazard zonation map (scale1:10,000)

Enhancement of NBRO's capacity for potential landslide mitigation

**Budget**

USD 5.0 million

**Funding status:**

Local and International Funding (technical adviser)

## L3: Project of Road Protection against Sediment-related Disaster for Priority Areas-Phase1

**Agencies involved:**

**Road Development Authority**, National Building Research Organization

**Background and Rationale:**

In Sri Lanka, the number of sediment-related disasters is increasing rapidly caused by heavy rains under the influence of climate change, and increasing development activities in mountainous area.

Sediment-related disasters have affected road networks and economic activities in Sri Lanka.

On main national highways, RDA has been implementing landslide countermeasures, however with limited countermeasures landslides are still one of the most important problems.

It is in agreement also with the policy of Sri Lanka to ensure the safety of a mountains road, and the necessity is high.

**Objectives:**

- To design and conduct countermeasure works for slopes along major national highways in the selected landslide prone areas with the highest priorities. (model of countermeasure works)
- To support design and construction of countermeasure works of slopes along major national highways in the selected landslide prone areas with higher priorities.
- To introduce early warning system for landslide along major national roads.
- Consulting services for geological surveys, detailed designs, bidding assistance, supervision, etc.

**Time frame:**

Year1-5 – Short-Middle term

**Geographical Area:**

Seven (7) Districts in mountain area

**Activities:**

- Geological surveys in landslide countermeasure planned sites with high priorities

- Design of countermeasure works against landslides
- Support of tender and contract
- Construction of countermeasure works (high priority sites)
- Introduction of early warning system for landslide
- Preparation of technical standards of design method, inspection and maintenance for road cutting slope in landslide prone areas
- Training for counterpart (design, inspection, maintenance)

**Output:**

Improvement of road slope safety (priority areas)
Network of early warning system for landslide in road sector
Enhancement of capacity of RDA and NBRO for landslide mitigation

**Budget**

USD 120.0 million

**Funding status:**

Local and International Funding (technical adviser, equipment, training)

## L4: Project of Road Slope Disaster Mitigation for Road Widening Areas-Phase2

**Agencies involved:**

Road Development Authority, National Building Research Organization

**Background and Rationale:**

Sediment-related disasters have affected to national road networks and economic activities in Sri Lanka.

Recently, many landslides have occurred in cutting slopes with construction/ widening roads, therefore landslides caused by road widening are one of the potential risks in road sector.

In the NRMP, there are many road widening plans in mountainous areas.

Therefore, mitigation works for road widening areas are required and also in the future.

**Objectives:**

- To support design and conduct countermeasure works for rode widening areas in major national highways (in high risk areas of landslide)
- To support prediction, investigation, monitoring, design, countermeasure works and maintenance of road widening areas in high risk areas of landslide.
- To support operation of early warning system for road widening areas.

**Time frame:**

Year6-10 –Middle - Long term:

**Geographical Area:**

Seven (7) Districts in mountainous areas

**Activities:**

- Updating landslide hazard maps
- Identify and selection of landslide potential risk areas
- Surveys, analysis, designs and supervisions
- Technical standard for road widening areas such as design, inspection, and maintenance
- Training for counterpart

**Output:**

Improvement of road widening slope safety

Improvement of operation of early warning system for landslides in road widening areas

Enhancement of capacity of RDA and NBRO for landslide caused by road widening

**Budget**

USD 120.0 million

**Funding status:**

Local and International Funding (technical adviser)

**Annex 10-1: Action to be Taken (Meteorological Observation/Early Warning )**

| Action to be Taken | Year 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Remarks | No |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HFA1: Governance | | | | | | | | | | | | |
| - Preparation of framework of meteorological management for data sharing networks including tsunami. | | | | | | | | | | | Central level<br>Overall country | M−1.1 |
| - Review/re-formulation of legal framework related to the meteorological management | | | | | | | | | | | | M−1.2 |
| - Provision of appropriate funding mechanism of the meteorological management activities | | | | | | | | | | | Usual management<br>Cosidering Climate Change | M−1.3 |
| - Installation of Maintenance and Calibration Facility | | | | | | | | | | | | M−1.4 |
| - Installation of Doppler Radar at Matale | | | | | | | | | | | in the central-northern part | M−1.5 |
| - Installation of meteorological stations | | | | | | | | | | | 4 stations | M−1.6 |
| - Installation of GPS radiosonde station at Pottuvil | | | | | | | | | | | in south-eastern part | M−1.7 |
| - Installation of lightning detection and tracking system (LDS) | | | | | | | | | | | | M−1.8 |
| HFA2: Risk Identification, Assessment, monitoring and early warning | | | | | | | | | | | | |
| Preparation of the national meteorological data collection network and its' information system, including EWS to the public. | | | | | | | | | | | | M−2.1 |
| - Development of Automatic Weather Analysis System | | | | | | | | | | | | M−2.2 |
| - Improvement of Global telecommunication System | | | | | | | | | | | | M−2.3 |
| - Stabilize VSAT communicartion system | | | | | | | | | | | | M−2.4 |
| - Keep adequate maintenance | | | | | | | | | | | | M−2.5 |
| - Keep stable operation of Automatic Weather Station (AWS) System | | | | | | | | | | | 38 AWSs<br>Additional AWSs | M−2.6 |
| - Improve capacity for appropriate use of dopplor radar (DR) | | | | | | | | | | | Southern part: Gongala<br>Northern part: Matale | M−2.7 |
| - Increase number of observation of GPS radiosonde | | | | | | | | | | | 2 times/ week -> 1 time/ day<br>1 time/ day -> 2 times/ day | M−2.8 |
| - Set warning criteria | | | | | | | | | | | Pilot areas<br>Overall country<br>Other issues such as strong winds, thunder storm, etc. | M−2.9 |
| - Keep adequate operation of warning standard (WS) | | | | | | | | | | | | M−2.10 |
| - Develop guidance | | | | | | | | | | | | M−2.11 |
| - Improve Numerical Weather Prediction (NWP) system | | | | | | | | | | | MSM Phase-1<br>MSM Phase-2, GSM Phase-1 | M−2.12 |
| HFA3: Use knowledge, innovation, education, build calture | | | | | | | | | | | | |

**Annex 10-1: Action to be Taken (Meteorological Observation/Early Warning )**

| Action to be Taken | Year | | | | | | | | | | Remarks | No |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| - Promotion of CBDRMPs to all meteorological hazards prone areas | ■ | ■ | ■ | | | | | | | | Pilot area | M−3.1 |
| | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | Overall | |
| - Prepare networks among organizations related to disaster | ■ | ■ | ■ | | | | | | | | | M−3.2 |
| - Upgrade the media unit in DOM for advisories and early warnings | ■ | ■ | ■ | | | | | | | | | M−3.3 |
| HFA4: Reduce the underlying risk factors | | | | | | | | | | | | |
| - Promote the integration of risk management associated with existing climate variability and future climate change into strategies | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | M−4.1 |
| HFA5:Preparedness for effective response and recovery | | | | | | | | | | | | |
| - Promote and support exchange of information among organizations related to disaster management at all levels | ■ | ■ | ■ | | | | | | | | National | M−5.1 |
| | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | District | |

**Annex 10-2: List of Candidate Projects (Meteorological Observation/Early Warning)**

List of Candidate Projects

| Kind of Disaster | No. of Required Action | Project No. | Project Title | Time Frame 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Budget (Mill. USD) | Partner (Lead Agency in Bold) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Meteorological disaster | M 1.4, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 3.1, 3.2, 3.3, 5.1 | M 1 | Project for effective improvement of current weather infrastructure - Phase 1<br>- Enhance stable operation of AWS system<br>- Enhance data sharing network system<br>- Develop Automatic Weather Analysis System<br>- Improve Global Telecommunication System (GTS)<br>- Improve NWP system<br>- Develop warning standard<br>- Improve capacity for utilization of DR data | | | | | | | | | | | 5.3 | **DOM**/Concerned agencies such as DMC |
| | M 2.6, 2.8, 2.9, 2.11, 2.12, 3.1, 5.1 | M 2 | Project for enhancement of weather forecasting - Phase 2<br>- Increase number of AWSs and keep stable opration<br>- Expand monitoring areas to entire island with new doppler radar utilization<br>- Improve NWP system<br>- Set warning standard to entire island | | | | | | | | | | | 2.75 | **DOM**/Concerned agencies such as DMC |
| | M 2.8, 2.9, 2.11, 3.1, 5.1 | M 3 | Project for enhancement of weather forecasting - Phase 3<br>- Improve NWP system with GSM<br>- Set warning standard for other issues<br>- Strengthen EWS | | | | | | | | | | | 1.2 | **DOM**/Concerned agencies such as DMC |
| | M 1.5, 1.6 | M 4 | Project for installation of Doppler Radar/ AWS<br>- Doppler radar<br>- Meteorological stations | | | | | | | | | | | 3.9 | **DOM** |
| | M 1.7, 1.8 | M 5 | Project for installation of equipments for weather forecasting<br>- GPS radiosonde<br>- Lightning detection and tracking system | | | | | | | | | | | 2.1 | **DOM** |
| | M 1.2 | M 6 | Project for provision of appropriate funding - Phase 1 | | | | | | | | | | | 2.5 | **DOM**/MFP |
| | M 1.2, 4.1 | M 7 | Project for provision of appropriate funding consideration of climate change- Phase 2 | | | | | | | | | | | 2.5 | **DOM**/MFP |

**Annex 10-3: Criteria of Future Program (Meteorological Obeservation/Early Warning)**

**Necessary Condition**

| | Candidate- Projects | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | M-1 | M-2 | M-3 | M-4 | M-5 | M-6 | M-7 | |
| (1) Whether the project has a demand from the government? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| (2) Whether the project needs to assist? | ✓ | ✓ | ✓ | | | | | |
| (3) Whether the project is assisted by the other donors? | ✓ | ✓ | ✓ | | | | | |
| (4) Whether JICA can implement the Project? | | | | | | | | |
| (5) Whether there is no issues of social and environmental matters? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |

**Sufficient Conditions in Detail**

| Screening Level | Criteria | Check point | M-1 | M-2 | M-3 | M-4 | M-5 | M-6 | M-7 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Level 1: Feasibility | Feasibility | Whether the project goal can be achieved ? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | Maturity | Whether the executive agencies are determined and coordinated? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | | Whether the executive agencies have enough capacities or the project has capacity enhancement aspect? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | | Whether EIA is required for the implementation, or EIA is included in the prohect? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | | Whether the land acquisition and resettlement are included in the project and there is achievable before the project? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | Financial Status | Whether there is any other financial resources other than JICA? | | | | | | | | |
| Level 2: Need/Impact | Effectiveness | Whether the project is effective in term of reduce of the disaster? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | Efficiency | Whether the project is efficient in term of time and/or finance? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | Impact | How beneficial is the project to the people of Sri Lanka? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | Sustainability | How sustainable is the benefit of the project or whether the project includes the component to secure the sustainability? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Level 3: Applicability | Japan's experience | Whether the Japan's experiences is applicable to the project in the engineering and managerial | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| | Time frame | Whether JICA can commit the project with that time frame? | ✓ | ✓ | ✓ | | | | | |

## M2: Project for enhancement of weather forecasting - Phase 2

**Agency involved :**
Department of Meteorology (DOM)

**Background and Rationale:**
In Sri Lanka, more than 90% of natural disasters are weather or climate related. Every year, floods, droughts, thunder, and lightning activity and strong winds cause disasters in various parts of the island.
DOM is responsible for the provision of warnings and advisories on bad weather (including cyclone, heavy rain, lightning, etc.) and Tsunami.
To provide reliable weather information, capacity enhancement and technical improvement of DOM is required, and the expectation for Japanese technical support is high.
The "Project for enhancement of weather forecasting-Phase1" aims at capacity enhancement for real time weather analysis and forecast.
In the Phase- 2, capacity enhancement for short range weather forecast is the main purpose.

**Objective:**
- to increase number of AWSs and keep stable operation
- to expand monitoring areas to entire island with new Doppler Radar
- to improve NWP
- to set warning standard to entire island

**Time Frame:**
Year 4 -7: Medium Term

**Activities:**
- to add new AWSs in data sparse areas
- to introduce new Doppler Radar for the observation of northern part of island
- to improve the WRFC Model and to develop the Meso Scale Model
- to introduce warning standard for entire island

**Output:**
- Improvement of Nowcast and Early Warning
- Improvement of Short Range Forecast
- Provision of weather information and warning for small area

**Budget:**
2.75 M USD

**Funding:**
Local and International Funding( technical, equipment, training)

## M3: Project for enhancement of weather forecasting – Phase 3

**Agency involved** :
Department of Meteorology (DOM)

**Background and Rationale:**

In Sri Lanka, more than 90% of natural disasters are weather or climate related. Every year, floods, droughts, thunder, and lightning activity and strong winds cause disasters in various parts of the island.
DOM is responsible for the provision of warnings and advisories on bad weather (including cyclone, heavy rain, lightning, etc.) and Tsunami.
To provide reliable weather information, capacity enhancement and technical improvement of DOM is required, and the expectation for Japanese technical support is high.
This project is in succession to the "Project for enhancement of weather forecasting- Phase 2". In the Phase 2, aiming at short range (3 days) forecast, in this project, aiming at medium range (7 days) forecast.

**Objectives:**
- to enhance capacity of weather forecasting aiming at 7days forecasting
- to set warning standard for o strong wind, thunder storm, etc.
- to strengthen EWS

**Time Frame:**
Year 8-10: Long term

**Focus Area:**
DOM head quarter and district observation stations

**Activities:**
- to improve NWP system with GSM
- to set warning standard for other issues
- to strengthen EWS

**Output:**
- Seven (7) days forecasting
- Warning standard for other issues
- Well-coordinated EWS system with 7 days forecasting and warning standard with other issues

**Budget:**
1.2 M USD

**Funding:**
Local and International Funding (technical, equipment, training)

**Annex 11-1: Action to be Taken (Overall Disaster Management)**

| Action to be Taken | No. | Year | | | | | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| HFA1: Governance | | | | | | | | | | | | |
| - Strengthening a technical advisory system in DMC (technical advisor) | PA-1.1 | | | | | | | | | | | |
| HFA2: Risk Identification, Assessment, monitoring and early warning | | | | | | | | | | | | |
| - Complete district disaster preparedness plans for response | PA-2.1 | | | | | | | | | | | ongoing |
| - Complete "Grama Nildari Level" preparedness plans | PA-2.2 | | | | | | | | | | | ongoing |
| - Complete disaster impact assessment and development future action plan for CBDRM | PA-2.3 | | | | | | | | | | | |
| HFA3: Use knowledge, innovation, education, build culture | | | | | | | | | | | | |
| - Planning training courses for CBDRM, Awareness and Education | PA-3.1 | | | | | | | | | | | ongoing |
| - Enhancing awareness through curriculum and school activity | PA-3.2 | | | | | | | | | | | ongoing |
| - Integration of DM in higher, professional and continuing education curriculum | PA-3.3 | | | | | | | | | | | ongoing |
| HFA5:Preparedness for effective response and recovery | | | | | | | | | | | | |
| - Capacity building for sustainable CBDRM activities for all disasters | PA-5.1 | | | | | | | | | | | |
| - Training all stakeholders for emergency response, by emphasizing search and rescue training for communities and professionals | PA-5.2 | | | | | | | | | | | |

List of Candidate Projects (as of *****)

| Kind of Disaster | No. of Required Action | Project No. | Project Title | Time Frame 1-2: Short (S) 3-5: Medium (M) 6-10: Long (L) | Budget (Mill. USD) | Partner (Lead Agency in Bold |
|---|---|---|---|---|---|---|
| CBDRM & PA | PA-2.1<br>PA-2.2<br>PA-2.3 | PA-01 | Strengthening District Disaster Management Centers' functions | M | 5 | **DMC**/DM line agencies, SLRCS, NGOs and CBOs |
| CBDRM & PA | PA-3.1<br>PA-3.2<br>PA-3.3<br>PA-5.1<br>PA-5.2 | PA-02 | Capacity Building for Sustainable CBDRM, Preparedness and Response, and Public Awareness | S to M | 3 | **DMC, MoDM,** SLIDA, MOE, University |
| CBDRM & PA | PA-1.1 | PA-03 | Strengthening a technical advisory system in DMC (technical advisor) | S | 1 | **DMC, MoDM** |

**Necessary Condition**

| | Candidate Projects | | |
|---|---|---|---|
| | PA-01 | PA-02 | PA-03 |
| (1) Whether the project has a demand from the government? | ✓ | ✓ | ✓ |
| (2) Whether the project needs to assist? | ✓ | ✓ | ✓ |
| (3) Whether the project is assisted by the other donors? | | ✓ | ✓ |
| (4) Whether JICA can implement the Project? | ✓ | ✓ | ✓ |
| (5) Whether there is no issues of social and environmental matters? | ✓ | ✓ | ✓ |

**Sufficient Conditions in Detail**

| Screening Level | Criteria | Check point | PA-01 | PA-02 | PA-02 |
|---|---|---|---|---|---|
| Level 1: Feasibility | Feasibility | Whether the project goal is achivable ? | ✓ | ✓ | ✓ |
| | Maturity | Whether the executive agencies are determined and coordinated? | ✓ | ✓ | ✓ |
| | | Whether the executive agencies have enough capacities or the project has capacity enhancement aspect? | ✓ | | |
| | | Whether EIA is required for the implementation, or EIA is included in the prohect? | | | |
| | | Whether the land acquisition and resettlement are included in the project and there is achievable before the project? | | | |
| | Financial Status | Whether there is any other financial resources other than JICA? | ✓ | ✓ | ✓ |
| Level 2: Need/Impact | Effectiveness | Whether the project is effective in term of reduce of the disaster? | | | |
| | Efficiency | Whether the project is efficient in term of time and/or finance? | ✓ | ✓ | ✓ |
| | Impact | How beneficial is the project to the people of Sri Lanka? | ✓ | ✓ | ✓ |
| | Sustainability | How sustainable is the benefit of the project or whether the project includes the component to secure the sustainability? | ✓ | ✓ | ✓ |
| Level 3: Applicability | Japan's experience | Whether the Japan's experiences is applicable to the project in the engineering and managerial aspects? | ✓ | ✓ | ✓ |
| | Time frame | Whether JICA can commit the project with that time frame? | ✓ | ✓ | ✓ |

**PA-01: Strengthening District Disaster Management Centers' Functions**

**Agencies involved:**

DMC, District Secretaries, Local Authorities in collaboration with SLRCS, CBOs and NGOs,

**Background and Rationale:**

Establishing CBDM resource centers, 25 centers over 25 districts, was proposed in the Road Map for DRM Sri Lank, 2005 as a sub-component of the Community-based Disaster Risk Management activity. The expected functions are being a resource center for local authorities, NGOs, universities and technical institutions on overall DM information, and supporting DM activities as primal facilitator at district level.

Initially, the Road Map planned to team up 5,000 DRM community teams in villages over 500 GN divisions, and to build 10 CBDRM resource centers; yet, there is no district resource centers established yet. As for community teams, DMC does not have tangible information since there is no documentation.

On the other hand, Emergency Operation Centers (EOCs) were established as planned in all districts and ready to be activated in case of any emergencies. EOCs maintain all necessary information required for responding to disasters and stock necessary resources, including equipment and contacts of skilled personnel for emergency. EOCs are also structured to be a leading actor for Incident Command System (ICS), providing necessary control in utilizing available resources to reach out affected people. They also closely work with governmental agencies and NGOs and SLRCS branches from district to community levels, so EOCs will be the center to connect disaster resource networks.

Further activities proposed for EOCs in the NDMP are 1) to strengthen institutional framework and coordination mechanism to facilitate the delivery of emergency response, 2) to sustain the resources network for emergency response effectively and 3) to enhancing the capacities of local authorities.

It is, therefore, proposed to upgrade existing facilities to a District Disaster Management Center, incorporating the functions of CBDM resource center, originally proposed in the Road Map, by utilizing the existing EOCs. The functions of CBDM resource center remain same as proposed before, i.e. 1) to disseminate disaster management information to communities and NGOs, 2) to improve adaptation of communities to new knowledge and 3) to improve their ownership through CBDM activities.

District disaster management center will function as information center based on district preparedness plan and as median station for DMC to reach out communities.

By end of 2010 sixteen (16) district disaster preparedness plans have been completed. Two districts, Matale and Batticaloa Badulla, have revised their plans in 2012 with technical supports from JICA. It is expected that remaining 14 districts will also update the data and revise their district disaster preparedness plans. DMC plans to complete the balance 9 districts: Vavuniya, Killinochchi, Jaffna, Trincomali, Batticaloa, Mulative, Monaragala and Mannar by the end of 2013. As for the preparedness and response plans for Grama Nildari level, less than 10% of plans

were drawn up so far; thus, the DMC needs to strive much effort on this to cover all. In order to expedite the progress it is necessary to establish a median station, i.e. district disaster management center, to outreach GNs and provide collective training to the leaders and committee members to support them drawing up their preparedness and response plans.

**Table: Number of Preparedness and Response Plan Completed (2012)**

| Preparedness and Response Plan | Year | | | | |
|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | Remaining |
| 1. District Plan (25 districts) | 12 | 4 | 0 | | 9 |
| 2. GN Plans (Drafts) (14,022 GN) | 197 | 135 | 0 | 573 | 13,117 |

Source: DRR Activities-12.10.2012 PPT. DMC.
Note: Number of total GN: Referred to Ministry of Public Administration and Home Affairs' Homepage.

**Objectives:**

Set up a District Disaster Management Center in each district, functioning as CBDM Resource Center, Emergency Operation Center, Emergency Supply Storage and Emergency Shelter.

**Time frame:**

Year 2-5 (2014-2016) Middle term

**Geographical Area:**

District and GN levels

**Activities:**

1. Formulate a standard design (non-physical structure) of CBDM information center, prepare necessary materials, and disseminate the information.
2. Train DMC district unit's staff to be a facilitator of CBDM activities (training will be covered in PA-02).
3. Prepare district disaster preparedness plans for response
4. Support communities to prepare "Grama Nildari Level" preparedness plans for response through CBDRM approach.
5. Maintain database of CBOs, NGOs and community teams for effective networking.
6. Strengthen institutional framework and coordination mechanism to facilitate the delivery of emergency response.
7. Sustain the resources network for emergency response effectively.
8. Enhance the capacities of local authorities in emergency response

**Output:**

District Disaster Risk Management Centers are established in 25 districts with intended functions, trained staff, necessary resources, and the median center of community outreach and the DMC.

**Budget**

USD5.0 million

**Funding status:**

Local and International Funding

## PA-02: Capacity Building for Sustainable CBDRM, Preparedness and Response, and Public Awareness

**Agencies involved:**

**DMC, MoDM**, MoE, SLIDA, Universities, CBOs and NGOs

**Background and Rationale:**

Training and Public Awareness division of DMC is responsible for training and public awareness activities for internal staff and also external bodies, such as governmental and non-governmental stakeholder organizations.

The main issues of training on disaster risk management identified in the Road Map are 1) unstructured training programs because of no prior needs assessment, 2) insufficient capacity of trainers and limited training materials, and 3) a general lack of coordinated allocation of training opportunities for sub-national authorities, public officers and community people. Strategies for probable solutions to the above issues were drawn in the Road Map and nine projects were proposed for enhancing public awareness, incorporating awareness programs in school education, and training public officers, professionals and people in general.

DMC conducted training programs for its staff, i.e. a refresher training, an Incident Command System (ICS) training, an introduction training for newly recruited staff and a capacity building training for assistant directors on technical aspects of flood, landslide mitigation and response in past few years; yet, all of them were short-program, maximum five days, and rather incidental programs, but not a structural training. It also coordinated and/or implemented capacity building training for stakeholder agencies; for example, a two day training program for 122 technical personnel in the Northern Province on disaster management with UNDP. DMC also allocated funds to strengthen the capacity of district level stakeholders, like the Police, local authorities' government officers and teachers from vulnerable schools.

Public awareness in school curriculum development on disaster risk management activities were well conducted by responsive agencies, DMC, Ministry of Education, National Institute of Education, Ministry of Tertiary Education and supporting donor agencies, such as giz, UNICEF, UNDP and international NGOs. "Disaster safety education booklet," "Disaster safety education resource kit for national colleges of education," "National guidelines – school disaster safety" and corresponding teachers' manuals were developed by giz, MoE and NIOE, and already distributed to all primary and junior secondary schools. They will be implementing school disaster safety activities to all schools and supporting them to prepare school emergency response plans in next five years.

As for higher education, two universities have master's degree on disaster management and more universities are now providing short-course, diploma courses, on disaster management for students and professionals; yet, training programs and implementation of them are still limited, so 1) training of professionals and 2) developing training program in continuing education are considered as remaining challenges in the education and training sector.

The key strategies in public awareness, education and training remain same for next five years, which are;

- to formulate a strategic policy and action plan to design, conduct and supervise all training under DRM's administration;
- to structure quality assurance system of DRM training, which are delivered by partner governmental agencies and academic institutions;
- to develop partnership with regional and academic institutions for reachable access to all stakeholders in the country; and
- to develop manuals and guidelines in various subject areas, which can be also used for training and awareness activities.

In addition, there is a need to increase the number of trainers to conduct capacity enhancement for CBDRM, awareness and education for coordinated allocation of available regional training opportunities.

**Objectives:**

Enhance the capacity of stakeholders in different tiers, national, sub-national and community to uphold sustainable CBDRM and public awareness activities, which concurrently to strengthen disaster resilient society

**Time frame:**

Year1-5 (2014-2018)- Short to Middle term

**Geographical Area:**

National level, District level, Grama Nilidari level

**Activities:**

1. Designing, implementing and monitoring training courses for CBDRM, public awareness, targeting DCM staff, related governmental agencies, educational institutions and professionals.
2. Specific awareness programs for government officials at sub-national level
3. General public awareness program at communities
4. Develop syllabus for continuing education and short-course at colleges and universities
5. Develop and implement specific-purpose training for state, non-state institutions and volunteers for emergency response, with emphasis on search and rescue for communities and professionals.
6.

**Output:**

Establishment of training course with several modules, including preparedness, DIA method, mapping, local evacuate unit, search & rescue, recovery, education, campaign and event for awareness.

50 trainers for CBDRM will be trained at DMC; at least two trainers for each districts, by 2015,

**Budget**

3 million USD

**Funding status:**

Local and International Funding

**PA-03: Strengthening a technical advisory system in DMC (technical advisor)**

**Agencies involved:**

**DMC, MoDM**,

**Background and Rationale:**

Considering the institutional capability of DMC, however, it is essential to rebuild from the ground of the organization by reviewing its various aspects, such as human resource development, personnel evaluation system, personnel interchange with other governmental agencies concerned to complement the deficiency of experts at DMC, to develop proper standard operation procedure (SOP), and to introduce an executive advisory engineer who oversees all institutional development and technical matters of all divisions in DMC. It is also essential that DMC will strengthen its coordination and guidance capacities to work efficiently and effectively with related state and non-state institutions.

One of the imperative challenges is to review and revise existing laws and regulations associated to the Disaster Management Act. It was pointed out during the survey that some of existing laws and regulations are enacted right after the colonization era and there has been no update or revision, and there are some contradictions and sometimes do not comply with the Act, or the Act does not fully encompass the preceding laws in it. It was also revealed that roles and functions among related state agencies were not clearly demarcated, and project execution plans were not quite coordinated among related state agencies. In order to effectively implement disaster management plan and emergency response plan, it is inevitable to periodically monitor and provide feedbacks to executing agencies which operate the activities of plans, and if it is necessary, amending laws, regulations or technical standards should be carried out for strengthening disaster management administration. In particular, DMC has overlooked the monitoring and evaluation of the Road Map, which indicated the establishment of a steering committee for those purposes, but so far it is not set out to properly evaluate the outputs of the activities. Although there are brief evaluations in the corporate plan and reports produced by other donor agencies, they do not distinctly reveal the degree of achievement, specific recommendations, or lessons learned from the activities. Considering all abovementioned aspects, it is suggested that an executive advisory engineer or administrator shall be appointed to strengthen overall administration of DMC, and to facilitate coordination among vertically-segmented state agencies' administrative system.

**Objectives:**

Strengthen administrative capabilities, functions and technical advisory system in DMC

**Time frame:**

Year1-3 (2014-2016)- Short term

**Geographical Area:**

National level, District level, Grama Nilidari level

**Activities:**

1. Appoint a technical advisor to oversee and strengthen overall administration of

DMC, and to facilitate coordination among related state ministries and agencies.

**Output:**

Administrative capabilities, functions and technical advisory system are improved, and DMC will be able to formulate necessary disaster management policies, review and amend laws and regulations, and properly coordinate with and provide disaster management related technical supports to state ministries and agencies concerned.,

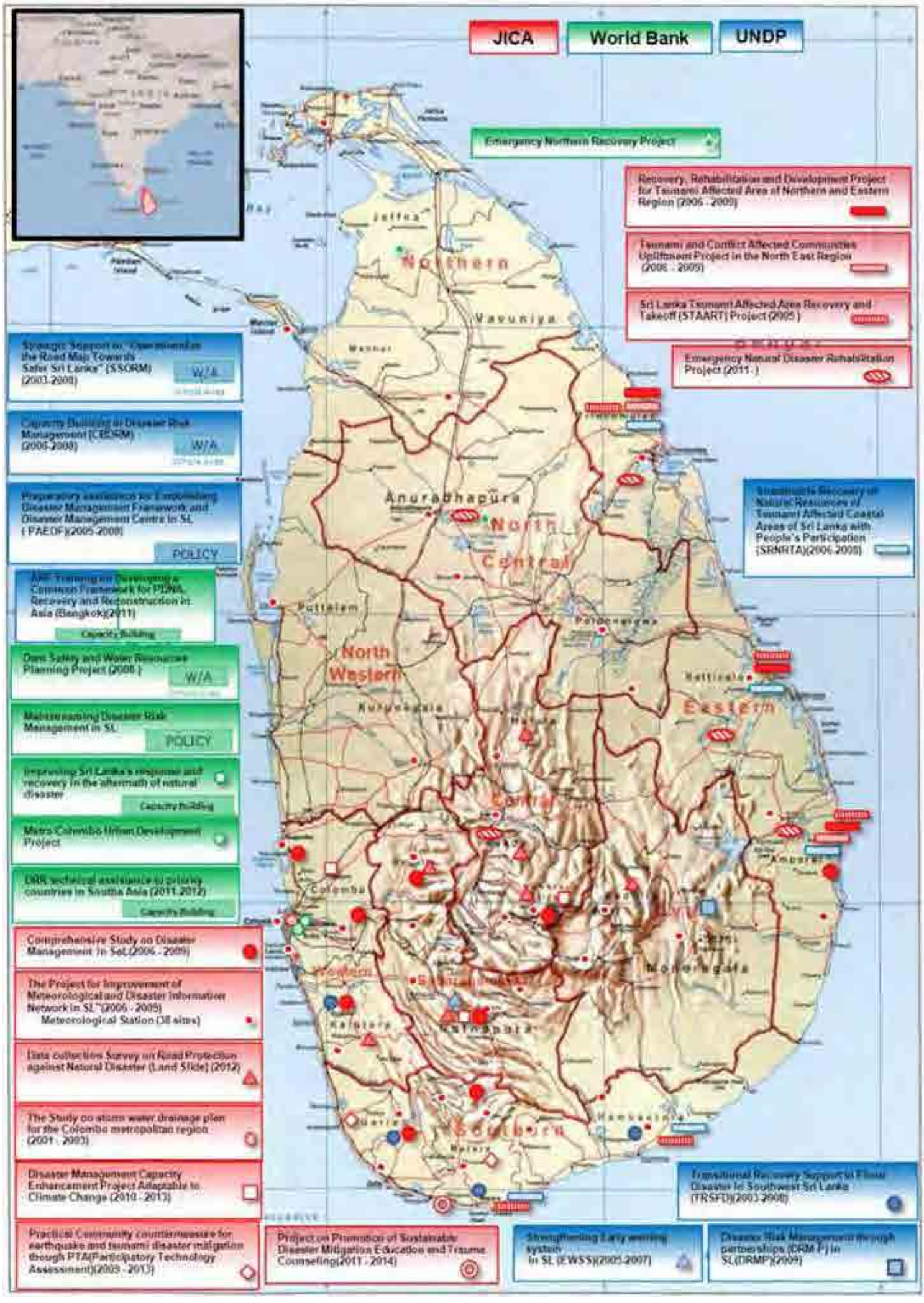
**Budget**

1 million USD

**Funding status:**

International Funding

## Annex 12: Project Location Map Assisted by International Agencies



## Annex 13: Survey Schedule

| Date | | Schedule/Content of the Study | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ryuichi HARA: Team Leader/ Program Planning | Yosuke USUI: Disaster Management Governance/ Others | Osamu ABE: Evaluation Analysis/ Management Policy Assistance | Hideki ARAKI: River Management | Akira OHKAWARA: Sediment-related Disaster | Tetsuro Fukui: Meteorological Observation/ Early Warning System | Hodaka IGO: Integrated Flood Management | Akira SASAKI: Project Coordination/ River Management 2 |
| 1-Nov-12 | Thu | | | | | | | | |
| 2-Nov-12 | Fri | | | | | | | | |
| 3-Nov-12 | Sat | | | | | | | | |
| 4-Nov-12 | Sun | | | | | | | | |
| 5-Nov-12 | Mon | | | | | | | | |
| 6-Nov-12 | Tue | | | | | | | | |
| 7-Nov-12 | Wed | | | | | | | | |
| 8-Nov-12 | Thu | | | | | | | | |
| 9-Nov-12 | Fri | | | | | | | | |
| 10-Nov-12 | Sat | | | | | | | | |
| 11-Nov-12 | Sun | | | | | | | | |
| 12-Nov-12 | Mon | | | | | | | | |
| 13-Nov-12 | Tue | Move to Sri Lanka | Move to Sri Lanka | | | | Move to Sri Lanka | Move to Sri Lanka | |
| 14-Nov-12 | Wed | Meeting w/JICA, JICA Experts | Meeting w/JICA, JICA Experts | | | | Meeting w/JICA, JICA Experts | Meeting w/JICA, JICA Experts | |
| 15-Nov-12 | Thu | Symposium: UNDP | Symposium: UNDP | | | | Preparation of ICR | Preparation of ICR | |
| 16-Nov-12 | Fri | Meeting w/ ID, NBRO, DOM | Symposium: UNDP | | | | Meeting w/ ID, NBRO, DOM | Meeting w/ ID, NBRO, DOM | |
| 17-Nov-12 | Sat | Site Survey in Ratnapura | Site Survey in Ratnapura | | | | Site Survey in Ratnapura | Site Survey in Ratnapura | |
| 18-Nov-12 | Sun | Review and Analysis of Collected Data | Review and Analysis of Collected Data | | | | Review and Analysis of Collected Data | Review and Analysis of Collected Data | |
| 19-Nov-12 | Mon | Meeting w/MDM | Meeting w/MDM | | | | Meeting w/MDM | Meeting w/MDM | |
| 20-Nov-12 | Tue | Meeting w/Mahaweli Authority | Meeting w/MASL, DSWRPP | | | | Meeting w/Mahaweli Authority | Meeting w/Mahaweli Authority | |
| 21-Nov-12 | Wed | Meeting w/ERD, WB | Meeting w/ERD, WB | | | | Meeting w/ERD, WB | Meeting w/ERD, WB | |
| 22-Nov-12 | Thu | Meeting w/JICA Experts | Meeting w/JICA Experts | | | | Meeting w/JICA Experts | Meeting w/JICA Experts | |
| 23-Nov-12 | Fri | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | |
| 24-Nov-12 | Sat | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | |
| 25-Nov-12 | Sun | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | |
| 26-Nov-12 | Mon | Meeting w/UDA | Meeting w/UDA | | | | Meeting w/UDA | Meeting w/UDA | |
| 27-Nov-12 | Tue | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | |
| 28-Nov-12 | Wed | Meeting w/RDA | Preparation of Draft Interim Report | | | | Meeting w/DOM | Preparation of Draft Interim Report | |
| 29-Nov-12 | Thu | Meeting w/ DMC | Meeting w/ DMC | | Move to Sri Lanka | | Meeting w/ DMC | Meeting w/ DMC | |
| 30-Nov-12 | Fri | Meeting w/SLLRDC | SINCOLD Seminar | | Meeting w/SLLRDC | | Meeting w/DOM | Meeting w/SLLRDC | |

## Annex 13: Survey Schedule

| Date | | Schedule/Content of the Study | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ryuichi HARA: Team Leader/ Program Planning | Yosuke USUI: Disaster Management Governance/ Others | Osamu ABE: Evaluation Analysis/ Management Policy Assistance | Hideki ARAKI: River Management | Akira OHKAWARA: Sediment-related Disaster | Tetsuro Fukui: Meteorological Observation/ Early Warning System | Hodaka IGO: Integrated Flood Management | Akira SASAKI: Project Coordination/ River Management 2 |
| 1-Dec-12 | Sat | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | |
| 2-Dec-12 | Sun | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | |
| 3-Dec-12 | Mon | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Move to Sri Lanka | Preparation of Draft Interim Report | Preparation of Draft Interim Report | |
| 4-Dec-12 | Tue | DiMCEP Seminnar | DiMCEP Seminnar | | DiMCEP Seminnar | DiMCEP Seminnar | DiMCEP Seminnar | DiMCEP Seminnar | |
| 5-Dec-12 | Wed | Meeting w/MOI<br>Meeting w/ JICA | Meeting w/MOI<br>Meeting w/ JICA | | Meeting w/MOI<br>Meeting w/ JICA | Meeting w/JICA | Meeting w/JICA | Meeting w/MOI<br>Meeting w/ JICA | |
| 6-Dec-12 | Thu | Meeting w/NBRO | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Meeting w/NBRO | Meeting w/DOM<br>Preparation of report | Preparation of Draft Interim Report | |
| 7-Dec-12 | Fri | Meeting w/RDA | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Meeting w/RDA | Meeting w/DOM<br>Preparation of report | Preparation of Draft Interim Report | |
| 8-Dec-12 | Sat | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | Preparation of Draft Interim Report | Preparation of Draft Interim Report | |
| 9-Dec-12 | Sun | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | Preparation of Draft Interim Report | Preparation of Draft Interim Report | |
| 10-Dec-12 | Mon | Site Survey in Nuwara Eliya | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Site Survey in Nuwara Eliya | Meeting w/DOM<br>Preparation of report | Preparation of Draft Interim Report | |
| 11-Dec-12 | Tue | Site Survey in Nuwara Eliya | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Site Survey in Nuwara Eliya | Meeting w/DOM<br>Preparation of report | Preparation of Draft Interim Report | |
| 12-Dec-12 | Wed | Meeting w/Survey Department | Meeting w/SD<br>Rain Water Seminar | | Meeting w/SD<br>Rain Water Seminar | Meeting w/Survey Department | Return to Japan | Meeting w/SD<br>Rain Water Seminar | |
| 13-Dec-12 | Thu | Symposium by NBRO | Symposium by NBRO | | Meeting w/MOI<br>Sympo. by NBRO | Symposium by NBRO | | Symposium by NBRO | |
| 14-Dec-12 | Fri | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | |
| 15-Dec-12 | Sat | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | |
| 16-Dec-12 | Sun | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | |
| 17-Dec-12 | Mon | Meeting w/ NBRO | Preparation of Draft Interim Report | | Preparation of Draft Interim Report | Meeting w/ NBRO | | Preparation of Draft Interim Report | |
| 18-Dec-12 | Tue | Meeting w/ GSMB | Meeting w/ GSMB<br>Meeting w/DG of ID | | Meeting w/DG of ID | Meeting w/ GSMB | | Meeting w/DG of ID | |
| 19-Dec-12 | Wed | Meeting w/ JICA | Meeting w/IWMI<br>Meeting w/JICA | | Meeting w/IWMI<br>Meeting w/JICA | Meeting w/JICA | | Meeting w/IWMI<br>Meeting w/JICA | |
| 20-Dec-12 | Thu | Meeting of Interim Report | Meeting of Interim Report | | Meeting of Interim Report | Meeting of Interim Report | | Meeting of Interim Report | |
| 21-Dec-12 | Fri | Meeting w/CCD<br>Meeting w/DMC | Meeting w/CCD<br>Meeting w/DMC | | Meeting w/DMC | Meeting w/CCD<br>Meeting w/DMC | | Meeting w/CCD<br>Meeting w/DMC | |
| 22-Dec-12 | Sat | Preparation of Draft Final Report | Preparation of Draft Final Report | | Preparation of Draft Final Report | Preparation of Draft Final Report | | Preparation of Draft Final Report | |
| 23-Dec-12 | Sun | Preparation of Draft Final Report | Preparation of Draft Final Report | | Preparation of Draft Final Report | Preparation of Draft Final Report | | Preparation of Draft Final Report | |
| 24-Dec-12 | Mon | Meeting w/NBRO | Preparation of Draft Final Report | | GIS Data Collection<br>Preparation of DFR | Meeting w/NBRO | | GIS Data Collection<br>Preparation of DFR | |
| 25-Dec-12 | Tue | Preparation of Draft Final Report | Preparation of Draft Final Report | | Preparation of Draft Final Report | Preparation of Draft Final Report | | Preparation of Draft Final Report | |
| 26-Dec-12 | Wed | Site Survey along Expressway | Preparation of Draft Final Report | | Preparation of Draft Final Report | Site Survey along Expressway | | Preparation of Draft Final Report | |
| 27-Dec-12 | Thu | Preparation of Draft Final Report | Preparation of Draft Final Report | Move to Sri Lanka | Preparation of Draft Final Report | Preparation of Draft Final Report | | Return to Japan | |

## Annex 13: Survey Schedule

| Date | | Schedule/Content of the Study | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ryuichi HARA: Team Leader/ Program Planning | Yosuke USUI: Disaster Management Governance/ Others | Osamu ABE: Evaluation Analysis/ Management Policy Assistance | Hideki ARAKI: River Management | Akira OHKAWARA: Sediment-related Disaster | Tetsuro Fukui: Meteorological Observation/ Early Warning System | Hodaka IGO: Integrated Flood Management | Akira SASAKI: Project Coordination/ River Management 2 |
| 28-Dec-12 | Fri | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | |
| 29-Dec-12 | Sat | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | |
| 30-Dec-12 | Sun | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | |
| 31-Dec-12 | Mon | Meeting w/ID, RDA | Meeting w/ID | Preparation of Draft Final Report | Meeting w/ID | Meeting w/RDA | | | |

## Annex 13: Survey Schedule

| Date | | Schedule/Content of the Study | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Ryuichi HARA: Team Leader/ Program Planning | Yosuke USUI: Disaster Management Governance/ Others | Osamu ABE: Evaluation Analysis/ Management Policy Assistance | Hideki ARAKI: River Management | Akira OHKAWARA: Sediment-related Disaster | Tetsuro Fukui: Meteorological Observation/ Early Warning System | Hodaka IGO: Integrated Flood Management | Akira SASAKI: Project Coordination/ River Management 2 |
| 1-Jan-13 | Tue | Meeting w/DMC | Meeting w/DMC | Meeting w/DMC | Meeting w/DMC | Return to Japan | | | |
| 2-Jan-13 | Wed | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | |
| 3-Jan-13 | Thu | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | |
| 4-Jan-13 | Fri | Meeting w/DG of DMC, w/ DMC | Meeting w/DG of DMC, w/ DMC | Meeting w/DG of DMC, w/ DMC | Meeting w/DG of DMC, w/ DMC | | | | |
| 5-Jan-13 | Sat | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | |
| 6-Jan-13 | Sun | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | Move to Sri Lanka |
| 7-Jan-13 | Mon | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | Preparation of Draft Final Report |
| 8-Jan-13 | Tue | Meeting w/ NPPD | Meeting w/ NPPD | Preparation of Draft Final Report | Meeting w/ID | | | | Preparation of Draft Final Report |
| 9-Jan-13 | Wed | Site Survey in Kurunegala | Site Survey in Kurunegala | Preparation of Draft Final Report | Site Survey in Kurunegala | | | | Site Survey in Kurunegala |
| 10-Jan-13 | Thu | Meeting w/ GIZ | Preparation of Draft Final Report | Meeting w/ GIZ | Preparation of Draft Final Report | | | | Meeting w/ GIZ |
| 11-Jan-13 | Fri | Preparation of Draft Final Report | Meeting w/ID | Preparation of Draft Final Report | Meeting w/ID | | | | Preparation of Draft Final Report |
| 12-Jan-13 | Sat | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | Preparation of Draft Final Report |
| 13-Jan-13 | Sun | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | Preparation of Draft Final Report |
| 14-Jan-13 | Mon | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | Preparation of Draft Final Report |
| 15-Jan-13 | Tue | Meeting w/ DMC Meeting w/JICA | Meeting w/ DMC, ID, JICA | Meeting w/ DMC Meeting w/JICA | Meeting w/OCHA, ID, JICA | | | | Meeting w/ DMC Meeting w/JICA |
| 16-Jan-13 | Wed | Meeting w/ JICA, Red Cross | Meeting w/ JICA, w/ID, w/MOI | Meeting w/ JICA, Red Cross | Meeting w/ JICA, w/ID, w/MOI | | | | Meeting w/ JICA, Red Cross |
| 17-Jan-13 | Thu | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | Return to Japan | | | | Preparation of Draft Final Report |
| 18-Jan-13 | Fri | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | | Preparation of Draft Final Report |
| 19-Jan-13 | Sat | Meeting w/ JICA | Meeting w/JICA | Meeting w/JICA | | | | | Meeting w/JICA |
| 20-Jan-13 | Sun | Preparation of Draft Final Report | Preparation of Draft Final Report | Preparation of Draft Final Report | | | | | Preparation of Draft Final Report |
| 21-Jan-13 | Mon | Meeting w/ DOM | Return to Japan | Meeting w/ DOM | | | | | Meeting w/ DOM |
| 22-Jan-13 | Tue | Meeting of DFR | | Meeting of DFR | | | | | Meeting of DFR |
| 23-Jan-13 | Wed | Preparation of Draft Final Report | | Preparation of Draft Final Report | | | | | Preparation of Draft Final Report |
| 24-Jan-13 | Thu | Preparation of Draft Final Report | | Preparation of Draft Final Report | | | | | Preparation of Draft Final Report |
| 25-Jan-13 | Fri | Site Survey in Matale | | Seminar of ICE | | | | | Site Survey in Matale |
| 26-Jan-13 | Sat | Preparation of Draft Final Report | | Preparation of Draft Final Report | | | | | Preparation of Draft Final Report |
| 27-Jan-13 | Sun | Preparation of Draft Final Report | | Preparation of Draft Final Report | | | | | Preparation of Draft Final Report |
| 28-Jan-13 | Mon | Meeting w/JICA | | Meeting w/JICA | | | | | Meeting w/JICA |
| 29-Jan-13 | Tue | Meeting w/UNDP | | Meeting w/UNDP | | | | | Meeting w/UNDP |
| 30-Jan-13 | Wed | Preparation of Draft Final Report | | Preparation of Draft Final Report | | | | | Preparation of Draft Final Report |
| 31-Jan-13 | Thu | Return to Japan | | Return to Japan | | | | | Return to Japan |

**Annex 14: List of People Met by the Mission**

| Organizations | | |
|---|---|---|
| **No.** | **Name** | **Designation** |
| **Ministry of Disaster Management (MDM)** | | |
| 1 | S. M. Mohamed | Secretary |
| 2 | S. Ranasinghe | |
| 3 | U. K. Bandara | |
| **Ministry of Finance & Planning** | | |
| 4 | M. P. D. U. K. Mapa Pathirana | Director General |
| 5 | D. L. U. Peiris | Director |
| **Ministry of Irrigation & Water Resources Management (MoI&WRM)** | | |
| 6 | K. W. Ivan de Silva | Secretary |
| 7 | Upali Wickramaratna | Additional Secretary (Technical) |
| 8 | D. D. Ariyaratne | Director (Plan Implementation) |
| 9 | P. U. Wikramarathne | |
| **Ministry of Land & Land Development Survey Department** | | |
| 10 | S. Sivanantharaja | Senior Superintendent of Surveys |
| **Disaster Management Centre (DMC)** | | |
| 11 | Gamini Hettiarachchi | Director General |
| 12 | Ravi Jayarathne | Acting Director |
| 13 | Anoja Senevirathne | Mitigation Division |
| 14 | Palitha Bandara | Training & Awareness Division |
| **National Physical Planning Department (NPPD)** | | |
| 15 | J. M. L. Jayasekara | Director General |
| **Irrigation Department of Sri Lanka (ID)** | | |
| 16 | Bandra Kamaladasa | Director General of Irrigation |
| 17 | M. Thuraisingham | Additional Director General of Irrigation<br>Former Director of Irrigation (Plan Implementation, Drainage & Flood Protection) |
| 18 | Y. Abdul Majeed | Additional Director General of Irrigation |

**Annex 14: List of People Met by the Mission**

| Organizations | | |
|---|---|---|
| **No.** | **Name** | **Designation** |
| 19 | R. G. Wickramaratne | Director of Irrigation (Disaster Management) |
| 20 | Sarath Wijesekara | Director of Irrigation (System Management) |
| 21 | T. Janaki Meegastenna | Director of Irrigation (Water Management) |
| 22 | Prema Hettiarachchi | Deputy Director Hydrology Division |
| 23 | D. N. H. L. Madawalagama | Former Deputy Director Dam Safety Division |
| 24 | Kithsiri Weligepola | Chief Engineer, Water Resources Planning |
| 25 | S. P. C. Sugeeshwara | Chief Engineer, Drainage Branch |
| 26 | J. D. Amarasekara | Irrigation Engineer |
| 27 | Sudharam Elakanda | Dam Safety and Water Resources Planning Project (DSWRPP) Project Director |

| **Department of Meteorology (DOM)** | | |
|---|---|---|
| 28 | Lalith Chandrapala | Director |
| 29 | S. H. Kariyawasam | |
| 30 | Mr. Ajith | |
| 31 | Mr. Jauasomghe | |
| 32 | Mr. Jayasekara | |
| 33 | Mr. Kelm | |
| 34 | Mr. Malika | |
| 35 | Mr. Nuan | |

| **National Building Research Organization (NBRO)** | | |
|---|---|---|
| 36 | Asiri Karanawela | Director General |
| 37 | R. M. S. Bandara | Director |
| 38 | Harshan de Silva | Senior Engineering Geologist |

| **Sri Lanka Land Reclamation & Development Corporation (SLLRDC)** | | |
|---|---|---|
| 39 | Harshan de Silva | Chairman |
| 40 | K. Rajapakes | Additional General Manager |
| 41 | C. B. Amarasinghe | Deputy General Manager |
| 42 | A. H. Thushari | Assistant General Manager |
| 43 | P. Wijeratne | Assistant General Manager |

**Annex 14: List of People Met by the Mission**

| **Organizations** | | |
|---|---|---|
| **No.** | **Name** | **Designation** |
| **Coast Conservation Department (CCD)** | | |
| 44 | A. H. Gamini Hiwagi | Deputy Director |
| 45 | Chandrika Jayanelk | Chief Engineer |
| Geological Survey and Mines Bureau(GSMB) | | |
| 46 | B. Anil Peris | Director General |
| 47 | Dr. Prame | Deputy Director / Geology |
| **Mahaweli Authority of Sri Lanka** | | |
| 48 | W. M. T. D. Weerakoon | |
| **Road Development Authority (RDA)** | | |
| 49 | H. M. K. G. G. Bandara | Director Planning |
| 50 | Namlie Siyambalapitiya | Deputy Director |
| 51 | P. R. D. Fernando | Planning Division |
| 52 | J. A. V. S. Jayakody | |
| 53 | Shantha Samarasinghe | |
| **Urban Development Authority (UDA)** | | |
| 54 | P. G. Pushpa Gamage | |
| **United Nations Development Programme (UNDP)** | | |
| 55 | Enrico Gaveglia | Deputy Country Director (Programme & Operations) |
| 56 | Ananda Mallawatantri | Assistant Country Director (Programme) |
| **World Bank (WB)** | | |
| 57 | Surauga Kahandawa | |
| **German Development Cooperation (GIZ)**<br>**(Deutsche Gesellschaft für Internationale Zusammenarbeit)** | | |
| 58 | Elke Krause Hannak | Advisor - Ministry of Education |
| 59 | Menake Wijesinghe | Advisor - Disaster Safety and Innovative Teaching |

| **Organizations** | | |
|---|---|---|
| **No.** | **Name** | **Designation** |
| **International Water Management Institute (IWMI)** | | |
| 60 | Ranjith Ariyaratne | |

| **Sri Lanka Red Cross Society (SLRCS)** | | |
|---|---|---|
| 61 | S. B. Madugalle | Deputy Director General |
| 62 | Gothami Chandraratne | Programme Office - Disaster Management |