MINISTRY OF DISASTER MANAGEMENT
MINISTRY OF IRRIGATION AND WATER RESOURCES MANAGEMENT
SRI LANKA

THE DISASTER MANAGEMENT CAPACITY ENHANCEMENT PROJECT ADAPTABLE TO CLIMATE CHANGE

FINAL REPORT

MARCH 2013

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.

GE
JR
13-069

MINISTRY OF DISASTER MANAGEMENT
MINISTRY OF IRRIGATION AND WATER RESOURCES MANAGEMENT
SRI LANKA

THE DISASTER MANAGEMENT CAPACITY ENHANCEMENT PROJECT ADAPTABLE TO CLIMATE CHANGE

FINAL REPORT

MARCH 2013

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.

Table of Contents

List of Figures

page

List of Tables

page

Chapter 1 Introduction

1.1 Background

The Indian Ocean tsunami disaster in December 2004 caused the worst damages in history in Sri Lanka. As a response to the disaster, the Government of Sri Lanka (GOSL) prepared the Disaster Management Act, No. 13 of 2005, and established the National Council for Disaster Management, Ministry of Disaster Management, and Disaster Management Centre based on the Act. Since then, GOSL is working actively towards Disaster Management. In responding to this situation, Japan International Cooperation Agency (JICA) has been conducting various types of support on both structural and non-structural measures that include emergency reponse and rehabilitation for the GOSL. JICA has also been providing supports for the disaster management system in Sri Lanka, through the lessons and experiences from the disasters in Japan. These supports include;

2005 – 2006: The Project Formulation Study
"Program on Strengthening the Disaster Management Administration"

2006 – 2009: Comprehensive Study on Disaster Management in Sri Lanka
(Development Study)

2006 – 2009: The Project for Improvement of Meteorological and Information Network
(Grant Aid Project)

The flood control master plan, early warning and evacuation plan, hydrological information system and intra-governmental network system, equipment for community-based disaster management activities, an automatic weather station system, etc. have been prepared and introduced throught the above development studies and grant aid project. Plans and equipment necessary for promoting disaster management activities have been prepared and the basic capacity of counterpart agencies has been improved by these projects.

However, the capacity for early implementation of prepared plans, proper maintenance of installed systems, and utilization of real time data still needs a further enhancement. In addition, the capacity for responding to the impacts of climate change, such as increase in number and intensity of disasters needs to be enhanced. Hence, the GOJ decided to implement the technical cooperation project in response to the GOSL's request.

1.2 Objectives

The objective and outcome of this Project are as follows:

【Overall Goal】

The disaster management model is disseminated.

【Project Purpose】

A model for a complete communication network in disaster observation, forecasting and community level activities including evacuation in the pilot areas is prepared.

【Outputs】

1: Leadership and coordination capacity of the Disaster Management Centre (DMC) is strengthened.
2: Analysis and monitoring capacity of the Department of Meteorology (DOM) is enhanced.
3: Analysis and monitoring capacity of the National Building Research Organization (NBRO) is enhanced.
4: Disaster management information is regularly transferred.
5: Disaster management capacities of districts, divisions and communities in pilot areas are improved.

The latest Project Design Matrix (PDM) that was agreed with the GOSL is shown in Table 1.3.1.

1.3 Target Areas

Target areas: Colombo and the pilot districts shown below.

Pilot districts: Nuwara Eliya district, Kalutara district, and Ratnapura district.

Additional pilot districts: Matale district, Batticaloa district

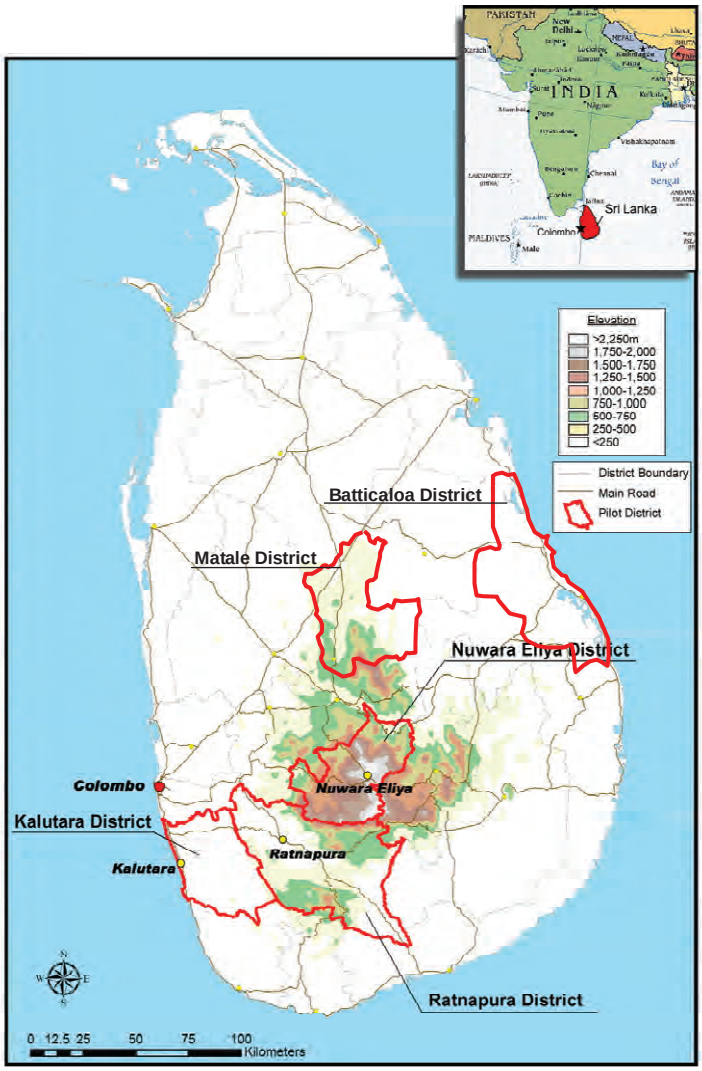


Figure 1.3.1 Location Map

Table 1.3.1 PDM

Project Design Matrix (Ver.5: 13th September 2012)

Project name: Disaster Management Capacity Enhancement Project Adaptable to Climate Change
Implementation Agency: Disaster Management Centre (DMC), Department of Meteorology (DOM), Department of Irrigation (DOI), National Building Research Organization (NBRO) Duration：March 2010 to March 2013

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The disaster management model is disseminated.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to districts, divisions and communities through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in districts, divisions and communities using information which DMC transmitted.	• Project final report • Reports issued by DMC, technical and local level organizations • Project progress report • Reports issued by concerned organizations • Emergency response plan • Annual report of DMC • Reports issued by local level organizations • Training guideline, manual, and implementation report	• No major change in policy and organization • Adequate budget and human resources for concerned organizations • No rapid change of natural environment • Counterparts who acquired skills through the project are not transferred
Project Purpose A model for complete communication network in disaster observation, forecasting & community level activities including evacuation in the pilot areas are prepared.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to pilot areas through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in the pilot area using information which DMC transmitted.		
Outputs 1. Leadership and coordination capacity of DMC is strengthened.	1-1 Number of coordination meetings on disaster management organized and outputs from those meetings 1-2 Development of National Emergency Operation Plan 1-3 Increase of contents of the annual report about disaster analysis 1-4 Formulation and trial of system 1-5 Number of development and execution of disaster management training program 1-6 District level Preparedness & Response Plan is evaluated and revised. (*)		
2. Analysis and monitoring capacity of DOM is enhanced.	2-1 The data acquired in AWS set up doesn't disappear. 2-2 Trial and improvement of short term forecasting (more than 2 days forecasting) 2-3 Trial of the warning standard at a regional level.		
3. Analysis and monitoring capacity of NBRO is enhanced.	3-1 Cost effective sediment disaster measures technique is executed in one place or more by Sri Lankan side own. 3-2 The result of the execution of the landslide risk evaluation and the behavior analysis is brought together as a report.		
4. Disaster management information is regularly transferred.	4-1 Warning is transmitted to the pilot area according to the warning official announcement rule. 4-2 Warning Transmission Trainings are executed one or more times in each pilot area.		
5. Disaster management capacities of districts, divisions and communities in pilot areas are improved.	5-1 Number of topics of coordination meetings on disaster management organized and outputs from those meetings 5-2 The hazard map is made by the guidance of the local government organization in the communities of pilot area. 5-3 Regularly evacuation trainings at the community level in the pilot area is executed by the guidance of the local government organization. 5-4 Countermeasures for priority issues in the additional pilot communities are implemented. (*)		

Activities	Inputs	Pre-condition
1.1 Enhancement of DMC capacity in facilitating effective functioning of the existing committees 1.2 Development of National Emergency Operation Plan 1.3 Improvement of DMC capacity to improve analytical approach in producing the performance report(s) 1.4 Formulation and trial of a system to assess and mitigate disasters that may be caused by development projects 1.5 Development and implementation of disaster management training program targeting on staff members of DMC, DOI, NBRO, DOM and other concerned person(s) 1.6 Evaluation and revision of district level Preparedness & Response Plan (*)	**Japanese side** • Long Term Expert (1) Project Leader / Policy • Expert Team: (1) Disaster management (2) Community based disaster management (3) Meteorological forecasting (4) Landslide management (5) Urban development (6) Regulation planning (7) Regional Level Disaster Management Plan	**Pre-condition** No major change in policy
2.1 Effective utilization and maintenance of equipments such as automatic weather station (AWS) and other sensing tools installed by JICA 2.2 The operation and the maintenance management manual are revised or are made according to the extracted problem. 2.3 Execution of the training concerning analysis of state of the weather 2.4 Formulation and trial of weather warning standard at regional level. 2.5 Trial and Improvement of short term weather forecast	• Procurement of monitoring equipments (water level sensor, rain gauge, computers, etc) • Counterpart training in Japan • Overseas project supporting fund	
3.1 Execution of cost effective sediment disaster measure technique 3.2 Formulation and execution of sediment disaster monitor and evaluation approach 3.3 Formulation and trial of sediment disaster warning standard		
4.1 Development of rules on warning issuance and organization of information management trainings related to operation of early warning 4.2 Execution of disaster information transmission training	**Sri Lanka side** • Placement of counterparts • Allocation of work station(s) for Japanese experts and counterparts • Allocation and release of project management funds	
5.1 Enhancement of district capacity in pilot areas in managing the existing disaster management committees 5.2 Implementation of community based disaster management promotion activities targeted districts in pilot areas 5.3 Implementation of community based disaster management activities at district in pilot areas and additional pilot areas(*) (installation of simple water level sensor(s) and rain gauge(s), small scale preventative work, organization of evacuation training(s))		

Pilot Areas: Ratnapura, Kalutara, Nuwara Eliya Additional Pilot Areas: Batticaloa, Matale (*)

1.4 Target Organizations

Ministry of Disaster Management/DMC, DOM, NBRO

Ministry of Irrigation and Water Resources Management/Department of Irrigation (DOI)

1.5 Implementation Structure

This Project is implemented by the long-term JICA expert (Mr. Arai) and the consultant team (headed by Mr. Uchikura). The long-term expert has been responsible for Output 1 except for Activities 1-4 and 1-6, and the consultant team has been responsible for Activity 1-4, Activity 1-6 and Outputs 2 to 5.

This report explains the works carried out by the consultant team.

1.6 Background of the Project

(1) Collected Information and References

The following information and references were collected.

Table 1.6.1 Collected Information and References

Categories	Information and References
Current status of disaster management agencies	- Report of "Program on Strengthening the Disaster Management Administration" by JICA - Report of Comprehensive Study on Disaster Management in Sri Lanka - Report on Detailed Planning Survey
Disaster information	- Information mentioned in the JICA reports above - Information from "DesInventor," the disaster inventory system available on the DMC website
Socioeconomic data	- Information mentioned in the JICA reports above - Census data - Information mentioned in the development plans and land use plans below
Data on relevant facilities	- Information mentioned in the JICA reports above - Location map of AWS by Department of Meteorology - Location map of hydrological observation stations which is to be automated by the Dam Safety and Water Resources Planning Project by World Bank
Data on development plan	- National Land Use Policy of Sri Lanka - National Physical Planning Policy and Plan of Sri Lanka - Development Plans - Draft National Disaster Management Plan - Road Map for Safer Sri Lanka

(2) Result of the Capacity Assessment

The result of the capacity assessment conducted at the beginning of the Project is shown as follows.

Table 1.6.2 Capacity Assessment on Activity 1-4

Assessed Items	Results
Personnel Organization	The Technology and Mitigation Division, which is in charge of Activity 1-4, consists of only two officers: the director and assistant director. The assistant director does most of the practical parts of this division's work, since Director is in the position to support DG of DMC. The organizational capacity of the Technology and Mitigation Division is at its limit due to the lack of human resources. One of the factors affecting the chance to enhance his/her capacity is the fact that the person in charge cannot be involved in one activity for a certain period because of the time shortage.
Capacity Gap for the Work	Regarding Activity 1-4, DMC is requested to propose survey items of the Disaster Impact Assessment (DIA) into the survey items of Environmental Impact Assessment (EIA) / Initial Environment Examination (IEE). The assistant director is responsible for the coordination with relevant organizations for the establishment of this system. The specialty of the assistant director is water resources and environment management. She worked for two years as DMC staff and she has twelve years of job experience in the water section. She does not have experience with the disaster management section except for the DMC work. Her basic ability to understand, to organize the problems and explanations seemed to be high through the first year's activities. According to her statements regarding the capacity assessment, although she is required to enhance the knowledge for community-based disaster management and to have exposure on the best practices on disaster management in other countries, she feels that she does not have enough knowledge in these fields. To implement this activity, it is necessary to understand the entire system and the issues of urban planning in Sri Lanka (knowledge for actual situations), to be able to draft flow charts or conceptual diagrams to explain to relevant people (ability to illustrate the situation), to make the relevant people understand (persuasion), to make draft plans for the system utilizing the results of the surveys (ability to propose), and to gain knowledge concerned with these matters (knowledge on DIA, EIA, etc.)

Table 1.6.3 Capacity Assessment on Output 2

Assessed Items	Results
Organization Charts and Personnel Organization	The Department of Meteorology (DOM), that is responsible for Output 2, is the only national meteorological organization in Sri Lanka and is in charge of observing meteorological phenomena and issuing meteorological information, such as weather forecasting, heavy rainfall information, seasonal climate information including drought and lightning information. Under the Director General, there are two Directors and four Deputy Directors. These four Deputy Directors manage the actual meteorological business. Under the Deputy Director, there are several MIC (meteorologists in charge) and OIC (officers in charge). They carry out the routine meteorological services. The personnel above MIC are the Class-I meteorologists regulated by WMO. The counterparts of this Project are the Class-I meteorologists and an electronic engineer. They have adequate knowledge of meteorological phenomena and skill for weather forecasting. However, there is a gap between their knowledge and skill on the meteorological analysis and weather forecast, and the ability to broadcast the disaster information for floods and landslides and information required by relevant organizations of disaster management.
Facilities and Instruments	The activities of the DOM, as the national meteorological organization, are wide ranging, and include meteorological observations (surface weather observation, upper air observation, radar observation, meteorological satellite observation, lightning analysis, collecting global observation data through GTS, etc.), weather forecasting (short-term and long-term weather forecasting, weather chart analysis, meteorological satellite analysis, numerical weather prediction, tsunamis, etc.), weather information (information, alerts, warnings, tsunami warnings, etc.), social education and enlightenment. As for the meteorological surface observations, they use conventional meteorological instruments, such as glass-tube thermometers, hair-type hygrometers, etc. However, 38 AWS stations were installed in 2009 using Japan grant aid and the final adjustments have now been implemented. For upper air observations, they use GPS radiosonde systems donated by a Japanese meteorological instrument company. Regarding meteorological radar, the installation works were being implemented in a bid to start observations at the end of 2011 using DOM's own funds with the administrative assistance of WMO. The GTS system was replaced in 2006 with the cooperation of WMO. DOM obtains meteorological satellite images and the results of numerical weather predictions (NWP) through the Internet and they utilize this information for their routine weather forecasting. A meso-scale NWP system for the Sri Lanka area was installed in 2011 in this Project. DOM doesn't issue meteorological 'warnings' except 'tsunami warnings,' but they issue information regarding heavy rainfall, lightning, and extreme phenomena such as cyclones, earthquakes and tsunamis to the related disaster prevention sectors. The development of visual

Assessed Items	Results
	meteorological information using mass media should be demanded in the near future. Excursions for elementary, junior high and high school students in DOM are held almost everyday. The educational campaign for the younger generation is promoted continually. The modernized facilities and instruments are being installed. It is expected that these several years will be a great turning point for the meteorological services modernization such as observations and forecasting.
Organization and Institution	DOM is trying to modernize their meteorological services in the conventional institution based on conventional observations and forecasting. However, it appears that new works are concentrated on a particular section and it is not clear which section is in charge. Installation of AWS: After the installation of 38 AWS stations (exactly 33 stations have been installed at present), the Electronic Division (ED) will have to implement routine maintenance operations, such as regular inspections every four months, maintenance of the AWS systems, quality control of meteorological observation data, management and operation of the automated data acquisition system and maintenance of the VSAT telecommunication system. ED also has to do its existing work, such as inspections and maintenance of conventional electronic equipment and OA facilities and LAN management. After the installation of meteorological radar, it is expected that their tasks will increase. So, task sharing and personnel recruitment would be desired. Management of AWS data: DOM has a section responsible for conventional observation data management, but the section responsible for new AWS data has not yet been decided. The existing computer/data division may be in charge but personnel recruitment and IT innovation would be desired. Installation of Meteorological Radar: Doppler type radar will be installed and DOM will be able to obtain observation data every five to ten minutes in the case of heavy rain. In order to utilize radar observation data, DOM has to analyze individual data, compare radar data to AWS observation data and convert it to rainfall values. This task is very hard to do for the existing radar division. So capacity development and technology transfer would be desired. Installation of NWP system: DOM has some experts in NWP operation and utilization, but not enough to carry on the routine short-term forecasting. In order to verify the results of NWP and improve NWP, system capacity development and technology transfer would be desired.

Table 1.6.4 Capacity Assessment on Output 3

Assessed Items	Results
Personnel Organization	The Landslide Studies and Services Division (LSSD) of NBRO is responsible for the activities of Output 3. LSSD has approximately 30 staffs and performs various tasks such as: study of landslide policy, urgent disaster investigation, landslide investigation and implementation of countermeasures, hazard mapping, landslide reference database creation, early warning activities, housing relocation instruction, and education on landslide disasters. The total staff of thirty is extremely small considering the large number of landslides in Sri Lanka. The three scientists of the LSSD in charge of Output 3 have an important role in the planning and implementation stage of this Project, and have training experience in Japan. Moreover, they are in positions of responsibility for implementing landslide countermeasures in Sri Lanka, and it can be judged that they have sufficient motivation towards this Project. They also have knowledge about the monitoring equipment introduced in this Project, and their knowledge on installation, observation, maintenance of equipment, and processing and analysis of data has reached the level that the JICA Expert has expected.
Knowledge and Experience Regarding Landslide Countermeasures	The counterparts have basic knowledge on landslide countermeasures gained through experience in Sri Lanka, training in Japan, and working with other international organizations. Also, they understand the purpose and mechanism of the equipment introduced in this Project. However, since this is the first installation in Sri Lanka, they have no experience in installation or observation of the equipment. They have some experience in observation and analysis using simplified techniques, and they recognize the importance of monitoring the landslide movement. Through monitoring, LSSD has the intention to understand the landslide mechanisms, to know the condition and movement of landslides, and finally to utilize the monitoring results in future disaster management activities. As for countermeasures against landslides, LSSD has understood the systems of countermeasures, and has experience in the design and installation of retaining walls and other countermeasures. However, the number of the projects that LSSD has implemented is small, and they have high expectations for this Project.

Table 1.6.5 Capacity Assessment on Output 4

Assessed Items	Results
Personnel Organization	The position of Director of the Early Warning Division, which is responsible for Output 4, is covered by the Director of the Emergency Operation Centre. There are only two Assistant Directors and no staff in the Early Warning Division. These two Assistant Directors are very busy with the O/M of communication equipment including tsunami towers during normal periods, and with responding to the inquiries from people and related organizations during emergency periods, etc. There is no time for them to discuss and solve the issues regarding early warnings, even though this is their primary responsibility. These two Assistant Directors have two years experience in DMC, and had no experience in the disaster management sector before assuming their current positions.
Related Equipment	Equipment for the information transfer, such as telephones, faxes, radios, tsunami towers, SMS etc., are being introduced gradually by donor support and their own funds. At the same time, megaphones and sirens, etc. are being provided at the community level. There are some issues such as more equipment is provided to the coastal areas for tsunamis, and the Intra-Governmental Network to communicate with related organizations is not being utilized, etc.
System Operation	Operation checks of the equipment are conducted every day, and the information transfer exercises to disseminate the tsunami warnings to the local people are conducted by themselves occasionally and a SOP (Standard Operation Procedure), to show the detailed actions to be taken by each officer for each disaster, has been prepared.

Table 1.6.6 Capacity Assessment on Output 5

Assessed Items	Resulst
DMC Headquarters	The Training, Education & Public Awareness Division of DMC consists of one (1) Director, one (1) Deputy Director, and one (1) Assistant Director. The Director of the division left DMC in June 2010 and the position is vacant at this moment. Therefore, almost all the works in the division have to be done by the remaining staff while a Deputy Director is assigned as the Acting Director. Under these circumstances, they are so busy completing their daily paper work that they have little time to allocate to the work that was originally assigned to them. The Assistant Director who is in charge of this Project has about three years working experience in DMC; however, he had no work experience in disaster management before he joined DMC. He has a university degree and has enough capability to understand his responsibility and implement his work in this Project. Also, he has proper understanding of the importance of community activities as he has an academic background in agriculture and has had experience working in agricultural villages.
DDMCU in Pilot Districts	DDMCU is normally staffed with one (1) DM Coordinator, some Assistant Coordinators and other staff. The DM Coordinators of Kalutara and Ratnapura are seconded from the Sri Lanka Army and both of them have been working as DM Coordinators from 2007, while the DM Coordinator of Nuwaraeliya was employed by DMC directly from the private sector and has been in his position from the year 2008. All DM Coordinators and Assistant DM Coordinators assigned to the pilot districts have an academic background of secondary education or above, and have the capability of understanding the disaster situation of their duty areas and their responsibility in disaster management. The two DM Coordinators from the Sri Lanka Army had experience in officer-level positions and it can be said that they have sufficient capability of leadership in disaster response, which was shown the past experiences with actual disaster cases.

(3) Situations and Issues of the Disaster Management Sector

The situations and issues of disaster management sector identified during the Project are organized as follows.

Table 1.6.7 Situation and Issues of the Disaster Management Sector

Assessed Items	Results
Disaster Management	DMC has expanded its scale and improved its facilities and systems since its establishment in 2005. Several assistant directors who have more than four years of experience improved their knowledge on disaster management and operational skills well enough to be a core part of the organization. DMC's organizational capacity and recognition from people have been improved.

Assessed Items	Results
	In particular, the information transfer capacity on tsunami warning has shown rapid development compared to the one at the development study. On the other hand, retirement and other factors triggered the scarcity of human resource on director class. There are few officers who have a capacity to determine the policy and future of DMC at the moment. Additionally, the recruit of support staff for the assistant directors has not been proceeded yet. The remaining assistant directors have little time to take care of something other than daily tasks, using limited resources. The Ministry of Disaster Management, the supervisor of DMC and other related organizations, is in the same situation as DMC and has not performed enough on comprehensive determination and coordination on the future disaster management policy. Furthermore, DMC's position as a lower organization of Ministry of Disaster Management makes it difficult for DMC to coordinate the other traditional organizations such as the Department of Irrigation and Department of Meteorology. The appropriate recruiting and training of staff and support for them is important. The enhancement of organization including securement of budget and human resources is the largest issue for both DMC and the Ministry of Disaster Management.
Flood countermeasures	Several flood and the sediment disasters occurred from the central mountainous region to southwestern region from 2003 to 2007. In 2009, an urban flood occurred in Colombo and large-scale floods happened mainly in eastern districts from 2010 to 2011. Since the frequency of floods is high, the need for flood countermeasures is urgent in the urban areas. On the other hand, floods are a part of people's lives outside of urban areas. Therefore, the needs for flood countermeasures are different from those in urban areas. Generally, this type of flood expands to the low-lying areas slowly. The number of deaths by floods is less than the number of affected people. Additionally, since the irrigation area can be increased or decreased depending on the scale of the flood, droughts are more vital problems than floods. In Sri Lanka, the Department of Irrigation is in charge of flood countermeasures, though its detailed role is not mentioned in any law or regulation. The Flood Protection Ordinance is the only document that states the role of the Department of Irrigation on flood countermeasures, though it only states that the Department of Irrigation is responsible for the flood countermeasures for the designated rivers. The DG of the Department of Irrigation was replaced in July 2012 and the major directors were also changed. Therefore, the support on disaster management sector by JICA after 2006 became unknown to the top class of the Department of Irrigation, though the new DG's motivation toward disaster management is high. In addition to this, the Department of Irrigation has implemented the construction of civil engineering structures such as dikes, dams, floodgates and water channels. Their technique is relatively elaborate and the organization of the Department of Irrigation functions well. Including not only the structural countermeasures, but also non-structural countermeasures such as modernization of monitoring and preparation of hazard maps, determination of the policies on flood countermeasures is the urgent issue.
Sediment Disaster Countermeasures	The Landslide Studies and Services Division is in charge of the sediment disaster countermeasures at NBRO. NBRO is positioned as a semi-government institute, which was not outstanding during the Comprehensive Study on Disaster Management in Sri Lanka in 2006. NBRO improved its capacity and recognition in the disaster management sector by implementing the activity for which they could take full responsibility. At the development study in 2006, their main activities were non-structural ones such as preparation of hazard maps utilizing 1/50,000 topographic maps and community-based awareness campaigns. After the study, they conducted the landslide observation, their own design and landslide countermeasures utilizing the limited resources in some sites. The Project instructed on landslide monitoring using the Japanese observation equipment and was supposed to instruct on structural countermeasures based on the observation results. The design of structural countermeasures based on the scientific verification and enhancement of construction ability are NBRO's challenges. Although the Project supported their enhancement, it should be continued after the termination of the Project. In addition to this, the establishment law, which states the position of the organization and securement of the human resources, is one of the important challenges of NBRO.
Weather Forecast	Before installation of the AWS by Japanese grant aid, the manual weather forecast by reading the recording papers and calibration, reporting observed value by phone calls, hand-written meteorological charts, and warning issuance were conducted by Department of Meteorology. Recently the metrological system has been modernized rapidly by installation of AWS, direct reception of satellite data, utilization of NWP by the Project, installation of Doppler radar (to be installed), etc. The weather forecasting capacity will be drastically improved by utilizing these systems appropriately. However, the technical level and the number of staff have not been improved much. The staff's capacity enhancement on operation and maintenance of modernized systems is an urgent issue, because the staff do not have practical experience on using the new equipment and systems although they have participated in a number of overseas training sessions such as the one in Japan. The Project has been supporting a part of their capacity enhancement.

Assessed Items	Results
	The new equipment and systems require the operation and maintenance separately, while the output can be varied when they are utilized together. The establishment of an integrated system is an issue for the appropriate utilization of the equipment and systems.
Forecasting System	The forecasting system is roughly divided to three parts: risk assessment, observation, and early warning issuance and information transfer. Regarding floods, the hazard map has not been prepared except for certain rivers in the southwest region. The observation system of rainfall and water level is still insufficient. The uncertainty of the responsible organization on hazard map preparation and the absence of detailed topographic maps are the reasons why the hazard maps have not been fully prepared. At minimum, 1/10,000 topographic maps are expected to be prepared. The observation system of rainfall and water level is critically insufficient except for a few pieces of equipment. Facilitation of the observation system is vital for appropriate early warning issuance. NBRO has proceeded with the preparation of hazard maps of 1/50,000 and 1/10,000 scale for sediment disasters. Regarding the method for hazard map preparation, the long-term expert of the Project proposed preparation of separate hazard maps for each sediment disaster based on the category of disasters as prepared by Japan. Additionally, the detailed topographic map is required for the detailed hazard map like for floods. The observation system for rainfall and other natural conditions is not sufficient. It is expected to organize the observation system, collaborating with other organizations in the future. Information transfer has been conducted by each technical agency through the media, the police and the army before the establishment of DMC. Currently, DMC is promoting the information transfer through regional government agencies, adding to the existed information transfer measures. Both the development study and the Project have supported its enhancement. Regarding tsunami warning, tsunami warning towers have been constructed and thus, the system has drastically improved.

Chapter 2 Accomplishments of the Project

2.1 Accomplishments of the Project

The accomplished activities and outputs are shown in the table below.

Table 2.1.1 Accomplished Activities and Outputs

Activity / Output	Activity	Output
Activity 1-4	Discussion on DIA System	Guideline
	Preparation of DIA check list for road sector	Manual, check list, sample of the check list
	Formulation of action plan	Action Plan
Output 2	Operation and maintenance of AWS	Maintenance sheets / check sheets
	Short-term weather forecast	Model, guidance, accuracy evaluation sheet
	Regional warning standards	Regional warning standard, evaluation sheet
	Proposal on utilization of Doppler radar	Proposal
Output 3	Landslide monitoring	Monthly report, design, cost estimation, The manual for evaluation of landslide disaster and countermeasures
	Landslide analysis	
	Design of landslide countermeasures	
	Design of early warning system	
	Preparation of the manual for evaluation of landslide disaster and countermeasures	
Output 4	Preparation of warning issuance and information sharing manual (flood and landslide)	Warning issuance and information sharing manual
	Operation and maintenance of IGN	IGN Users Guide
	Implementation of information transfer exercise (flood and landslide)	Exercise Evaluation Report
	Evaluation of information transfer exercise (tsunami)	Exercise Evaluation Report
	Formulation of database for manual rain gauges	Database for rain gauges
Output 5	Enhancement of operation capacity of disaster management committee	Activity report
	Promotion of community based disaster management	Activity report

2.2 Input by Japanse Side

2.2.1 Actual Assignment of Consultant Team

The total man-months (MM) of three years are shown as follows.

Table 2.2.1 MM of the 1st Year (Total 16.33 MM)

Name	Position	Organization	MM	Output / Activity
Yoshihiko Uchikura	Team Leader / Disaster Management Policy / Early Warning System	Oriental Consultants Co., Ltd. (OC)	3.00	Output 1, Output 4
Ryo Matsumaru	Local Disaster Management Administration / Community Based Disaster Management	IRM	2.33	Output 5
Chuji Yamamoto	Weather Forecast	Japan Meteorological Business Support Center (JMBSC)	3.00	Output 2

Name	Position	Organization	MM	Output / Activity
Satoru Tsukamoto	Sediment Disaster Countermeasures 1 (Monitoring)	Kokusai Kogyo Co., Ltd.	1.67	Output 3
Shigekazu Fujisawa	Sediment Disaster Countermeasures 2 (Structural measures)	Kokusai Kogyo Co., Ltd.	1.00	Output 3
Motoyo Araki	Urban Development	Oriental Consultants Co., Ltd. (OC)	2.83	Activity 1-4
Hiroyuki Takamatsu	Disaster Management Technique	Pacific Consultants Co., Ltd. (PCKK)	1.00	Output 4
Nobuhisa Kawakami	Disaster Management Information (Responsible of PCKK)	Pacific Consultants Co., Ltd. (PCKK)	0.50	Output 4
Azusa Okuno	Human Resource Development / Coordinator (Responsible of OC)	Oriental Consultants Co., Ltd. (OC)	1.00	Output 5

Table 2.2.2 MM of the 2nd Year (Total 16.33 MM)

Name	Position	Organization	MM	Output / Activity
Yoshihiko Uchikura	Team Leader / Disaster Management Policy / Early Warning System	OC	5.63	Activity 1-6, Output 4
Ryo Matsumaru	Local Disaster Management Administration / Community Based Disaster Management	IRM	4.27	Output 5
Chuji Yamamoto	Weather Forecast	JMBSC	3.50	Output 2
Akio Sasaki	Weather Forecast Model (Additional)	JMBSC	0.50	Output 2
Satoru Tsukamoto	Sediment Disaster Countermeasures 1 (Monitoring)	Kokusai Kogyo Co., Ltd.	1.00	Output 3
Shigekazu Fujisawa	Sediment Disaster Countermeasures 2 (Structural measures)	Kokusai Kogyo Co., Ltd.	2.17	Output 3
Motoyo Araki	Urban Development	OC	3.50	Activity 1-4
Hiroyuki Takamatsu	Disaster Management Technique	PCKK	1.13	Output 4
Azusa Okuno	Human Resource Development / Coordinator	OC	2.73	Output 5
Seiji Kamioka	Regional Disaster Management Plan (Additional)	PCKK	1.40	Output 4

Table 2.2.3 MM of the 3rd Year (Total 16.33 MM)

Name	Position	Organization	MM	Output / Activity
Yoshihiko Uchikura	Team Leader / Disaster Management Policy / Early Warning System	OC	3.67	Output 4
Ryo Matsumaru	Local Disaster Management Administration / Community Based Disaster Management	IRM	3.00	Output 5
Chuji Yamamoto	Weather Forecast	JMBSC	3.50	Output 2

Name	Position	Organization	MM	Output / Activity
Satoru Tsukamoto	Sediment Disaster Countermeasures 1 (Monitoring)	Kokusai Kogyo Co., Ltd.	1.50	Output 3
Shigekazu Fujisawa	Sediment Disaster Countermeasures 2 (Structural measures)	Kokusai Kogyo Co., Ltd.	2.17	Output 3
Motoyo Araki	Urban Development	OC	3.26	Activity 1-4
Hiroyuki Takamatsu	Disaster Management Technique	PCKK	1.00	Output 4
Azusa Okuno	Human Resource Development / Coordinator	OC	1.00	Output 5
Masanori Tozawa	Landslide Monitoring Training (Additional)	Asano Taiseikiso Engineering Co., Ltd.	2.24	Output 3

2.2.2 Provided Equipment

Office equipment for DMC, equipment for the NWP model to the Department of Meteorology, and landslide observation equipment to NBRO were provided.

Table 2.2.4 Office Equipment for DMC

Equipment Name	Model / Specification	Qty.	Date	Location	Cond.
GIS Software	ArcGIS Single License Ver.10 ESRI	1	2010/08/02	DMC office	OK
Desktop PC	Extensa E270 Acer	1	2010/07/22	DMC office	OK
Laptop PC	Aspire 4736 Acer	1	2010/07/22	DMC office	OK
Multifunction Copier	iR 2318L Canon	1	2010/07/07	DMC office	OK
Handy GPS	Dakota 20 GARMIN	1	2010/05/26	DMC office	OK

Table 2.2.5 Equipment for NWP Model by DOM

Equipment Name	Model / Specification	Qty.	Date	Location	Cond.
Server	Power Edge R410 Dell	1	2010/12/24	DOM office	OK
Hard Disk (HDD)	1 TB	1	2010/12/24	DOM office	OK
Compiler	Composer XE 2011 Intel	1	2010/12/24	DOM office	OK

Table 2.2.6 Equipment for Landslide Monitoring by NBRO

Equipment Name	Model / Specification	Qty.	Date	Location	Cond.
Rain Gauge Data Logger	NetLG-201E OSASI	1	2010/06/01	Nuwara Eliya	OK
Rain Gauge Data Logger	NetLG-201E OSASI	1	2010/06/01	Ratnapura	OK
Rain Gauge	RS-1 OSASI	1	2010/06/01	Nuwara Eliya	OK
Rain Gauge	RS-1 OSASI	1	2010/06/01	Ratnapura	OK
Network Controller	NetCT-1E OSASI	1	2010/06/01	Nuwara Eliya	OK
Extensometer	SLG-30E OSASI	6	2010/06/01	Nuwara Eliya	OK
Extensometer	SLG-30E OSASI	2	2010/06/01	Ratnapura	OK
3 Core Cable	500m OSASI	1 set	2010/06/01	Nuwara Eliya	No
Water Level Sensor	DS-1 OSASI	1	2010/06/01	Nuwara Eliya	OK
Water Level Sensor	DS-1 OSASI	2	2010/06/01	Nuwara Eliya	No
Water Level Sensor	DS-1 OSASI	1	2010/06/01	Ratnapura	OK
Water Level Data Logger	NetLG-001E	1	2010/06/01	Nuwara Eliya	OK
Water Level Data Logger	NetLG-001E	1	2010/06/01	Ratnapura	OK
Strain Gauge / Water Level Data Logger	NetLG-301E	2	2010/06/01	Nuwara Eliya	OK

Equipment Name	Model / Specification	Qty.	Date	Location	Cond.
Inclinometer	KB-10HC Tokyo Sokki	1	2010/06/01	Ratnapura	OK
Inclinometer	KB-10HC Tokyo Sokki	1	2010/06/01	Nuwara Eliya	OK
Adapter for Inclinometer	IA-32 Tokyo Sokki	1	2010/06/01	Ratnapura	OK
Adapter for Inclinometer	IA-32 Tokyo Sokki	1	2010/06/01	Nuwara Eliya	OK
Carrying case	KBF-60 Tokyo Sokki	1	2010/06/01	Ratnapura	OK
Carrying case	KBF-60 Tokyo Sokki	1	2010/06/01	Nuwara Eliya	OK
Guide tube for Inclinometer with accessories	KBF-31-3, KBF-32, KBF-34, KBF-37, KBF-38, KBF-39 OSASI	1 set		Ratnapura	OK
Water Level Sensor	DS-1 OSASI	1		Ratnapura	OK
Water Level Data Logger	NetLG-001E	1		Ratnapura	OK
Network Controller	NetCT-1E OSASI	1		Nuwara Eliya	OK

2.2.3 Actual Expenses for Work in Sri Lanka

The actual expense per year is shown in the following tables.

Table 2.2.7 Payment for Local Staff

Year	Output/Activity	MM	Amount (LKR)	Remarks
1st	Activity 1-4	1.0	140,000	-
	Output 4	6.0	1,150,000	O&M of IGN
	Output 4	2.0	450,000	Formulation of manual
	Output 5	1.0	185,000	Support of District level DM committee
2nd	Activity 1-4	11.0	1,092,000	-
	Activity 1-4	0.2	10,000	GIS
	Activity 1-6	6.0	702,000	-
	Output 2	0.4	14,400	Typist
	Output 4	15.0	1,800,000	O&M of IGN
	Output 4	2.0	500,000	Survey on rain gauge
	Output 5	5.7	698,580	Support of District level DM committee
3rd	Activity 1-4	10.0	1,050,000	-
	Activity 1-4	0.5	60,000	GIS
	Activity 1-6	1.4	42,000	-
	Output 3	1.0	154,000	-
	Output 4	2.0	360,000	Survey on rain gauge
	Output 4	21.0	250,000	Formulation of manual
	Output 4	13.0	1,590,000	O&M of IGN
	Output 4	0.4	65,000	Translation
	Output 5	1.3	336,000	Support of District level DM committee

Table 2.2.8 Sub Contract with Local Consultants

Year	Output/Activity	Amount (LKR)	Remarks
1	Output 3	1,397,000	Boring
	Output 5	3,343,465	CBDRM
2	Output 3	908,652	Topographic Survey
	Output 5	1,895,685	CBDRM
	Output 5	6,033,500	District level DM committee/CBDRM
3	Output 3	1,285,000	Boring
	Output 5	6,666,000	CBDRM

Table 2.2.9 Workshops

Year	Output/Activity	Amount (LKR)	Remarks
2	Activity 1-6	482,236	District Level DM committee
3	Activity 1-4	268,239	DIA Workshop

The following tables show the expenses shown above with regard to outputs/activities.

Table 2.2.10 Expense by Output / Activities (LKR)

Output / Activity	Local Employees	Sub-contract	Workshop	Total
Activity 1-4	2,352,000	-	268,239	2,620,239
Activity 1-6	744,000	-	482,236	1,226,236
Output 2	14,400	-	-	14,400
Output 3	154,000	3,590,652	-	3,744,652
Output 4	6,165,000	-	-	6,165,000
Output 5	1,219,580	17,938,650	-	19,158,230
Total				32,928,757

2.3 Plan of Operation (Actual Operation)

The actual operation of the activities is shown and compared with the original plan of operation as follows.

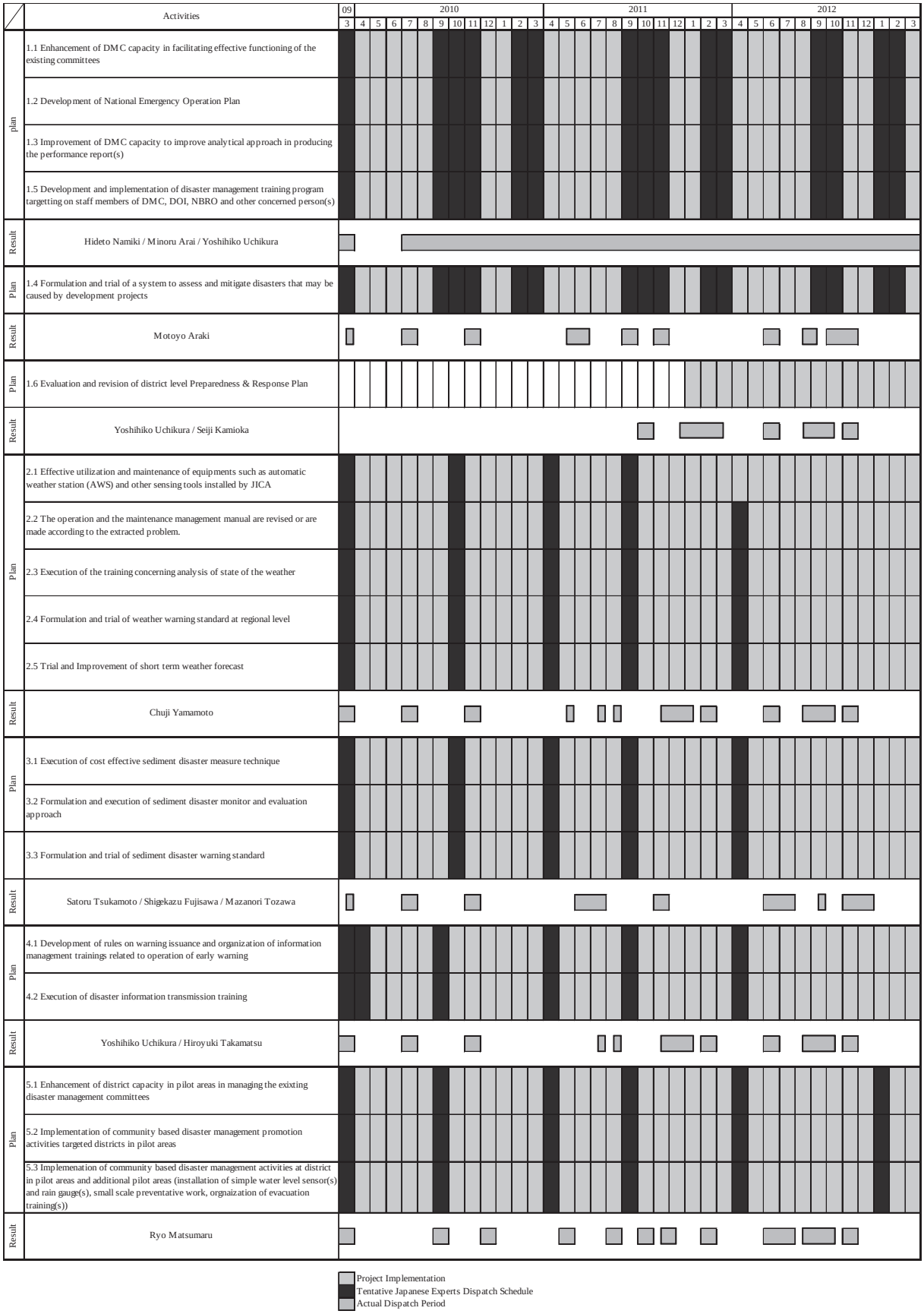


Figure 2.3.1 Comparison between PO and Actual Operation

2.4 History of PDM Modification

The series of Project Design Matrix (PDM) Version 1 to 5 and the history of PDM modification are shown as follows.

Table 2.4.1 PDM Ver.1

Project Design Matrix

Project name : Disaster Management Capacity Enhancement Project Adaptable to Climate Change
Implementation Agency : Disaster Management Centre (DMC), Department of Meteorology (DOM), Department of Irrigation (DOI), National Building Research Organization (NBRO)
Duration : February 2010 to February 2013

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The disaster management model is disseminated.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to districts, divisions and communities through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in districts, divisions and communities using information which DMC transmitted.	• Project final report • Reports issued by DMC, technical and local level organizations • Project progress report • Reports issued by concerned organizations • Emergency response plan • Annual report of DMC • Reports issued by local level organizations • Training guideline, manual, and implementation report	• No major change in policy and organization • Adequate budget and human resources for concerned organizations • No rapid change of natural environment • Counterparts who acquired skills through the project are not transferred
Project Purpose A model for complete communication network in disaster observation, forecasting & community level activities including evacuation in the pilot areas are prepared.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to pilot areas through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in the pilot area using information which DMC transmitted.		
Outputs 1. Leadership and coordination capacity of DMC is strengthened.	1-1 Number of coordination meetings on disaster management organized and outputs from those meetings 1-2 Development of National Emergency Response Plan 1-3 Increase of contents of the annual report about disaster analysis 1-4 Establishment of a system to assess and mitigate disasters that may be caused by development projects 1-5 Number of development and execution of disaster management training program		
2. Analysis and monitoring capacity of DOM is enhanced.	2-1 The data acquired in AWS set up doesn't disappear. 2-2 Trial of short term forecasting (more than 2 days forecasting) 2-3 The warning standard at a regional level is operated.		
3. Analysis and monitoring capacity of NBRO is enhanced.	3-1 Low-cost sediment disaster measures technique is executed in one place or more by Sri Lankan side own. 3-2 The result of the execution of the landslide risk evacuation and the behavior analysis is brought together as a report.		
4. Disaster management information is regularly transferred.	4-1 Warning is transmitted to the pilot area according to the warning official announcement rule. 4-2 Warning Transmission Trainings are executed one or more times in each pilot areas.		
5. Disaster management capacities of districts, divisions and communities in pilot areas are improved.	5-1 Number of topics of coordination meetings on disaster management organized and outputs from those meetings 5-2 The hazard map is made by the guidance of the local government organization in the communities of pilot area. 5-3 Regularly evacuation trainings at the community level in the pilot area is executed by the guidance of the local government organization.		

Activities

1.1 Enhancement of DMC capacity in facilitating effective functioning of the existing committees
1.2 Development of National Emergency Response Plan
1.3 Improvement of DMC capacity to improve analytical approach in producing the performance report(s)
1.4 Establishment of a system to assess and mitigate disasters that may be caused by development projects
1.5 Development and implementation of disaster management training program targeting on staff members of DOI, NBRO, DOM, districts, divisions and other concerned person(s)

2.1 Effective utilization and maintenance of equipments such as automatic weather station (AWS) and other sensing tools installed by JICA
2.2 The operation and the maintenance management manual are revised or are made according to the extracted problem.
2.3 Execution of the training concerning analysis of state of the weather
2.4 Decision of weather warning standard at regional level is established.
2.5 Trial of short term weather forecast

3.1 Execution of low-cost sediment disaster measure technique
3.2 Establishment and execution of sediment disaster monitor and evaluation approach
3.3 Making of sediment disaster warning standard

4.1 Development of rules on warning issuance and organization of information management trainings related to operation of early warning
4.2 Execution of disaster information transmission training

5.1 Enhancement of district capacity in pilot areas in managing the existing disaster management committees
5.2 Implementation of community based disaster management promotion activities targeted districts in pilot areas
5.3 Implementation of community based disaster management activities at district in pilot areas (installation of simple water level sensor(s) and rain gauge(s), small scale preventative work, organization of evacuation training(s))

Inputs

Japanese side

- Long Term Expert (1) : Team Leader/ policy
- Expert Team : (1) Disaster management
  (2) Community based disaster management
  (3) Meteorological forecasting
  (4) Landslide management
  (5) Urban development
  (6) Regulation planning
- Procurement of monitoring equipments (water level sensor, rain gauge, computers, etc)
- Counterpart training in Japan
- Overseas project supporting fund

Sri Lanka side

- Placement of counterparts
- Allocation of work station(s) for Japanese experts and counterparts
- Allocation and release of project management funds

Pre-condition
No major change in policy

※1 JICA Preparatory Study will manage matters related to flood mitigation.
※2 Pilot areas for the Project will be determined based on discussions during the Study.

Table 2.4.2 PDM Ver.2

Project Design Matrix (Ver.2: 5th August 2012)

Project name : Disaster Management Capacity Enhancement Project Adaptable to Climate Change
Implementation Agency : Disaster Management Centre (DMC), Department of Meteorology (DOM), Department of Irrigation (DOI), National Building Research Organization (NBRO) Duration : February 2010 to February 2013

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The disaster management model is disseminated.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to districts, divisions and communities through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in districts, divisions and communities using information which DMC transmitted.	• Project final report • Reports issued by DMC, technical and local level organizations • Project progress report • Reports issued by concerned organizations • Emergency response plan • Annual report of DMC • Reports issued by local level organizations • Training guideline, manual, and implementation report	• No major change in policy and organization • Adequate budget and human resources for concerned organizations • No rapid change of natural environment • Counterparts who acquired skills through the project are not transferred
Project Purpose A model for complete communication network in disaster observation, forecasting & community level activities including evacuation in the pilot areas are prepared.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to pilot areas through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in the pilot area using information which DMC transmitted.		
Outputs 1. Leadership and coordination capacity of DMC is strengthened.	1-1 Number of coordination meetings on disaster management organized and outputs from those meetings 1-2 Development of National Emergency Response Plan 1-3 Increase of contents of the annual report about disaster analysis ~~1-4 Establishment of a system to assess and mitigate disasters that may be caused by development projects~~ **1-4 Formulation and trial of system** 1-5 Number of development and execution of disaster management training program		
2. Analysis and monitoring capacity of DOM is enhanced.	2-1 The data acquired in AWS set up doesn't disappear. 2-2 Trial **and improvement** of short term forecasting (more than 2 days forecasting) 2-3 **Trial of** the warning standard at a regional level~~is operated~~.		
3. Analysis and monitoring capacity of NBRO is enhanced.	3-1 ~~Low cost~~**Cost effective** sediment disaster measures technique is executed in one place or more by Sri Lankan side own. 3-2 The result of the execution of the landslide risk evacuation and the behavior analysis is brought together as a report.		
4. Disaster management information is regularly transferred.	4-1 Warning is transmitted to the pilot area according to the warning official announcement rule. 4-2 Warning Transmission Trainings are executed one or more times in each pilot areas.		
5. Disaster management capacities of districts, divisions and communities in pilot areas are improved.	5-1 Number of topics of coordination meetings on disaster management organized and outputs from those meetings 5-2 The hazard map is made by the guidance of the local government organization in the communities of pilot area. 5-3 Regularly evacuation trainings at the community level in the pilot area is executed by the guidance of the local government organization.		

Activities	Inputs	Pre-condition
1.1 Enhancement of DMC capacity in facilitating effective functioning of the existing committees 1.2 Development of National Emergency Response Plan 1.3 Improvement of DMC capacity to improve analytical approach in producing the performance report(s) 1.4 ~~Establishment~~ **Formulation and trial** of a system to assess and mitigate disasters that may be caused by development projects 1.5 Development and implementation of disaster management training program targeting on staff members of DOI, NBRO, DOM, districts, divisions and other concerned person(s)	**Japanese side** • Long Term Expert (1) ~~Team~~ **Project** Leader / Policy • Expert Team : (1) Disaster management (2) Community based disaster management (3) Meteorological forecasting (4) Landslide management (5) Urban development (6) Regulation planning • Procurement of monitoring equipments (water level sensor, rain gauge, computers, etc) • Counterpart training in Japan • Overseas project supporting fund	**Pre-condition** No major change in policy
2.1 Effective utilization and maintenance of equipments such as automatic weather station (AWS) and other sensing tools installed by JICA 2.2 The operation and the maintenance management manual are revised or are made according to the extracted problem. 2.3 Execution of the training concerning analysis of state of the weather 2.4 ~~Decision~~ **Formulation and trial** of weather warning standard at regional level~~is established~~ 2.5 Trial and Improvement of short term weather forecast		
3.1 Execution of ~~low cost~~ **cost effective** sediment disaster measure technique 3.2 ~~Establishment~~ **Formulation** and execution of sediment disaster monitor and evaluation approach 3.3 ~~Making~~ **Formulation and trial** of sediment disaster warning standard		
4.1 Development of rules on warning issuance and organization of information management trainings related to operation of early warning 4.2 Execution of disaster information transmission training	**Sri Lanka side** • Placement of counterparts • Allocation of work station(s) for Japanese experts and counterparts • Allocation and release of project management funds	
5.1 Enhancement of district capacity in pilot areas in managing the existing disaster management committees 5.2 Implementation of community based disaster management promotion activities targeted districts in pilot areas 5.3 Implementation of community based disaster management activities at district in pilot areas (installation of simple water level sensor(s) and rain gauge(s), small scale preventative work, organization of evacuation training(s))		

Pilot Areas: Ratnapura, Kalutara, Nuwara Eliya

Table 2.4.3 PDM Ver.3

Project Design Matrix (~~Ver.2 5th August 2012~~Ver.3: 18th January 2012)

Project name : Disaster Management Capacity Enhancement Project Adaptable to Climate Change
Implementation Agency : Disaster Management Centre (DMC), Department of Meteorology (DOM), Department of Irrigation (DOI), National Building Research Organization (NBRO) Duration : February 2010 to February 2013

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The disaster management model is disseminated.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to districts, divisions and communities through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in districts, divisions and communities using information which DMC transmitted.	• Project final report • Reports issued by DMC, technical and local level organizations • Project progress report • Reports issued by concerned organizations • Emergency response plan • Annual report of DMC • Reports issued by local level organizations • Training guideline, manual and implementation report	• No major change in policy and organization • Adequate budget and human resources for concerned organizations • No rapid change of natural environment • Counterparts who acquired skills through the project are not transferred
Project Purpose A model for complete communication network in disaster observation, forecasting & community level activities including evacuation in the pilot areas are prepared.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to pilot areas through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in the pilot area using information which DMC transmitted.		
Outputs 1. Leadership and coordination capacity of DMC is strengthened.	1-1 Number of coordination meetings on disaster management organized and outputs from those meetings 1-2 Development of National Emergency ~~Response~~ Operation Plan 1-3 Increase of contents of the annual report about disaster analysis 1-4 Formulation and trial of system 1-5 Number of development and execution of disaster management training program 1-6 District level Preparedness & Response Plan is evaluated and revised. (*)		
2. Analysis and monitoring capacity of DOM is enhanced.	2-1 The data acquired in AWS set up doesn't disappear. 2-2 Trial and improvement of short term forecasting (more than 2 days forecasting) 2-3 Trial of the warning standard at a regional level.		
3. Analysis and monitoring capacity of NBRO is enhanced.	3-1 Cost effective sediment disaster measures technique is executed in one place or more by Sri Lankan side own. 3-2 The result of the execution of the landslide risk evacuation and the behavior analysis is brought together as a report.		
4. Disaster management information is regularly transferred.	4-1 Warning is transmitted to the pilot area according to the warning official announcement rule. 4-2 Warning Transmission Trainings are executed one or more times in each pilot areas.		
5. Disaster management capacities of districts, divisions and communities in pilot areas are improved.	5-1 Number of topics of coordination meetings on disaster management organized and outputs from those meetings 5-2 The hazard map is made by the guidance of the local government organization in the communities of pilot area. 5-3 Regularly evacuation trainings at the community level in the pilot area is executed by the guidance of the local government organization. 5-4 Countermeasures for priority issues in the additional pilot communities are implemented. (*)		

Activities	Inputs	Pre-condition
1.1 Enhancement of DMC capacity in facilitating effective functioning of the existing committees 1.2 Development of National Emergency ~~Response~~ Operation Plan 1.3 Improvement of DMC capacity to improve analytical approach in producing the performance report(s) 1.4 Formulation and trial of a system to assess and mitigate disasters that may be caused by development projects 1.5 Development and implementation of disaster management training program targeting on staff members of DOI, NBRO, DOM, districts, divisions and other concerned person(s) 1.6 Evaluation and revision of district level Preparedness & Response Plan (*)	**Japanese side** • Long Term Expert (1) Project Leader / Policy • Expert Team / (1) Disaster management (2) Community based disaster management (3) Meteorological forecasting (4) Landslide management (5) Urban development (6) Regulation planning (7) Regional Level Disaster Management Plan	No major change in policy
2.1 Effective utilization and maintenance of equipments such as automatic weather station (AWS) and other sensing tools installed by JICA 2.2 The operation and the maintenance management manual are revised or are made according to the extracted problem. 2.3 Execution of the training concerning analysis of state of the weather 2.4 Formulation and trial of weather warning standard at regional level. 2.5 Trial and Improvement of short term weather forecast	• Procurement of monitoring equipments (water level sensor, rain gauge, computers, etc) • Counterpart training in Japan • Overseas project supporting fund	
3.1 Execution of cost effective sediment disaster measure technique 3.2 Formulation and execution of sediment disaster monitor and evaluation approach 3.3 Formulation and trial of sediment disaster warning standard		
4.1 Development of rules on warning issuance and organization of information management trainings related to operation of early warning 4.2 Execution of disaster information transmission training	**Sri Lanka side** • Placement of counterparts • Allocation of work station(s) for Japanese experts and counterparts • Allocation and release of project management funds	
5.1 Enhancement of district capacity in pilot areas in managing the existing disaster management committees 5.2 Implementation of community based disaster management promotion activities targeted districts in pilot areas 5.3 Implementation of community based disaster management activities at district in pilot areas and additional pilot areas(*) (installation of simple water level sensor(s) and rain gauge(s), small scale preventative work, organization of evacuation training(s))		

Pilot Areas: Ratnapura, Kalutara, Nuwara Eliya Additional Pilot Areas: Batticaloa, Matale (*)

Table 2.4.4 PDM Ver.4

Project Design Matrix (~~Ver.3: 18th January 2012~~ Ver.4: 2nd August 2012)

Project name : Disaster Management Capacity Enhancement Project Adaptable to Climate Change
Implementation Agency : Disaster Management Centre (DMC), Department of Meteorology (DOM), Department of Irrigation (DOI), National Building Research Organization (NBRO) Duration : February 2010 to February 2013

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The disaster management model is disseminated.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to districts, divisions and communities through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in districts, divisions and communities using information which DMC transmitted.	• Project final report • Reports issued by DMC, technical and local level organizations	• No major change in policy and organization • Adequate budget and human resources for concerned organizations • No rapid change of natural environment • Counterparts who acquired skills through the project are not transferred
Project Purpose A model for complete communication network in disaster observation, forecasting & community level activities including evacuation in the pilot areas are prepared.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to pilot areas through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in the pilot area using information which DMC transmitted.	• Project progress report • Reports issued by concerned organizations	
Outputs 1. Leadership and coordination capacity of DMC is strengthened.	1-1 Number of coordination meetings on disaster management organized and outputs from those meetings 1-2 Development of National Emergency Operation Plan 1-3 Increase of contents of the annual report about disaster analysis 1-4 Formulation and trial of system 1-5 Number of development and execution of disaster management training program 1-6 District level Preparedness & Response Plan is evaluated and revised. (*)	• Emergency response plan • Annual report of DMC • Reports issued by local level organizations • Training guideline, manual, and implementation report	
2. Analysis and monitoring capacity of DOM is enhanced.	2-1 The data acquired in AWS set up doesn't disappear. 2-2 Trial and improvement of short term forecasting (more than 2 days forecasting) 2-3 Trial of the warning standard at a regional level.		
3. Analysis and monitoring capacity of NBRO is enhanced.	3-1 Cost effective sediment disaster measures technique is executed in one place or more by Sri Lankan side own. 3-2 The result of the execution of the landslide risk evaluation and the behavior analysis is brought together as a report.		
4. Disaster management information is regularly transferred.	4-1 Warning is transmitted to the pilot area according to the warning official announcement rule. 4-2 Warning Transmission Trainings are executed one or more times in each pilot area.		
5. Disaster management capacities of districts, divisions and communities in pilot areas are improved.	5-1 Number of topics of coordination meetings on disaster management organized and outputs from those meetings 5-2 The hazard map is made by the guidance of the local government organization in the communities of pilot area. 5-3 Regularly evacuation trainings at the community level in the pilot area is executed by the guidance of the local government organization. 5-4 Countermeasures for priority issues in the additional pilot communities are implemented. (*)		

Activities

1.1 Enhancement of DMC capacity in facilitating effective functioning of the existing committees
1.2 Development of National Emergency Operation Plan
1.3 Improvement of DMC capacity to improve analytical approach in producing the performance report(s)
1.4 Formulation and trial of a system to assess and mitigate disasters that may be caused by development projects
1.5 Development and implementation of disaster management training program targeting on staff members of DMC, DOI, NBRO, ~~DOM, districts, divisions~~ and other concerned person(s)
1.6 Evaluation and revision of district level Preparedness & Response Plan (*)

2.1 Effective utilization and maintenance of equipments such as automatic weather station (AWS) and other sensing tools installed by JICA
2.2 The operation and the maintenance management manual are revised or are made according to the extracted problem
2.3 Execution of the training concerning analysis of state of the weather
2.4 Formulation and trial of weather warning standard at regional level
2.5 Trial and improvement of short term weather forecast

3.1 Execution of cost effective sediment disaster measure technique
3.2 Formulation and execution of sediment disaster monitor and evaluation approach
3.3 Formulation and trial of sediment disaster warning standard

4.1 Development of rules on warning issuance and organization of information management trainings related to operation of early warning
4.2 Execution of disaster information transmission training

5.1 Enhancement of district capacity in pilot areas in managing the existing disaster management committees
5.2 Implementation of community based disaster management promotion activities targeted districts in pilot areas
5.3 Implementation of community based disaster management activities at district in pilot areas and additional pilot areas(*) (installation of simple water level sensor(s) and rain gauge(s), small scale preventative work, organization of evacuation training(s))

Inputs

Japanese side

- Long Term Expert (1) Project Leader / Policy
- Expert Team (1) Disaster management
  (2) Community based disaster management
  (3) Meteorological forecasting
  (4) Landslide management
  (5) Urban development
  (6) Regulation planning
  (7) Regional Level Disaster Management Plan
- Procurement of monitoring equipments (water level sensor, rain gauge, computers, etc)
- Counterpart training in Japan
- Overseas project supporting fund

Sri Lanka side

- Placement of counterparts
- Allocation of work station(s) for Japanese experts and counterparts
- Allocation and release of project management funds

Pre-condition
No major change in policy

Pilot Areas: Ratnapura, Kalutara, Nuwara Eliya Additional Pilot Areas: Batticaloa, Matale (*)

Table 2.4.5 PDM Ver.5

Project Design Matrix (Ver.5: 13th September 2012)

Project name : Disaster Management Capacity Enhancement Project Adaptable to Climate Change
Implementation Agency : Disaster Management Centre (DMC), Department of Meteorology (DOM), Department of Irrigation (DOI), National Building Research Organization (NBRO) Duration: March 2010 to March 2013

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The disaster management model is disseminated.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to districts, divisions and communities through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in districts, divisions and communities using information which DMC transmitted.	• Project final report • Reports issued by DMC, technical and local level organizations • Project progress report • Reports issued by concerned organizations • Emergency response plan • Annual report of DMC • Reports issued by local level organizations • Training guideline, manual, and implementation report	• No major change in policy and organization • Adequate budget and human resources for concerned organizations • No rapid change of natural environment • Counterparts who acquired skills through the project are not transferred
Project Purpose A model for complete communication network in disaster observation, forecasting & community level activities including evacuation in the pilot areas are prepared.	1. Improvement of transmission speed and decrease of false report of disaster information which sent from disaster observation organization to pilot areas through Disaster Management Centre. 2. The disaster prevention activities and early warning alert are done in the pilot area using information which DMC transmitted.		
Outputs 1. Leadership and coordination capacity of DMC is strengthened.	1-1 Number of coordination meetings on disaster management organized and outputs from those meetings 1-2 Development of National Emergency Operation Plan 1-3 Increase of contents of the annual report about disaster analysis 1-4 Formulation and trial of system 1-5 Number of development and execution of disaster management training program 1-6 District level Preparedness & Response Plan is evaluated and revised. (*)		
2. Analysis and monitoring capacity of DOM is enhanced.	2-1 The data acquired in AWS set up doesn't disappear. 2-2 Trial and improvement of short term forecasting (more than 2 days forecasting) 2-3 Trial of the warning standard at a regional level.		
3. Analysis and monitoring capacity of NBRO is enhanced.	3-1 Cost effective sediment disaster measures technique is executed in one place or more by Sri Lankan side own. 3-2 The result of the execution of the landslide risk evaluation and the behavior analysis is brought together as a report.		
4. Disaster management information is regularly transferred.	4-1 Warning is transmitted to the pilot area according to the warning official announcement rule. 4-2 Warning Transmission Trainings are executed one or more times in each pilot area.		
5. Disaster management capacities of districts, divisions and communities in pilot areas are improved.	5-1 Number of topics of coordination meetings on disaster management organized and outputs from those meetings 5-2 The hazard map is made by the guidance of the local government organization in the communities of pilot area. 5-3 Regularly evacuation trainings at the community level in the pilot area is executed by the guidance of the local government organization. 5-4 Countermeasures for priority issues in the additional pilot communities are implemented. (*)		

Activities	Inputs	Pre-condition
1.1 Enhancement of DMC capacity in facilitating effective functioning of the existing committees 1.2 Development of National Emergency Operation Plan 1.3 Improvement of DMC capacity to improve analytical approach in producing the performance report(s) 1.4 Formulation and trial of a system to assess and mitigate disasters that may be caused by development projects 1.5 Development and implementation of disaster management training program targeting on staff members of DMC, DOI, NBRO, DOM and other concerned person(s) 1.6 Evaluation and revision of district level Preparedness & Response Plan (*)	**Japanese side** • Long Term Expert (1) Project Leader / Policy • Expert Team : (1) Disaster management (2) Community based disaster management (3) Meteorological forecasting (4) Landslide management (5) Urban development (6) Regulation planning (7) Regional Level Disaster Management Plan • Procurement of monitoring equipments (water level sensor, rain gauge, computers, etc) • Counterpart training in Japan • Overseas project supporting fund	No major change in policy
2.1 Effective utilization and maintenance of equipments such as automatic weather station (AWS) and other sensing tools installed by JICA 2.2 The operation and the maintenance management manual are revised or are made according to the extracted problem. 2.3 Execution of the training concerning analysis of state of the weather 2.4 Formulation and trial of weather warning standard at regional level. 2.5 Trial and Improvement of short term weather forecast		
3.1 Execution of cost effective sediment disaster measure technique 3.2 Formulation and execution of sediment disaster monitor and evaluation approach 3.3 Formulation and trial of sediment disaster warning standard		
4.1 Development of rules on warning issuance and organization of information management trainings related to operation of early warning 4.2 Execution of disaster information transmission training	**Sri Lanka side** • Placement of counterparts • Allocation of work station(s) for Japanese experts and counterparts • Allocation and release of project management funds	
5.1 Enhancement of district capacity in pilot areas in managing the existing disaster management committees 5.2 Implementation of community based disaster management promotion activities targeted districts in pilot areas 5.3 Implementation of community based disaster management activities at district in pilot areas and additional pilot areas(*) (installation of simple water level sensor(s) and rain gauge(s), small scale preventative work, organization of evacuation training(s))		

Pilot Areas: Ratnapura, Kalutara, Nuwara Eliya Additional Pilot Areas: Batticaloa, Matale (*)

Table 2.4.6 History of PDM Modification

No.	Date	Meeting	Revised Part	Original	Revision
1	2010/03/24	Meeting on Inception Report		No revision on the PDM agreed on 11th December 2010	-
2	2011/08/05	Joint Coordinating Committee (2011/08/04)	Indicator of Activity 1-4	Establishment of a system to assess and mitigate disasters that may be caused by development projects	Formulation and trial of system
			Indicator of Activity 2-2	Trial of short term forecasting (more than 2 days forecasting)	Trial and improvement of short-term forecasting
			Indicator of Activity 2-3	The warning standard at regional level is operated	Trial of the warning standard at regional level
			Activity 3-1	Low cost sediment disaster measures technique is executed in one place or more by Sri Lankan side independently	Cost effective sediment disaster measures technique is executed in one place or more by Sri Lankan side independently
			Activity 1-4	Establishment of a system to assess and mitigate disasters that may be caused by development projects	Formulation and trial of a system to assess and mitigate disasters that may be caused by development projects
			Activity 2-4	Decision of weather warning standard at regional level is established	Formulation and trial of weather warning standard at regional level
			Activity 3-1	Execution of low cost sediment disaster countermeasure technique	Execution of cost effective sediment disaster countermeasure technique
			Activity 3-2	Establishment and execution of sediment monitor and evaluation approach	Formulation and execution of sediment monitor and evaluation approach
			Activity 3-3	Making of sediment disaster warning standard	Formulation and trial of sediment disaster warning standard
			Input	Team leader / Policy	Project leader / Policy
3	2012/01/18	Agreement on Modification of Project Design Matrix (PDM) (2012/01/18)	Indicator of Activity 1-2	Development of National Emergency Response Plan	Development of National Emergency Operation Plan
			Indicator of Activity 1-6	-	District-level Preparedness and Response Plan is evaluated and revised
			Indicator of Activity 5-4	-	Countermeasures for priority issues in the additional pilot communities are implemented
			Activity 1-2	Development of National Emergency Response Plan	Development of National Emergency Operation Plan
			Activity 1-6	-	Evaluation and revision of district-level Preparedness and Response Plan
			Activity 5-3	Implementation of community-based disaster management activities at district in pilot areas	Implementation of community-based disaster management activities at district in pilot areas and additional pilot areas

No.	Date	Meeting	Revised Part	Original	Revision
4	2012/08/02	Joint Coordinating Committee (2012/07/16)	Activity 1-5	Development and implementation of disaster management training program targeting staff members of DOI, NBRO, DOM, districts, divisions and other concerned person(s)	Development and implementation of disaster management training program targeting staff members of DOI, NBRO, DOM and other concerned person(s)
			Input	-	Japanese Expert of Regional Level Disaster Management Plan
			-	-	Additional pilot areas: Batticaloa and Matale
5	2012/10/11	Joint Coordinating Committee (2012/10/11)	Duration	February 2010 – February 2013	March 2010 – March 2013

Chapter 3 Accomplished Activity

3.1 Overall Accomplished Activity

3.1.1 Discussion on Inception Report

The meeting was held at the Ministry of Disaster Management on 17th March 2010 regarding the Inception Report, and the items required to conduct the Project were agreed. The minutes of the meeting are shown in Attachment 0-1.

3.1.2 Joint Coordinating Committee (JCC)

Following three JCC were held, and chaired by the Secretary of the Ministry of Disaster Management.

Table 3.1.1 JCC

No.	Date	Topic	Agreement Date of M/M
1	4th August 2011	・ Accomplished activity in the 1st year ・ Modification of Technology Transfer Plan for 2nd year and 3rd year ・ Modification of PDM	18th August 2011
2	16th July 2012	・ Accomplished activities in the 2nd year ・ Work Plan of the 3rd Year ・ Modification of PDM	3rd August 2012
3	9th September 2012	・ Achievement of activities ・ Report of the result of Terminal Evaluation	11th October 2012

The 1st JCC was conducted in order to make the agreement on the modification of the work plan for the 2nd and 3rd years, considering the result of the activities in the 1st year. The 2nd JCC was held to explain the accomplished activities in the 2nd year and agree on the work plan of the 3rd year activities. The 3rd JCC was conducted to share and agree on the report of terminal evaluation. Minutes were taken at every JCC meeting and were signed by the Secretary of the Ministry of Disaster Management and the Project leader of the expert team.

The minutes of the meeting for each JCC are shown in Attachment 0-1.

3.1.3 Counterpart Meeting

Taking into account the confusions caused by lack of communications between the Sri Lankan side and the Japanese side in the 1st year, the counterpart meetings were held frequently from the 2nd year. The counterpart meetings were conducted to share the information on progress on the predetermined topics by the cooperation of Sri Lankan side and Japanese side.

Table 3.1.2 Counterpart Meetings

No.	Date	Topics	Participants from Expert Team
1	6th June 2011	How to implement the activities in 2nd year	All
2	22th June 2011	Output 1 (Including Activity 1-4)	Namiki, Araki

No.	Date	Topics	Participants from Expert Team
3	6th July 2011	Output 3 (Landslide Monitoring)	Fujisawa
4	25th July 2011	Output 2 (AWS, NWP)	Yamamoto
5	5th August 2011	Output 4 (Evaluation of the information transfer exercise)	Uchikura
6	21st November 2011	Debriefing session on the training in Japan	All
7	23rd November 2011	Preparation of the annual seminar	All
8	8th December 2011	Additional activity (Revision of PRP)	Kamioka, Takamatsu, Matsumaru, Uchikura
9	25th January 2012	Output 4 (IGN and EW manual)	Uchikura
10	26th January 2012	Additional activity (Revision of PRP)	Kamioka, Uchikura, Matsumaru
11	23rd February 2012	Output 4 (IGN)	Uchikura
12	28th June 2012	How to implement the activities in 3rd year	Namiki, Arai, Uchikura, Matsumaru, Takamatsu, Okuno
13	29th June 2012	Output 2 (AWS, NWP)	Yamamoto
14	20th July 2012	Output 5 (Report of the activity in the pilot areas)	Okuno
15	30th July 2012	Output 1 (Report of the interview survey to evacuees by warning message)	Arai
16	20th August 2012	Output 1 (Disaster Management Plan of Japan)	Arai
17	17th September 2012	Output 4, Output 5 (Preparation of information transfer exercise)	Arai, Uchikura, Matsumaru, Okuno
18	5th October 2012	Output 4 (Evaluation meeting on the information transfer exercise)	Uchikura
19	26th November 2012	Preparation of the final annual seminar	Arai, Uchikura, Matsumaru, Okuno
20	28th November 2012	Output 2 (Accomplished activities for 3 years)	Uchikura, Yamamoto
21	28th November 2012	Output 3 (Discussion on structural countermeasures)	Uchikura, Tsukamoto, Fujisawa, Tozawa

3.1.4 Newsletter

Newsletters were issued every time after the major outcomes are achieved from the 2nd year. The back numbers are listed below. Copies of the newsletters are attached as Attachment 0-2.

Table 3.1.3 Back Number of Newsletters

No.	Month	Contents
1	June 2011	Outline of Project, Landslide and Flood Assessment Mission
2	August 2011	Information Transfer Exercise on Landslide, Joint Coordinating Committee
3	October 2011	Report on Recent Activity for Output 2 and Output 5
4	December 2011	Report on Counterpart Training Program in Japan, Progress of Activity 1-4 for Disaster Impact Assessment
5	March 2012	Evaluation and Revision of District Level Preparedness and Response Plan (PRP)
6	March 2012	Training Programme on Disaster Management
7	July 2012	Progress of Output 1, New Project Leader of DiMCEP
8	August 2012	JCC, Counterpart Meetings
9	September 2012	Progress of Output 1 and Output 4

3.1.5 Annual Seminar

Annual seminars were held at the end of each year in order to share the outputs with all counterparts and relevant organizations.

Table 3.1.4 Annual Seminar

Year	Date (Venue)	Participant Organization (no. of participants)	Contents
1	30th November 2011 (Conference Hall of Hilton Residence)	C/P organizations, NDMCC member organizations, Organizations related to Activity 1-4 (development agencies) (Approx. 50)	・ Accomplished activities in the 1st year ・ Introduction of Japanese disaster management plan by long-term expert ・ Group discussion on Activity 1-1 (NDMCC) ・ Group discussion on Activity 1-4 (DIA)
2	1st December 2012 (Conference Hall of Renuka Hotel)	C/P organizations, organizations related to Output 4 (including police and media) (Approx. 60)	・ Accomplished activities in the 2nd year ・ Differences between Japanese and Sri Lankan disaster management plans by long-term expert ・ Report and group discussion on disaster management drills (based on the training in Japan) ・ Report and group discussion on information sharing (based on the training in Japan)
3	4th December 2012 (Ballroom of Galle Face Hotel)	C/P organizations, various organizations related to outputs, donor agencies (Approx. 80)	・ Achievement in 3 years, comments on the achievements and Q&A ・ Speeches on the sustainability of the activities by DGs of DMC, DOM and NBRO and Q&A

Presentations were held to share the outputs among counterparts, and group discussions were conducted to collect the participants' opinions on the selected topics in the first and second years. Especially in the 2nd year, the participants of the training held in Japan took the main role at the discussion, providing feedback from the training. And in the 3rd year, the main topic was to discuss how to keep the activities sustainable after the termination of the Project, and a number of comments were collected from the participants. The DGs of counterpart organizations made speeches and presentations on the future activities. The Secretary of the Ministry of Disaster Management showed high motivation to continue the activities and high expectation of continuous support by JICA. The Japanese side highly appreciated the activities by the Sri Lankan side, and expressed the intention to continue the support.

3.1.6 Trainings in Japan

The training in Japan was conducted twice in total, once in the 1st year and another time in the 2nd year as follows.

Table 3.1.5 Training in Japan

Year	1	2
Period	27th August to 9th September 2010	20th October to 5th November 2011
Participants	・ Ms. A.A.A.K.K. Seneviratne (DMC) ・ Mr. M.P.N.C. Amarathunga (NBRO) ・ Ms. B.A.K. Chandralatha (DOI) ・ Mr. D.A. Jayasinghearachchi (DOM) (Total 4 participants)	・ Mr. Sugathadasa Mudiyanselage Disanayake (DMC) ・ Mr. A.N. Mudiyanselage Adhikari Chandrasiri (DDMCU) ・ Mr. Mohanarajah Seenithamby (DOI) ・ Mr. G.M.M.A. Wimalasuriya (DOM) ・ Mr. Bandara Mahesh Rankothge Somaratne (NBRO) (Total 5 participants)
Training Objectives	・ Use the experience gained, such as the study tour on comprehensive disaster management drills, and the lecture on Japanese disaster management policy and its system, to improve the disaster management activities in Sri Lanka. ・ Incorporate the Japanese view of disaster management into this Project and flood management plan study that is currently underway, following the role of each counterpart agency.	・ Raise the awareness about disaster management and understand the necessity for the parties concerned to work closely together for disaster management through learning about Japan's approaches to disaster management. ・ Make use of the outcomes of the training in solving the issues stemming from implementation of the Project.
Contents of the Training	・ Learn the roles of the national government, provinces, cities and local residents on disaster management ・ Learn the significance of comprehensive disaster management drills ・ Learn the Japanese policy for land use ・ Learn the Japanese flood countermeasures (Flood Countermeasures Course) ・ Learn the Japanese landslide countermeasures (Landslide Countermeasures Course) ・ Learn the operation and maintenance of the observation equipment and data management systems (Meteorology Course)	・ Learn about the actual conditions of the Great East Japan Earthquake and tsunami ・ Learn about Japan's approaches to disaster management ・ Learn about Japan's flood countermeasures (Flood Countermeasure Course) ・ Learn about Japan's landslide countermeasures (Landslide Countermeasure Course) ・ Learn about Japan's weather forecast operation (Meteorology Course)
Training Venue	(Comprehensive disaster management) ・ Shizuoka prefecture disaster management drill ・ Shinano river down stream basin office ・ Niigata prefecture office ・ Sanjo city office (Flood countermeasures) ・ River planning division, Ministry of Land, Infrastructure and Transportation ・ Tanaka, Sugao, Inatoi, Inatoi retention basins ・ Underground retention basin of Kanda river (Sediment disaster countermeasures) ・ Sabo & landslide technical center ・ Observation equipment manufacturer ・ Landslide site in Yuzurihara (Meteorology) ・ Weather station of Japan Meteorological Agency ・ Meteorological measures test center ・ JMBSC	(Comprehensive disaster management) ・ Great East Japan Earthquake (visit to the tsunami-affected area) ・ Kinki prefectures joint disaster management drill ・ Kagawa prefecture office ・ Saijo city office (Flood countermeasures) ・ Flood control measures of Tone River ・ Flood control by Tokyo metropolitan government ・ Water reservoir management (Sediment disaster countermeasures) ・ Landslide site in Yuzurihara ・ Steep sloping land countermeasure of Kanagawa prefecture (Meteorology) ・ JMBSC ・ Forecast Department, Japan Meteorological Agency

The counterpart organizations of this technical cooperation project consist of four organizations, DMC, DOM, NBRO and DOI, and each of them has an important role for disaster management. A total of five people, one person from each organization and one from DDMCU, attended this training. (The officers of DDMCU were not selected as the training participants in the 1st year.)

DMC and DDMCU are organizations in charge of overall coordination of disaster management, and the other three organizations are technical agencies. The training participants from the technical agencies were not very interested in the training programs about general disaster management but had high expectations for the technical training programs. Although this training focused on strengthening the disaster management capabilities, the training program shall fullfill the participants needs. Therefore, in addition to the training program on "general disaster management", the program was designed to include 3 to 4 days of "flood countermeasures,", "landslide countermeasures" and "meteorology", which enables the program to include both the original purposes and the needs of the training participants.

3.2 Activity 1-4

3.2.1 Outputs, Activities, Objectively Verifiable Indicators

(1) Output 1

Leadership and coordination capacity of DMC is strengthened.

(2) Activities

1-4 Formulation and trial of a system to assess and mitigate disasters that may be caused by development projects

(3) Objectively Verifiable Indicators

1-4 Formulation and trial of a system

(4) Counterpart in Charge of the Project

Responsible Counterpart: Mr. U.W.L. Chandradasa, Director, Technology and Mitigation Division

(Retired in November 2011. The position is still vacant.)

Counterparts in charge of Activity 1-4: Ms. Seneviratne Amarashingha, Assistant Director, Technology and Mitigation Division

3.2.2 Concept of Output and Activities

(1) Concept of Activities and Indicators

- The aim of this activity is that "a system to assess and mitigate disasters that may be caused by development projects" will be institutionalized formally in the future, and the disaster damages will be reduced by taking countermeasures before implementation of the development action.
- DMC aims to obtain the ability to propose, test, and improve the system with the cooperation of the relevant agencies through this activity.

(2) Output Materials Prepared during Activities

This activity is to formulate a disaster impact assessment (DIA) checklist system for the road sector. Materials such as DIA guidelines for the road sector, checklists, a manual on filling out the documents and sample checklists have been prepared for a trial of the system by this activity. The materials shall be modified and improved appropriately after finishing this Project. Furthermore, the concept, procedure and materials of this system are expected to be used as a good example for DMC and other sectors for developing the similar DIA systems.

3.2.3 Achievement of the Activities

(1) Achievement of the Indicators

Indicator 1.4 Formulation and trial of a system

- DiMCEP proposed a system to assess and mitigate disaster risks that may be caused by development projects, using a "checklist" that was incorporated into the existing system for road projects. DiMCEP prepared DIA guidelines that explain the background and objective of the system, the checklist used for this system, a manual that explains how to fill the documents out with sample checklists.
- The checklist was tested by RDA to identify any descrepancies.
- RDA selected two projects for the trial. The Form A & B are tested for a new project of widening and improvement of roads of which the detailed design had been completed. The Form C & D are tested for an existing road located in a mountainous area that had experienced a disaster recently.

(2) Achievement of the Target in the 3rd Year

Target 1:	The DIA checklist system for the road development sector will be trialed.
Target 2:	DMC will be able to highlight the importance of disaster management for development projects and future development of this system through the presentation of a series of activities to the relevant agencies.

Target 1:The DIA checklist system for the road development sector will be conducted.

- On 13th September 2012, DiMCEP held a workshop for RDA officers who will be in charge of the trial. The checklist forms were finalized after the workshop, and the RDA conducted the trial in October.
- RDA held a Technical Evaluation Committee (TEC) meeting on 8th November, 2012. The TEC evaluated and discussed about the Project in terms of disaster management,

Target 2:DMC will be able to highlight the importance of disaster management for development projects and future development of this system through the presentation of a series of activities to the relevant agencies.

- A workshop for development agencies was held on 7th December.The DIA concept and the checklist system was explained by DMC, and their experience of the trial was introduced by RDA. According to the questionnaire filled in by the participants, it was found that the need for DIA and data sharing are requested. (Attachment 1-2: Questionnaire, Attachment 1-3: Results of the questionnaire)
- DG of RDA approved this system as a self-assessment system of RDA on 18th December, 2012. (RDA sent a letter to DMC.) (Attachment 1-4: Letter from RDA)

3.2.4 Details of Activities

Activity 1-4 of Output 1 is designed to formulate a system and conduct a trial of the system to assess and mitigate disasters that may be caused by development projects. Detailed activities are explained below.

(1) Discussion for DIA System

[Background and Objectives]

- Since DMC has received a lot of claims that "disasters are caused by development," DMC aimed to establish a system to assess the development activities in advance in terms of disasters.
- Sri Lanka has Environmental Impact Assessment (EIA) which is a legalized assessment system for new projects by third parties. DMC has expected incorporating some of the TORs which are related to disasters into the EIA as a system to realize the above objective.
- In response, DiMCEP determined to establish a system which utilizes the existing systems such as the EIA.

[Role Allocation]

- Counterpart (C/P): Processes for decision making, , approval of the contents, explanation to other agencies and promotion (official response to other agencies) as DMC.
- JICA Expert: Development of the DIA concept, meeting with other agencies, development of materials: checklists, guidelines, manuals and samples, planning and preparation of workshops (preparation of the contents, cost estimation for workshop, printing, etc.)
- Assistant researcher: Interviews and site survey, support preparations for documents including guideliens, making arrangement with other agencies, preparation of workshops (support for works)

[Contents of Activities]

In the first year (2010), DiMCEP conducted interviews and site surveys to identify the types of actual disasters. Although the C/P was supposed to conduct the survey, due to the lack of human resources in DMC, the survey was conducted by the assistant researcher of DiMCEP.

- In the second year (2011), the above survey results were used to identify the further actions required as a disaster respone. The DIA concepts were developed and proposed by the DiMCEP, and approved by the DMC.
- A discussion was held between DiMCEP and Central Environmental Authority (CEA), which is the agency responsible for conducting the EIA. Even though the needs of DIA was understood, CEA did not agree to the idea of incorporating the DIA TOR into the EIA TOR.

- For this reason, DMC suspended the approach to CEA, and decided to establish an independent system without involving the EIA system. Specifically, DiMCEP started to develop a checklist system utilizing the design approval system of the road sector as the first trial.
- In the second year, DiMCEP developed a draft DIA checklist system for the road sector. The checklist was filled out by the RDA officers and road design consultants as a trial to find out any problems.. Based on the result of the trial, the draft checklists were revised, and guideliens and manuals were produced. The completed forms were used as a draft samples.
- On 26 April 2012 (In third year), DiMCEP held a workshop to explain the concepts of DIA checklist and its uses to RDA officers and NBRO officers who are responsible for the landslide (sediment disaster). C/P of DMC explained the concepts of the chhecklist, and an RDA officer and design consultant presented the issues on filling out the forms in this workshop. Participants of the workshop discussed and brougt up the ideas for improvement of the forms and system.
- DMC requested the JICA Expert Team to provide another workshop for RDA officers again before the trial, which was originally shceduled in August. This is because the last workshop which was held in April was targeted at the director level of RDA, DMC felt the need to explain the concept and contents including procedures to the officers in all levels. Moreover, RDA brought up the opinion how to differentiate the guidelines for the road design projects recently being developed by UNDP, which also contain the disaster management perspectives. Therfore, the JICA Expert Team agreed that DMC explains the differences at the workshop.
- DiMCEP held the workshop mentioned above on 13th September, 2012. The checklists were finalized after the workshop and the trial was conducted by RDA in October.
- On 8 November 2012, the Technical Evaluation Committee (TEC) which is an internal committee of RDA held a meeting to evaluate the Project using the checklists and the checklist system.
- The results were reported to DG of RDA. On 18 December 2012, the checklist was approved by DG as an internal “self-assessment system” by RDA.
- In November, the JICA Expert Team developed the action plans, and reviewed by the C/P. On 4 December 2012, the action plan was presented at the Annual Seminar by C/P. The C/P explained the background, process, concept of the DIA, and the outline of the checklists at the seminar. RDA emphasized that; since disasters are sector-wide issues, this approach shall be implemented by the other sector organizations, accumulation of data and disaster records are very important; and the data shall be shared not only for the assessment, but also to reduce cost and time for the projects.

- On 7 December 2012, DiMCEP held a workshop to introduce the DIA checklist system to the other sectors. C/P explained the DIA concept, and RDA explained the contents and results of the trial, needs of the DIA system and the future potential.
- RDA is planning to provide a training program for engineers to adopt the checklist system as their own system.

(2) DIA Checklist System for Road Sector

- The process and outline of the checklist system are explained below.
- DiMCEP conducted interviews and site surveys with local government officers and residents in the affected area to identify specifically what types of disasters were “caused by the development activities”.
- Based on collected data, DiMCEP concluded that there are four types of disasters; 1) disasters attributed to with or without development actions, 2) disasters due to design defficiencies (including inadequate of design standards and design conditions), 3) disasters due to problems with construction work, and 4) disasters attributed to wrong practice in utilization or management (Table 3.2.1).

Table 3.2.1 Organizing the Situation under Which Disasters Occurred

No.	Situation under which disaster occurred	Status of the development actions
1	Natural condition unrelated to the design condition occurred. Unexpected circumstances occurred.	The area was caught in the disaster.
2	Setting level of design condition was inadequate.	Adequacy of design condition will be called into question.
	Design was not appropriate (the design did not meet the design conditions).	Mistakes in design will be called into question.
3	Construction method was not appropriate (it was not constructed as designed). Construction plan was not appropriate. Safety management during the construction term was not appropriate.	Mistakes in construction will be called into question.
4	Rules or state of utilization or management were not appropriate (It was not used as expected).	If used in the correct way, the disaster would not have occurred.

- DiMCEP defines as “Natural Disaster” for the disasters No. 1 and “Technological Disaster” for the disasters Nos. 2–4 in Table3.2.1. The differences are the following: humans cannot control natural phenomenon (natural disasters), but humans can control it by changing design and/or management methods (technological disasters).
- In Sri Lanka, types of ”disasters” were not clearly defined, and all the disasters were called as “disasters”. Therefore, the disasters had to be classified into types prior to implementing the DIA system.

- Furthermore, since the assessment shall be conducted at different phases, the technological disasters were classified further into two tipes; 1) disasters caused by design deficiency and wrong practice of construction, and 2) disasters caused by mis-management of the facilities.
- DiMCEP organized the disaster types for DIA as follows. (Table 3.2.2)

Table 3.2.2 Classification of Disasters

Classification	
1. Natural Disaster	
2. Technological Disaster	2.1 Disaster at Design & Construction Stage
	2.2 Disaster at Management & Maintenance Stage

- DiMCEP considered using the design condition as a margin line to divide natural disasters and technological disasters, which enable the design parameters to be determined.
- DiMCEP decided to use design conditions as a margin line in the DIA system for Sri Lanka. Therefore, disasters caused by situations unrelated to design conditions will be dealt with as natural disasters, and disasters caused by situations due to design conditions will be dealt with as technological disasters in this system. They are assessed as a different disasters. (Figure 3.2.1)

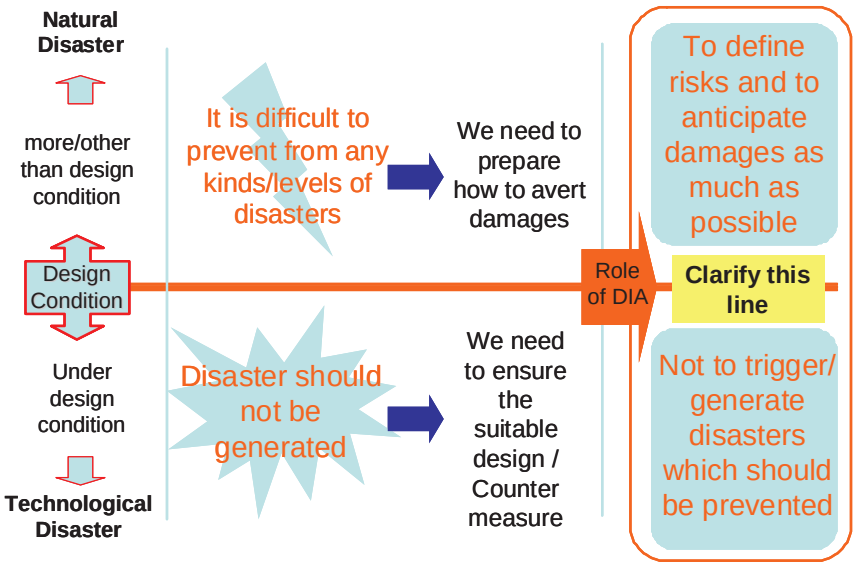


Figure 3.2.1 Concept of DIA for Sri Lanka

- To establish a practical system exclusively to Sri Lanka, the existing system was utilized as much as possible and, the work volume for the officers was reduced by implementing the simple methods.
- As shown in Figure 3.2.2, the road development project in Sri Lanka has three steps: pre-feasibility study, feasibility study and detailed design. Following the aforementioned conditions, DiMCEP decided to develop a DIA checklist for the detailed design approval stage as a self-assessment system. (Figure 3.2.2)

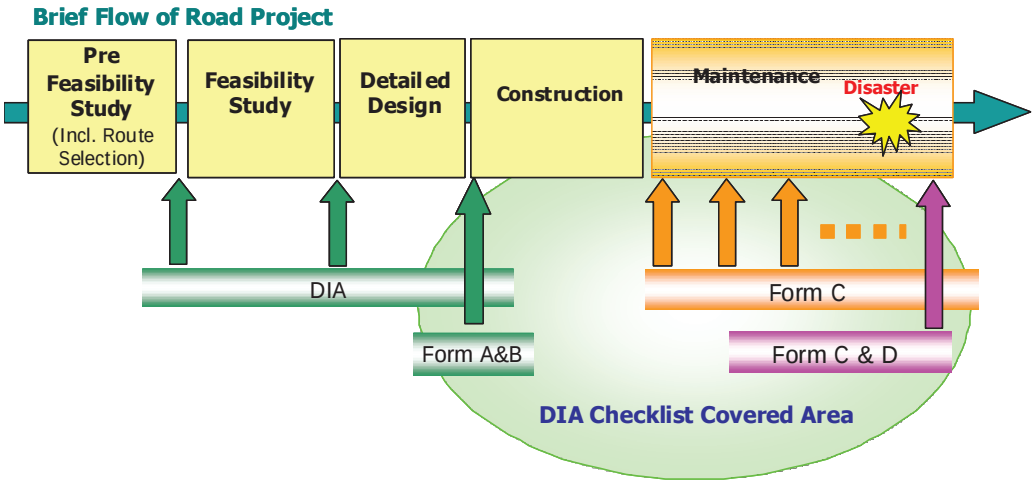


Figure 3.2.2 Ideal Status for Implementation of DIA

- Furthermore, continuous improvement, such as review of design standards and/or maintenance systems, etc. is important for disaster risk reduction (DRR).
- The following procedure is important to support the improvement of DRR: taking records on the disaster situation, sharing the information, verification of the causes and discussion on the causes and countermeasures. By updating this procedure, enhancement of the quality of design standards and guidelines, appropriate setting of design conditions and improvement of evacuation plans, etc. will be realized. By these efforts, response capacity against disasters by design and management, etc. will be enhanced. (Figure 3.2.3)

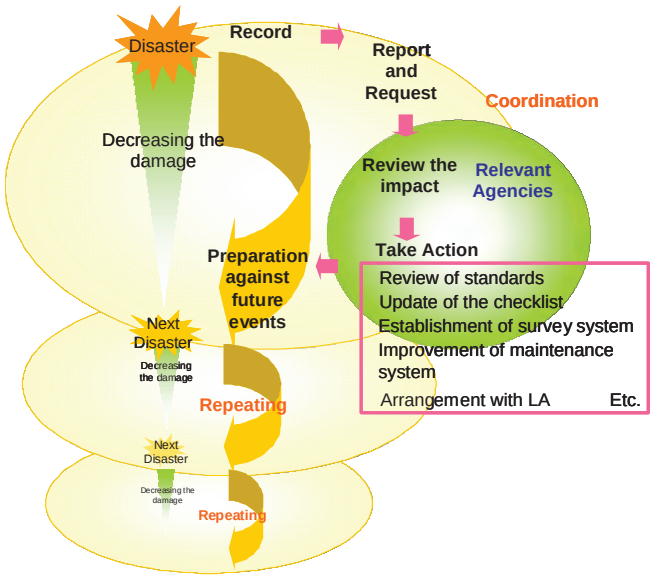


Figure 3.2.3 Disaster Risk Reduction by Continuous Implementation of DIA System

- Assessment on “constructions compliance to the design” was not included in this system because the assessment shall be conducted as an inspection for the construction completion.

- In addition, target disasters for this system are floods, which are major disasters in Sri Lanka and landslides (sediment disasters) which are major disasters in the road sector.
- The DIA checklist was configured based on the classifications shown in Table3.2.2 and Figure 3.2.4.

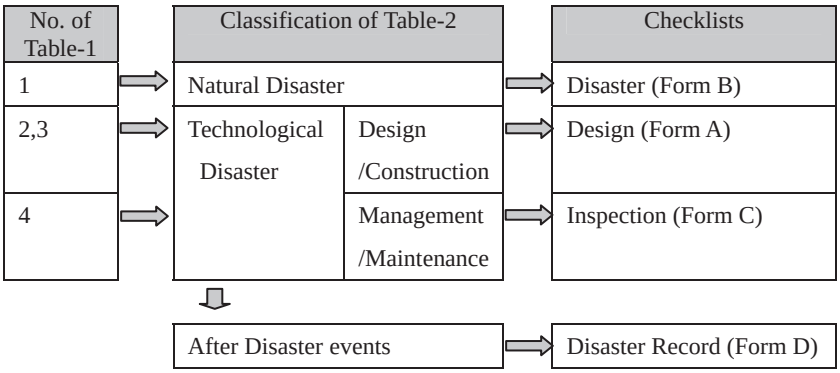


Figure 3.2.4 Composition of Checklist System for Road Projects

- "Types of countermeasures against the natural disasters" shall be identified in the disaster management part (Form B) for No. 1 in Table3.2.1.
- "Types of countermeasures at design stage" shall be identifed in the design part (Form A) for Nos. 2 and 3 in Table3.2.1. The design condition shall be defined in the design part.
- Three types of checklists were prepared to evaluate "How to identify the hazards during in-service?" in the inspection part (Form C) for No. 4 of Table3.2.1.
- Furthermore, (Form D) was added to record the disasters which will be used for preparation of countermeasures against the future disasters.
- The following table shows the principal contents of checklists. (Table 3.2.3)

Table 3.2.3 Principal Contents of the Checklists

Type	Principal Contents	Assessment Points
Form A Design	Confirmation of design standards and design conditions. Confirmation of hazard locations and road structure locations including structural measures.	Which countermeasures are considered at the design stage?
Form B Disaster	Confirmation of the non-structural measures, cooperation with local government, related organizations, etc.	Which kinds of preparations are considered against the natural disasters?
Form C Inspection	Inspection of the condition of hazardous locations and road structures including structural measures by periodical checkup.	How to identify the hazards after in-service?
Form D Disaster Record	Record of the disaster situation by site visits and interviewing people in the affected area.	How was the situation affected by the disaster?

- RDA currently approves detailed designs by document circulation. Reflecting the RDA's willingness to change the approval system to the meeting style, It is agreed that Forms A

and B will be used after finishing the detailed design, and evaluated by the newly established TEC.

- Form C will be introduced as a part of maintenance activity. Since the existing system did not have a periodical checkups, inspections using this form will be expected to be conducted at least once a year. Form C consists of three activities: screening, inspection and disaster record. The periodical checkups will be conducted for screening. In cases when abnormal conditions are found by the screening, RDA will request technical agencies to conduct an inspection. Though DiMCEP drafted the inspection form for landslides (sediment disasters), NBRO proposed using their own format for landslide inspections (sediment disasters). When disaster occurs, RDA will record the road structure condition using the form for disaster record.

- Form D will be filled out by the Disaster Management Centre (DMC). Although the District Disaster Management Coordinating Unit (DDMCU: branch office of DMC) visits the site and reports on the situation to DMC when a disaster occurs, DDMCU does not have a nationwide form for interview surveys at present. Therefore, it is decided that DMC will take records using this form.

(3) Development of Action Plan

[Action Plan for the next step]

- The following three activities will be conducted.

  1. RDA continues to conduct DIA checklist system.
  2. DMC introduces DIA concept and checklist system to other sectors.
  3. DMC promotes to incorporate DIA consideration to other approval systems for development projects (e.g., Building Application, Basic Information Questionnaire (BIQ), Initial Environmental Examination (IEE), EIA, Strategic Environmental Assessment (SEA), etc.)

- For the first item above, the system will be finalized by RDA and approved by DG of RDA within one month. After 6 to 10 months from the approval, RDA will provide training for about 70 engineers in 9 provinces to ensure they understand the DIA system and how to fill out the forms. After that, RDA will continue this system as its own system.

- For the second item, DMC will introduce the DIA concept and DIA checklist system to several agencies within a year. DMC will promote the awareness of the DIA concept to incorporate it into the design approval system for each sector. Within two years, any agencies, other than RDA, that has interest in the DIA system will be encouraged to establish their own DIA system, such as the checklist system of RDA. DMC will support the agencies continuously by providing advice through the coordination with technical agencies.

- For the third item, DMC aims to establish a self-assessment system for other stages of project processes (other than detailed design) with RDA and other agencies that have

interest in DIA within 5 years. DMC encourages the agencies to keep their motivation and continuously support them by providing advice through the coordination with these technical agencies. Then, DMC will support establishment of the assessment systems like EIA by third parties by proposing the concept of the system and coordination with technical agencies within ten years.

[Next Challenges]

- DMC aims to incorporate a DIA TOR into EIA as an assessment system by third parties in the future. There was an opinion that the EIA shall be incorporated to DIA for more effective use, avoiding overlap, brought up at the workshops and from individual meetings. However, since the assessment contents and purposes of EIA and DIA are different, those may not be combined. DMC needs to show the differences of EIA and DIA, and define each responsibility.
- All the concerned people for development projects, such as technical agencies, local government, consultants, residents, etc., need to have a thorough understanding of the DIA concept. Because this DIA system requires cooperations among the stakeholders, it is important to share information on disaster records, and work together for preparation of countermeasures, both for structural and non-structural measures, against future disaster events to prevent the similar damages. This system will work effectively by updating the process by all the stakeholders.

Table 3.2.4 Schedule of Activities for Establishment of DIA system

	One year	Years								
	One – Twelve Months	2	3	4	5	6	7	8	9	10
(1) Continuation of the DIA checklist system with RDA										
RDA will finalize the system	▬									
RDA will approve the system	▬									
RDA will conduct a Workshop for RDA staff & engineers	▬▬▬▬▬▬									
RDA will continue the system	▬▬▬▬▬▬	▬	▬	▬	▬	▬	▬	▬	▬	▬
(2) Introducing the DIA concept to other sectors										
DMC will promote DIA system to other sectors.	▬▬▬▬▬▬									
Some technical agencies will prepare their own checklist system	▬▬▬▬▬▬	▬	▬	▬	▬	▬	▬	▬	▬	▬
DMC will confirm the progress of their action and support them	▬▬▬▬▬▬	▬	▬	▬	▬	▬	▬	▬	▬	▬
(3) Preparation to include DIA into other evaluation and approval systems										
RDA and/or other agencies will prepare self-check system to other phases	▬▬▬▬▬▬	▬	▬	▬	▬	▬	▬	▬	▬	▬
Evaluation system by third party will be prepared	▬▬▬▬▬▬	▬	▬	▬	▬	▬	▬	▬	▬	▬

3.2.5 Summary of Activities

- As mentioned above, indicators and objectives were achieved. DiMCEP expects that the DIA system will be a legalized system in the future.
- Since the DIA system was originally a new concept for Sri Lanka, it is a valuable output that the concept has been established.
- Secondly, DMC and relevant agencies should understand that the DIA system cannot be concluded by one-time assessment. DiMCEP developed the DIA checklist because CEA expressed concern on the idea for incorporating the DIA into EIA. Through this process, it was understood that the assessment at the detail design is just a part of the whole DIA system.
- In Sri Lanka, there are many workshops and seminars which discuss about the importance of effort towards DRR. However, they have not shown any actual practice by the implementing agencies. By introducing the DIA checklist system, several other sectors has shown their interests in using the system, which in tern, is very effective result for the future deveopment. Those sectors need to adjust the system for their needs because the system was developed for and by the RDA.
- It was difficult to implement the technical transfer to C/P, due to a shortfall in human resources of DMC. However, through the workshops, seminars and meetings, the C/P had opportunities to learn the concept. And the C/P was able to explain to the participants during the RDA trainings and workshops, and expressed the ideas for the future expectations. It can be concluded that the technical transfer was provided sucsessfully.
- However, problems with the shortfall in DMC human resources remains, which is a limitation for the future steps. The C/P shall prepare additional supporting staffs for continuing the activities.
- The action plan shall be implemeted with adequate speed. Because some agencies including RDA are having high expectations for the development of another system in the annual seminar held on 4th December and workshop held on 7th December. Taking this opportunities, the action plan shall be implemented in coopeartion with RDA as quickly as possible for the effective use.
- Establishment of the whole DIA system require a long time. DMC is expected to formulate the system for the disaster management in cooperation with various organizations.

3.3 Activity 1-6

3.3.1 Outputs, Activities, Objectively Verifiable Indicators

(1) Output 1

Leadership and coordination capacity of DMC is strengthened.

(2) Activities

1.6 District-level Preparedness & Response Plan is evaluated and revised

(3) Objectively Verifiable Indicators

1-6 Evaluation and revision of District-level Preparedness & Response Plan

(4) Counterpart in Charge

Responsible counterpart: Mr. J.M.S. Jawaweera, Director, Preparedness and Planning Division

Counterpart in charge of Activity 1-6:

Mr. N.P. Madawanarachchi, Assistant Director, Preparedness and Planning Division

Mr. Chathura Liyanaarachchi, Assistant Director, Preparedness and Planning Division

Mr. I.A.K. Ranaweera, Assistant Director, Matale DDMCU
(Current Assistant Director, Kandy DDMCU)

Mr. S. Inparajan, Assistant Director, Batticaloa DDMCU

3.3.2 Concept of Output and Activities

(1) Conceput of Activities and Indicators

- Floods and landslides occurred due to the heavy rain from the northeastern to central mountainous area from January to February 2011. As a response to this disaster, JICA dispatched short-term experts to conduct a survey in the affected area to grasp the damage and mechanism of the disaster, and made recommendations toward the recovery and future disaster management. One of the recommendations was “Formulation and utilization of a regional disaster management plan”.
- The regional disaster management plan is in the process of preparation at each district, division and GN level. The district-level regional disaster management plan is almost completed (to be printed) or waiting for the approval except for the northen districts. However, the division-level and GN-level regional disaster management plans need more time to be completed. The district-level regional disaster management plan needs to be

revised and elaborated because it only includes a PRP (Preparedness and Response Plan). The regional disaster management plan requires regular updates and revision of the contents as appropriate (reflecting the experience of the disasters) however, the updates and revisions have not been done in Sri Lanka yet.

- Following the recommendation by the short-term expert, the Project selected Batticaloa and Matale districts as pilot areas and supported the revision of the PRP considering the existing PRP contents and the survey conducted on emergency response after the flood.
- The Project held the workshop for Assistant Directors of all DDMCU and DMC staff in Colombo and introduced the activity on PRP preparation and revision. The objective of this workshop was to share the revised PRP of the two pilot districts with other national and district-level officers and utilize its revision process when revision is required again after the future disasters.

(2) Output Materials Prepared during Activities

- The Project revised the Batticaloa and Matale DDMP (District Disaster Management Plan (PRP is the main part of DDMP)). It is expected that relevant organizations of both districts can take each responsibility based on the DDMP in emergencies, and the DDMP can be referred to and utilized by other districts.
- The Project focuses on refining the methods to revising DDMP at the time of disaster not only for the two pilot districts, but for all districts which are expected to be motivated to revise their DDMP in as necessary.

3.3.3 Achievement of the Activities

Indicator 1.6 District-level Preparedness & Response Plan is evaluated and revised.

- The DDMP including PRP of the selected pilot areas, Batticaloa and Matale, was evaluated and revised. The DDMP was distributed and discussed at the District Disaster Management Committee in both districts. Appendix 1-7 shows the revised DDMP of Batticaloa district.
- The process of evaluation and revision of PRP was shared at the workshop which is targeted at DMC officers and AD of all DDMCU. The revised DDMP was expected to be adopted to the draft DDMP of the north district and of other districts.

3.3.4 Detail of Activity

The schedule of activity is shown in the chart below. The activity was performed mainly during 5 months from October 2011 to February 2012 of the 2nd year of the Project. (The final approval and printing of the PRP were succeeded to the 3rd year.)

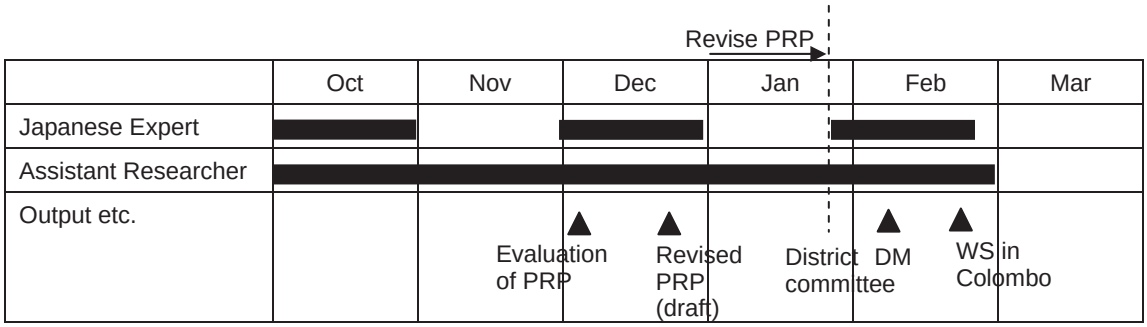


Figure 3.3.1 Schedule of the Activity

The expert team led the activity, requesting proactive participation by the counterpart from DMC to the activity, and attended the activities in the pilot areas. AD of DDMCU took responsibility for not only the contents of PRP, but also for the interview survey to the relevant organizations and preparation of workshops.

The interview survey and other necessary works were supported by the local employees because the assignment period of Japanese experts in Sri Lanka was limited.

(1) Evaluation of District Level PRP

- The interview surveys with Assistant Directors of Batticaloa and Matale districts and related organizations (the organizations from various responsibilities such as providing information and warning to the people, set-up and operation of evacuation shelters, procurement and distribution of relief goods and rescue etc.) was implemented in order to verify the existing PRP.
  - The current position of PRP and its recognition
  - The emergency response to the disaster, determination factors for the response, internal and external coordination of organization, review of the response
  - Existence of the record of the emergency response and the emergency response manual
  - Utilization of PRP at the disaster and contents to be revised
- The contents of the existing PRP were compared to the contents of the Japanese regional disaster management plan.
- The existing PRP was evaluated and concluded as follows after the 2 activities mentioned above.
  - The PRP has never been distributed to the relevant organizations, or the contents of PRP are not fully understood even though it has been distributed. Thus, it is not utilized.
  - The role and responsibility of relevant organizations mentioned in the PRP is not different from the role and responsibility during emergency response on the actual disaster.

- The role and responsibility of district-level disaster management related organizations in the PRP is not organized with respect to each organization and emergency response item.
- Each organization has recognized the necessity of coordinating meetings among relevant organizations, though the structure of emergency response mentioned in the PRP does not fit certain areas.
- The concept of the PRP and its overall framework are not clear. Its comprehensive contents target the wide range of organizations, though it is too complicated for practical use in an emergency.

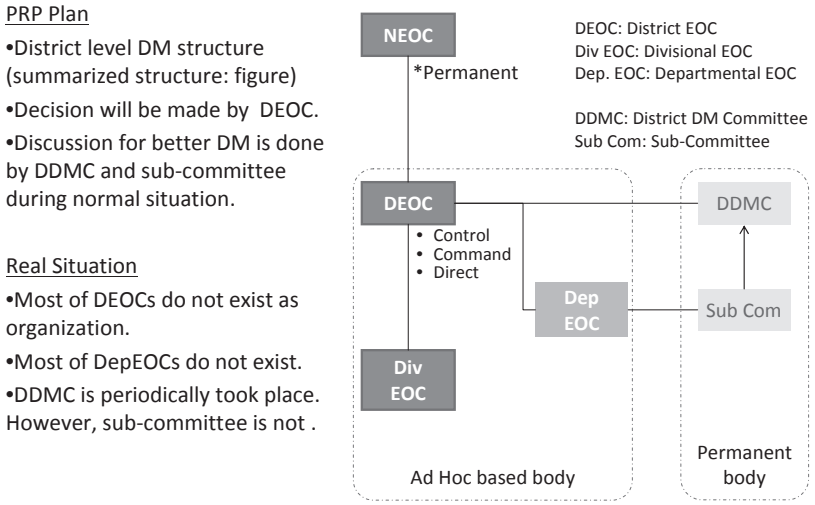


Figure 3.3.2 Difference of Emergency Response Structure between PRP and Real Situation

(2) Revision of District Level PRP

- According to the evaluation result, the policy for the revision and concept of PRP were prepared. The expert team obtained the approval of DMC on this policy.

(The Concept of PRP)

- PRP shall indicate role and responsibility of organizations related to regional disaster management at the time of disaster.
- PRP shall indicate the coordination of the role and the responsibility and items to be coordinated for relevant organizations to involve and cooperate in the emergency response appropriately and effectively.

(The Policy for the Revision)

- The role and responsibility of relevant organizations should be reorganized, comparing the actual role and responsibility taken by each organization based on their experience and practical knowledge and the written items of the existing PRP.
  →The role and responsibility of relevant organizations should be determined each agency and corresponding item.

- The coordinating system of relevant organizations in emergency should not be unified but reorganized to include the flexibility to apply the regional characteristics.
- The PRP should be simple enough for the easy access. (Minor parts should be attached as the appendix at the back of the book.)
- The member list and contact list of the committee should be updated.
- The PRP should apply binding to make removal and replacement of the pages easy.

(Suggestion from DMC and DDMCU)

- Preparation of PRP is urgent in the north region where the PRP has not been prepared. The PRP should be consistent with the existing format for which revision has been done.
- The framework of DDMP should be revised because PRP is a part of DDMP. It shall be revised considering the concept of Disaster Cycle.
- Political leadership should be included in the PRP since it is important in an emergency.
- The basic contents of the PRP should not be different but the same for each district.

◆ Considering the policy for the revision and the suggestions above, the overall framework was revised as follows.

- DDMP applied the framework considering the Disaster Management Cycle. Additionally, referring to the suggestions from DMC, the basic contents of the DDMP are the same for both districts. The contents differing between each district will be written in the detailed activity plan that is being prepared based on the PRP.

  1) Introduction
  2) Prevention & Mitigation (Being prepared)
  3) Preparedness & Response (PRP)
  4) Rehabilitation & Reconstruction (Being prepared)
  5) Appendix (Including the contact list, separable)

- Introduction and PRP were simplified as much as possible and the minor contents are covered in the appendix. Additionally, the format of PRP was organized for users to be easily understood.

  1) Introduction
     Position of the plan
     Prioritized items in the plan
     Items to be implemented in the plan

2) Institutional Arrangements
   National position of the PRP
   Legal position of the organizations (agencies) related to PRP

3) Emergency Response
   Framework of the emergency response
   Role of each organization (agency)

- Regional profiles and detail of the committees and subcommittees were edited in the appendix. “The role and the responsibility of each organization” and “contact list” were also included in the appendix and edited to be a portable volume.

- The modification history of the PRP framework is shown on the following page.

Table 3.3.1 Modification of PRP framework

Latest version	Old version	Modification History
PART I - INTRODUCTION	FIRST PART – INTRODUCTION AND INSTITUTION ARRANGEMENT	➢ Title Revised
1.1 BACKGROUND	1.1. BACKGROUND	➢ "District Preparedness and response planning process" aim deleted from the disaster management plan background
1.1.1 Purpose of Planning	Purpose of Planning	➢ No change
1.1.2 Broad Contents of the Plan	Broad Contents of the Plan	➢ Terms corrected
-	1.1.1 Legal Framework for Disaster Management (DM) in Sri Lanka	➢ Deleted
-	1.1.2 The National Disaster Management Policy	➢ Deleted
-	1.1.3 Some Selected Guiding Principles of the Policy relevant to the sub-national level preparedness planning:	➢ Deleted
1.2 District Profile	1.2 District Profile	
1.2.1 Geographical Backgound	1.2.1 Geographical Backgound	➢ Details omitted
1.2.2 Historical Background	1.2.2 Historical Background	➢ Details omitted
1.2.3 Administrative Background	1.2.3 Administrative Background	➢ Details (Administrative boundaries table, District information table, Population details tables etc.) deleted from the main body text and replaced in the refer annex document I -2
1.3 Hazard Vulnerability and Risk Analysis	(paragraph 2.2 of the old version)	➢ See the modifications of the paragraph 2.2
1.3.1 Main disasters affecting the district	(paragraph 2.2.1 of the old version)	➢ See the modifications of the paragraph 2.2.1
1.3.2 Hazards and vulnerability assessment	(paragraph 2.2.2 of the old version)	➢ See the modifications of the paragraph 2.2.2
Part II DISASTER PREVENTION & MITIGATION PLAN	–	➢ Being Prepared
Part III - DISASTER PREPAREDNESS & RESPONSE PLAN	Second part- DISASTER PREPAREDNESS & RESPONSE PLAN	➢ Part III of the latest version
	2.1 Introduction	➢ Deleted
3.1 Introduction	2.1.1 Development of District Disaster Management Plan	➢ "Figure 1 Relationship and inclusion of DPRPs in SL DM act and NDM policy" revised ➢ Related policies list deleted
(para 1.3 of the latest version)	2.2 Hazard and vulnerability analysis	➢ Replaced in paragraph 1.3
(para 1.3.1 of the latest version)	2.2.1 Main disasters affecting the district	➢ Replaced in paragraph 1.3.1 ➢ Other types of disasters (man made) deleted ➢ "Table 2-1 history of disasters and probability of disaster episodes in the district" deleted from the main body document
(para 1.3.2 of the latest version)	2.2.2 Hazards and Vulnerability Assessment	➢ Replaced in paragraph 1.3.2 ➢ Detailed information (rainfall, seasonality of hazards etc.) deleted from the main body document and replaced in the refer annex document I -1
-	2.2.3 Tsunami hazard threat	➢ Deleted
3.2 Institutional arrangements	2.3 Institutional arrangements	➢ The new figure "District level disaster management structure" inserted
3.2.1 Emergency Operations Centre (EOC)	2.3.1 Emergency Operations Centre (EOC)	➢ Text revised ➢ "Figure 3- Structure of the Emergency Operation Center - EOC" deleted
-	2.3.2 Incident Command System	➢ Deleted
3.2.2 District Disaster Management Committee (DDMC)	District Disaster Management Committee (DDMC)	➢ Text revised
3.2.3 Sub-committees		➢ New paragraph
-	Constitution of the District Disaster Management Committee	➢ Deleted
-	District Disaster Management Coordinator	➢ Deleted
-	2.3.4 Institutional Arrangements for Emergency Operations	➢ Deleted
-	2.3.5 Disaster Preparedness / Emergency Operations Coordination Structure and Flow of Information at different levels	➢ Deleted ➢ "Figure 4 Emergency Operations coordination structure and flow of information central province" deleted
3.3 Emergency Response	2.4 Initial Response and Notification	➢ Title Revised ➢ Revised figure "Mechanism for Emergency Operation at District Level ("Figure 4 Response structure during warning stage" in the old version)" inserted
3.3.1 Activation Steps	2.4.1 Activation Steps	➢ No change
3.3.2 Functions of the Emergency Operations Centre (EOC)	2.4.2 Functions of the Emergency Operations Centre (EOC)	➢ Replaced in the annexture III-2
3.3.3 Functions of the District Disaster Management Committee (DDMC)		➢ New paragraph
3.3.4 Functions of the Sub Committees	2.4.3 Sub-committees Responsible for various functions	➢ Text revised
	2.4.4 Roles and Responsibilities of sub-committees on different tasks	➢ Replaced in the annexture III-3
3.4 Resources Availability in the District	2.5 Resources Availability in the District	➢ No change
3.4.1 Introduction	2.5.1 Resources	➢ Title Revised ➢ Text revised ➢ Division level details list revised
3.4.2 Locations of Identified Temporary Shelter and Transit Camps	2.5.2 Locations of Identified Temporary Shelter and Transit Camps	➢ No change
	2.5.3 NGOs and Voluntary Agencies	➢ deleted
3.4.3 Community Participation in preparedness	2.5.4 Community Participation in preparedness	➢ No change
3.4.4 NGOs and CBOs identified for Response Activities at Divisional Level	2.5.5 NGOs and CBOs identified for Response Activities at Divisional Level	➢ No change
3.4.5 Equipments(Earthmovingequipments, Ambulances,Lorries,Chainsaw,Boats, Tractors,Bowser)	2.5.6 Equipments(Earthmovingequipments,Ambulances,Lorries,Chainsaw,Boats,Tractors,Bowser)	➢ No change
3.5 Reporting Procedure at different stages	2.6 Reporting Procedure at different stages	➢ No change
PART IV DISASTER REHABILITATION & RECONSTRUCTION PLAN	–	➢ Being Prepared
–	PART 3 EARLY WARNING PLAN (BEING PREPARED)	➢ deleted
–	PART 4 EMERGENCY OPERATION PLAN (BEING PREPARED)	➢ deleted
–	PART 5 DISASTER MITIGATION PLAN (BEING PREPARED)	➢ deleted

(3) Meetings and Workshops

- This activity requires regular clarification of the intentions of DMC, DDMCU and relevant organizations. In order to accomplish the activity outputs, which is a capacity enhancement of DMC, the expert team involved the C/P in the activity and organized a meeting to present the objectives of the activity and its process clearly.

(Meetings with DMC and DDMCU)

- Through the discussions with the counterparts, the expert team, DMC and DDMCU reached consensus on revision of PRP by holding two counterpart meetings which include DG's participation. Since the end of 2011, the Preparedness and Planning Division managed by a new director and two assistant directors has been started. Since they have recognized the urgent need to prepare a PRP for the north region that had not prepared any PRP yet, they were cooperative in the activity.

- At the meetings, the objectives of the revision of PRP were emphasized with the counterpart. The team explained the present situation of existing PRP and its contents, the relation between organizational coordination structure in emergencies and the permanent structure such as Committee and Sub-Committee, "the role and responsibility" of relevant organizations, and the policy and contents on revision of the PRP were understood.

(District Disaster Management Committee)

- The District DM Committee was held on February 10th in Matale and 27th in Batticaloa. The expert team explained the objectives and contents of revision of the PRP, the "role and responsibility" of each organization and promoted revision of the PRP in detail by utilizing DIG, etc. In Matale, the experienced assistant director presented the points from his revised PRP. After the presentation, the expert team conducted DIG, discussed on the actions to be taken by each organization before, during and after disasters, in order to develop committee members' understanding on PRP. GA's active participations in the discussion provided an opportunity to simulate the actual disaster management. In Batticaloa, the expert team explained the revision of PRP because the assistant director of DDMCU was new to the position. In Batticaloa, the discussion including DIG was changed into a group discussion by sub-committees because more participants attended the meeting than in Matale. They discussed the actions to be taken by each committee member during emergencies, and promoted understanding of the PRP.

- With regard to the contents of PRP, the comments from each organization will be summarized for finalization of the PRP. Some participants expect regular committee meetings to be held, providing discussions and preparations for future disasters. The expert team emphasized that committee meetings shall be held and the PRP shall be revised after disaster.

(Workshop in Colombo)

- The workshop for the assistant directors of all DDMCU was held in Colombo on 2nd March 2012. The objective of the workshop was to introduce the activities necessary for

the revision of the PRP, to promote its process and contents, and to utilize the process and contents on the next revision of PRP after disasters in the future. The workshop was lead by the Preparedness and Planning Division of DMC.

- At the workshop, the expert team briefly explained the objective of revision of the PRP, evaluation results of the PRP, the policy and contents of PRP, and the role and responsibility of each organization. The assistant director of DMC presented the contents of the draft PRP that will be promoted in the north region in the future. After his presentation, assistant directors of Batticaloa and Matale presented their activities on revision of the PRP to provide a practical image of the revision to the participants.
- At the workshop, the revised PRP and the draft format of the PRP for the north region were compared. The participants discussed finalization of the format.

3.3.5 Summary of Activity

As mentioned above, Activity 1-6 was conducted reflecting the actual flood damages that was caused from January to February 2011. The expert team held a number of meetings with the C/P and coordinated the committees in the pilot areas, encouraging the C/P' participation so that the GOSL can develop their skills to revise the PRP independently for the future disasters. At the end of the activity, the expert team invited assistant directors of all DDMCU to the workshop in Colombo. Assistant directors of the pilot districts of which the PRP revised, introduced their activities at the workshop. Therefore, the activity is considered to be fully accomplished.

The following issues are raised.

- The survey to the relevant organizations in the region revealed that the PRP had not been distributed or utilized. The revised PRP needs to be distributed and promote the understanding of its contents.
- The PRP was revised in respone to the reasons for not utilized, roles which the PRP must have, and intentions of DMC and DDMCU. The clarification of "role and responsibility" of each organization is one of the largest outputs of the activity. Each organization is expected to identify their actions to be taken in each plan based on "the role and responsibility." DMC and DDMCU are expected to spread the revision of PRP to other relevant organizations.
- While the expert team believes that the regional characteristics shall be reflected to the contents of PRP, DMC considers that the contents of PRP should be determined by the central government due to the lack of capacities of regional government agencies. The discussion on the authority of each region on the contents of PRP needs to be continued.

It is necessary to hold the committee meetings regularly to support the action plans of each organization, to promote the revision of PRP after disasters occur, and to instruct on the utilization of the PRP.

3.4 Output 2

3.4.1 Outputs, Activities and Objectively Verified Indicators

(1) Output 2

Analysis and monitoring capacity of the Department of Meteorology (DOM) is enhanced.

(2) Activities

2.1 Effective utilization and maintenance of equipment such as the automatic weather station (AWS) and other sensing tools installed by JICA

2.2 The operation and the maintenance management manuals are revised or are made according to the extracted problem

2.3 Execution of training concerning analysis of state of the weather

2.4 Formulation and trial of weather warning standards at the regional level

2.5 Trial and improvement of short-term weather forecasting

(3) Objectively Verified Indicators

2-1 The data acquired in AWS set up doesn't disappear

2-2 Trial and improvement of short-term forecasting (more than 2-day forecasting)

2-3 Trial of the warning standards at the regional level

(4) Counterparts in Charge of the Project

Responsible counterpart:

Mr. S. H. Kariyawasam, Director, Meteorological Services & Media
(Director General of DOM at present)

Counterparts in charge of Output 2:

Mr. S. R. Jayasekara, Deputy Director,
Weather Forecasting & Disaster Management Activities

(Substantial person responsible after Mr. Kariyawasam was promoted)

Mr. M. D. Dayananda, Deputy Director, Data & Instruments

Mr. S. Premalal, Deputy Director, Climate Change & Publicity

Mr. D. A. Jayasinghearachchi, Meteorologist in Charge, National Meteorological Centre

Mr. Nuwan Kumarasinghe, Electronic Engineer, Electronic Division

Mr. W. A. G. M. Malika, Meteorologist, National Meteorological Centre

3.4.2 Understanding of Outputs and Activities

(1) Understanding of Output 2

- In Sri Lanka, DOM is in charge of issuing meteorological warning such as a heavy rain warning, a cyclone warning, a ligntning warning and etc., and Tsunami warning too. Regarding Tsunami warning, the capability of information gathering and disseminating is improved significantly under relationship with JMA and PTWC after Indian Ocean Tsunami disaster 2004. The DiMCEP aims to improve not only dessimination of Tsunami warning but also capability of observation, analysis, forecast and warning of heavy rainfall which causes flood and landslide.
- DOM has collected the manual observation data by all meteorological stations and wireless network in the country. In addition to this, the staffs of DOM have prepared and analyzed the hand-written meteorological chart based on the information that is delivered through low speed GTS network from overseas meteorological stations, though the information is delivered a few hours after its issuance. Therefore staffs' basic capacities on meteorology was relatively high, while the facilities have constricted their development.
- Recently in DOM, modernization of IT (Information Technology) has been improved rapidly, such as replacement of GTS, installation of AWS, installation of GMS (Geostationary Meteorological Satellite) receiving system, installation of meteorological Doppler radar system and enhancement of internet environment for referring to meteorological information of advanced countries.
- Under this circumstance, the project supports adequate maintenance and operation of AWS which is a base of modernized meteorological service. At the same time the project assists development of regional warning standards and trials of short term weather forecast using NWP system.
- After the project, we expect DOM to continue these activities progressively and improve the accuracy of weather forecasting using new materials such as AWS, NWP system, meteorological radar and meteorological satellites.
- At the same time, in the future, sharing of real time meteorological observation data with organizations concerned, issuance of high quality weather forecasts and issuing of high-accuracy meteorological warnings in advance are expected. And these activities will contribute to conservation of national assets and the security of the people.

(2) Understandings of Activities and Objectively Verifiable Indicators

- Confirmation of the operation and maintenance system for AWS and instructions for technical improvement will be conducted. The project assists implementation of AWS observations and storage of AWS data.
- Analysis of the relationship between rainfall and flood/ landslide events in historical records will be conducted. The project assists DOM to develop regional warning standards through the

analysis. After adequate storage of hourly and 10 minute AWS data, we can expect DOM to revise the warning standards based on the accumulated AWS data using the same method.

- Development of guidance will be conducted using NWP results from the equipment which was installed in the 2nd year of the project. The project assists DOM to develop guidance for major cities.
- Through these activities, the project assists human resource development of DOM in order to continue the technical innovation.

(3) Understanding of Output

A lot of documentations were producted and improved during the project period, these items are pointed up as final outputs.

- AWS: Operation manual, Maintenance manual, Daily/Weekly/Monthly check sheet and Regular inspection book
- Short term forecast: NWP system, Guidance formula and Hitting ratio of precipitation forecast
- Warning standard: Probable daily rainfall list, Excess daily rainfall list and Regional warning standard list

To produce these outputs is not the purpose of this project, the activity of output 2 will be implemented to make proposals and advises to utilize these outputs in the meteorological services of DOM.

3.4.3 Achievement of Output

(1) Achievement of Output Goal

Indicator 2.1 The data acquired in AWS set up doesn't disappear.

- This indocator is evaluated by each item as below.
  - The AWS operation manual, maintenance manual and trouble-shooting manual have already been prepared and are used in regular maintenance activities.
  - The AWS system check sheets and books, such as the daily check sheet, weekly check sheet and regular maintenance book have already been prepared and are used in regular maintenance activities. The written check sheets and books are stored by each responsible section.
  - The equipments and facilities are well maintained and the accuracy of observation is kept well.
  - Observation data are physically stored redundantly.
- The AWS operation manual, maintenance manual and trouble-shooting manual have already been prepared, kept and utilized in each section.

- The AWS system check sheets and books, such as the daily check sheet, weekly check sheet and regular maintenance book have already been prepared and are used in regular maintenance activities. The written check sheets and books are stored by each responsible section.
- Daily and weekly system checks in manned stations are performed by each station staff. A monthly system check in the collaborative station and regular maintenance in all stations are done by the electronic division in HQ.
- The regular inspection plan in each year has already been approved by DG and started.
- AWS data, such as hourly values and 10 min values, are collected in the AWS server, a monitoring PC and an external hard disc unit. Quality control was due to start in 2010, but has not started yet because the AWS installation work has not been completed.
- AWS is installed in 36 stations (of 38 planned stations). However, due to a communication system (VSAT) problem, only 27 stations can be monitored in HQ as of the end of December 2012.

Indicator 2.2 Trial and improvement of short term forecasting (more than 2 days forecasting)

- The goal of the project is considered as follows;
  1) NWP system is operated everyday, and the result is stored properly.
  2) The guidance for major cities is developed, the weather forecast (precipitation and temperature) for up to 72 hours is trialed in DOM internally, and the results are compared with observed values.
  3) The methodology to improve the accuracy of the results (improvement of guidance skill) is understood, and the efforts to improve the accuracy and apply it for actual weather forecasting are taken.
- The NWP (Numerical Weather Prediction) system was installed in June 2011. The WRF (Weather Research and Forecast) model was used as a mesoscale model in this NWP system. This model can estimate meteorological values over a 5 km grid size around Sri Lanka for up to 72 hours in the future.
- In order to utilize the NWP outputs for weather forecasting, the JICA expert instructed the guidance and some C/Ps are developing station guidance formulas such as precipitation guidance and temperature guidance for main cities.
- The C/P has already developed precipitation and temperature guidance formulas tentatively and evaluated the guidance method with traditional forecasting information. The improvement of weather forecast was found out obviously.

Indicator 2.3 Trial of the warning standard at a regional level

- The goal of the project is considered as follows;

1) Warning standards for daily rainfall amount are set up at the regional level by statistical analysis.

2) The warning standards are trialed in DOM internally, and the results are compared with any disaster occurrence.

3) The methodology to improve the accuracy of the results is understood, and the efforts to improve the accuracy and apply it for actual warning issuance are undertaken.

- The JICA expert instructed on extreme statistical analysis in the first year. As there was a lack of data in some stations, the result were recalculated. This result is called "50 year probable rainfall" and it means a heavy rainfall that occurs once a 50 years.
- The JICA expert instructed a regional case study of a heavy rain event and frequency statistical analysis based on DOM's daily rainfall data and DMC's disaster records. The draft versions of rainfall warning standard in 21 DOM's principal stations were calculated. And it was shown that 1% excess probability and 0.5% excess probability were effective as a warning standard.
- The JICA expert showed C/P that AWS hourly data, 3 hour accumulation data and daily accumulation were very usefull for the warning criteria and confirmed that this methodology could make leading time shorten and target area locally.
- The JICA expert and C/P applied this method to the actual heavy rainfalls and confirmed the availability and effectivity. In order to integrate this method to the routine forecasting work of DOM, more verification in whole country and application to the different seasons should be considered.

(2) Target of the 3rd Year

(Target 1) Regular maintenance activity for all AWS stations is implemented and inspection records are archived

(Target 2) Quantitative weather forecast based on the guidance is trialed in DOM internally and rainfall forecast hitting ratio is improved

(Target 3) Regional warning standards for rainfall are proposed in DOM internally and warning issuance based on the observed rainfall data and guidance is trialed

(Target 4) As for weather forecast and warning, the result of trial by proposed methods is compared with the traditional method, and the discussion for their official utilization is started during the project period

(Target 1) Regular maintenance activity for all AWS stations are implemented and inspection records are archived

- The regular maintenence was implemented based on the annual plan and the inspection records were archived in HQ.
- The faulty points of AWS system, such as PCs in stations, communication equipments, data loggers and obsrervation instruments, were extracted and budgetary steps for refinement and replacement was taken.

(Target 2) Quantitative weather forecast based on the guidance is trialed in DOM internally and rainfall forecast hitting ratio is improved

- The point guidance formulas in Colombo and Kandy were developed and the verification with AWS data was implemented. As a result, the hitting ratio of daily rainfall marked 60% and RMSE (Root Mean Square Error) of maximum/ minimum temperature marked the same level of JMA's result.
- This hitting ratio of guidance method scored better than the hitting ratio of traditional method, which is almost 40%.
- The issues to be improved on NWP system were clarified through the development process of guidance as below.
  - The grid size of GSM data are too rough
  - The parameters of WRF model should be tuned for a tropical zone
  - The observation data, such as AWS data and SST (Sea surface temperature) should be taken into account as an initial data
  - The nesting method should be improved

(Target 3) Regional warning standards for rainfall are proposed in DOM internally and warning issuance based on the observed rainfall data and guidance is trialed

- It is comfirmed that the excess probability 1% and 0.5% are effective and useful for the rainfall warning standard in the result of frequency statistical analysis and comparison with DMC's disaster records.
- It is comfirmed that the combination of this standard and AWS data (Hourly data, 3 hour accumulation and daily data) improves immediacy warning.
- The accuracy of guidance is not enough due to lack of stored data (NWP data) and it's not enough for daily rainfall prediction. More data storage and retry of analysis should be required.

(Target 4) As for weather forecast and warning, the result of trial by proposed methods is compared with the traditional method, and the discussion for their official utilization is started during the project period

- The verification between AWS data and guidance, and the verification between AWS data and DOM's traditional weather focast were implemented, and evaluated the hitting ratio. In result, the hitting ratio of the guidance method showed better result than the traditional method.
- As for warning, due to the verification on the heavy rainfall case study October 2012, the combination of proposed regional warning standard and AWS realtime data brings good result timely and locally.

- When applying this method into the daily weather services, it's essential to reduce the failures for warning. Therefore more verification should be needed in other regions and other seasons. At the same time, the internal verification on the heavy rainfall event shall be continued in the forecasting section.

3.4.4 Activity Plan

The purpose of Output 2 activity includes maintenance of AWS, trial of short term weather forecast and trial of regional rainfall standard. In addition, consideration for utilization of DWR (Doppler Weather Radar) was included because the installation works of DWR is being conducted by DOM.

(1) Maintenance of AWS

[Background and Objectives]

- It was decided that 38 AWS would be installed, including in 21 DOM's principal station, by the Grant Aid Project in 2008. 33 AWS stations were handed over to DOM in July 2009. But remaining 5 stations were located in the conflict area, so the installation works were left to DOM. Now the installation work of 3 stations was already finished and 2 stations, Jaffna and Trincomalee, are not installed yet.
- Some defects, such as communication system trouble, observation instrument trouble, HW/ SW trouble in monitoring PC and UPS trouble, have been found since the installation of the system. Refinement works and replacement of equipments were continued for several years, though some defects are still remained in several stations.
- DOM formulated the maintenance plan and tried to implement maintenance works from the time of handover of AWS. But there was a difficulty for DOM to implement a maintenance works according to the plan, because AWS system was under the defect liability period in the first year and second year. The refinement and replacement of facilities were out of DOM responsibility during this period. DOM organized several "AWS meetings" with contractors and suppliers, and comfirmed working schedule and detail of works.
- Under this circumstance, the project has been started. The purpose of this activity was to enhance DOM to take the initiative in implementation of maintenance activity, storage and utilization of AWS data for the effective weather services.

[Role Allocation]

- C/P: Operation, maintenance and inspection of AWS, and preparation of manuals
- Expert: Confirmation of operation, maintenance and inspection activities, recommendations for improvement, and technical assistance

[Contents of Activities]

- In the 1st year of the project, there were many missing data in AWS system and difficult situation for DOM to plan and carry out maintenance works since AWS system was in the defect liability period. Under this situation, some activities were implemented as below.

- Introduction of Japanese situation on maintenance and utilization of AWS
- Confirmation of AWS manuals
- Confirmation of AWS check sheets and inspection books
- Instruction on backup of observation data

- In the 2nd year, major refinement works were carried out by suppliers, and AWS system started to work well, though same defects, such as communication error and instrument troubles were still found out. Under this situation, some activities were implemented as below.
  - Confirmation of maintenance schedule and inspection books
  - Accompany to DOM regular maintenance team and suggestion on maintenance work
  - Backup of AWS data
  - Disclosure of AWS data on IGN, especially for hourly rainfall data
- In the 3rd year, there were some remaining defects in AWS. However DOM started to carry out regular maintenance activity. In this circumstance, following activities were implemented.
  - Confirmation of maintenance schedule and inspection books
  - Confirmation of working situation of AWS system and instruments
  - Backup of AWS data
  - Utilization of AWS data in weather forecast and warning

(2) Short Term Weather Forecast

[Background and Objectives]

- Weather forecast used to be conducted by expert forecasters with surface weather maps and upper air weather maps, current weather trend, past cases and experiences, seasonal factors and local conditions. It is called “Subjective forecast” and “Qualitative forecast”. At present, many countries started to utilize NWP (Numerical Weather Prediction) system that estimates atomospheric condition using atomospherical and oceanographical processes. At the same time, weather forecasters refer the satellite observation data, radar observation data and etc., and issue weather forecast by the experience based on the meteorological theory. It is called “Objective forecast” and “Quantitative forecast”.
- “Subjective forecast to objective forecast” and “Qualitative forecast to quantitative forecast”are the trend concepts and many developed countries adopted this objective and quantitative forecast.

Table 3.4.1 Forecastable Period and NWP Category by Area Size

Period \ Model		Meso Scale Model MSM	Regional Model RSM	Global Model GSM
Short term	Several days	○	← ○	← ○
Weekly	1 week	○	← ○	← ○
Monthly	1 month	―	―	○
Seasonal	3 to 6 months	―	―	○
Long term	1/2 to 1 year	―	―	○
Climate Change Prediction	100 years (Approx.)	―	―	○
Calculated area		Around Japan	East Asia	Whole earth
Grid size		5 – 10 km	10 – 50 km	Over 20 km

- This is a general example only. The methodology depends on the implementing agencies.
- For short term and weekly forecasts, the forecast area is extracted from the result of GSM. The meteorological data of the extracted area is recaliculated by deviding the area into smaller spots.

- DOM requested to install NWP system for weekly and seasonal in addition to the short term model. But long term model requires high performance computer, high speed internet linkage and expert researcher of NWP. In the result of consideration and discussion with DOM, the short term forecasting NWP model was installed and the technical support for a guidance skill, that translate NWP model output to weather forecast, was conducted.

[Role Allocation]

- C/P: Operation of NWP system, and development of Guidance
- Expert: Technical assistance for NWP system operation, advisory for improvement of Guidance and evaluation of hitting ratio

[Contents of Activities]

- In the 1st year, through the investigation on the current situation (Kinds of forecast/ warning, judgement process, NWP expert, telecommunication speed and IT environment) of DOM and requirement of DOM, some issues were clarified as shown below.
  - Nationwide outlook and major cities forecast were conducted as routine work
  - There were some officers who knos NWP
  - NWP servers could be kept in the existing server room
  - Due to the low communication speed, large size data set could not bedownloaded

- According to DOM's requirement, WRF model could be applied for NWP, and GSM data could be downloaded from NCEP/ NCAR web site

- In the 2nd year, installation of NWP system and technical transfer of guidance skill were implemented. Following activities were conducted.
  - Excercises on NWP model installation and environment adjustment
  - Visualization of NWP results
  - Excercises on NWP model handling and maintenance
  - Excercises on guidance development
  - Excercises on viewpoint of model improvement
  - Basic training on development of guidance for Colombo city

- In the 3rd year, technical transfer of guidance development, point guidance and nationwide guidance, was carried out. And using rainfall prediction and maximum/ minimum temperature prediction, hitting ratio of guidance method and traditional method was evaluated. And discussion for improvement of NWP system with DOM was held through pointing out some issues. Following activities were conducted.
  - Development of guidance for Colombo
  - Application to another city (Kandy)
  - Technical transfer of evaluation method of hitting ratio (rainfall prediction and temperature prediction)

(3) Regional Warning Standard

[Background and Objectives]

- DOM issues daily weather forecast three times a day. But when bad weather situation, such as heavy rainfall, strong wind, lightning/ thunder storm, cyclone disaster and etc., is expected, DOM issues special weather information (Bad Weather Advisory and Bad Weather Warning).

- DOM adopts the threshold "100mm a day" as a heavy rainfall standard, but it is not fixed value. DOM sometimes issues special weather information when rainfall amount is less than threshold, it depends on the decision of the duty forecaster, the duty forecaster decides not only by rainfall amount but also report from DOM observatories, satellite data, NWP results of IMD and TMD.

- As same as weather forecast, "Subjective forecast to objective forecast" and "Qualitative forecast to quantitative forecast", is the trend concept for warning. Many developed countries adopted quantitative method.

- DOM also requested to install quantitative method for warning, but due to the lack of knowledge on quantitative method, DOM could not start to utilize this method. Since formulation of regional rainfall standard and utilization of AWS realtime data were

proposed, development of warning standard was supported by Japanese expert in the Project.

[Role Allocation]

- C/P: Extraction of DOM historical observation data
- Expert: Technical assistance for heavy rainfall event analysis, advisory for local level warning standard, evaluation of the result and proposal for utilization of AWS data

[Contents of Activities]

- In the 1st year, as a basic investigation on the current situation (Kinds of forecast/ warning, judgement process) of DOM and requirement of DOM was implemented. The following activities were implemented.
  - Introduction of advisory/ warning issuance in Japan
  - DOM issues special weather information when bad weather is expected
  - Extreme statistical analysis on daily maximum rainfall, using DOM 21 principal stations data in previous 30 years.
  - Technical transfer of the extreme statistical analysis program
- In the 2nd year, completion of extreme statistical analysis and estimation of excess probability analysis were implemented. The former clarifies an extreme event such as “Extreme rainfall that occurs once a 100 year” and the latter shows middle frequency event such as “Heavy rainfall that occurs once a year”. After the verification of its suitability by studying the past heavy rainfall events, the expert and counterpart found that the latter value is suitable for the warning standard. Following activities were conducted.
  - Frequency appearance analysis and excess probability analysis on daily rainfall in several DOM stations for previous 20 years
  - Relation analysis between rainfall amount and disaster events
  - Relation analysis between AWS data (hourly data, 3hour data and daily data) and latest disaster events
  - In the result of this analysis, it is confirmed that AWS hourly data and 3 hour data were effective to issue warning timely and locally
- In the 3rd year, according to the result of 2nd year activities, excess probability analysis in DOM 21 principal stations is implemented. In order to formulate regional rainfall standard, statistical analysis and verification in all stations were implemented. JICA expert and the counterpart conducted the following activities.
  - Frequency appearance analysis and excess probability analysis for DOM 21 principal stations in previous 20 years
  - Verification of heavy rain-derived incidents in DMC’s disaster records
  - As a result of verification, 1% and 0.5% excess probability were effective for warning standard

- AWS data, hourly data and 3 hour amount, were useful to issue warning
- Adapting this result to heavy rainfall event in October 2012, possibility to issue warning before the event was confirmed
- This result was presented in the final annual seminar

(4) Utilization of DWR (Doppler Weather Rader)

[Background and Objectives]

- Rain gauge can observe rainfall data accurately, but it can observe the data only at its installed point. Sri Lanka is located in the tropical area and usually has a large amount of rainfall in a certain place only for a limited period. Therefore it is difficult to install the rain gauges in exact rainfall points and record the precise rainfall amount.
- Weather radar can observe rainfall situation in wider area than rain gauges, but it is not quantitative value. Also since the rador can be roiled behind the heavy rain area and mountains, observed rainfall amount includes errors.
- To capitalize on advantages of both rain gauges and weather radar, it is recommended to combine both data. This technique is called “RAP: Radar-Rain gauge Analyzed Precipitation” and utilized in many countries. Using this technique, it is possible to estimate rainfall value in many places, in 1km grid size, even if there is no rain gauge.
- DOM is now carring out installation works of DWR. Introduction and consideration for utilization of DWR was planned in this project.

[Role Allocation]

- C/P: DWR installation works and provision of DWR information
- Expert: Confirmation of installation works, introduction of actual case in Japan and proposal on DWR utilization

[Contents of Activities]

- In the 1st year, there was information that DOM asked WMO the consultation on installation of DWR. As a result, the basic study was done by WMO’s consultant and its installation was supposed to be carried out in 2011.
- In the 2nd year, installation schedule was clarified and consideration on DWR data utilization and provision of information was started. Following activities were implemented.
  - Confirmation of DWR installation schedule
  - Confirmation of DWR specification, function and data utilization
  - According to the original plan, DWR supposed to be operated in February 2012. However installation schedule was delayed due to weather condition. So schedule was postponed to June 2012

- The utilization case in Japan was introduced and utilization samples, such as RAP technique and VSRP (Very short range precipitation prediction), were explained.
- DOM couldn't show the details of DWR specification, because DOM did not receive such information from supplier.

◆ In the 3rd year, following activities were implemented.

- Confirmation of DWR installation schedule and specification
- Installation schedule was delayed again due to weather condition. So schedule was postponed after August 2012
- Utilization samples, such as RAP technique and VSRP were explained again and concrete process was shown
- Installation works started in October, but the crane vehicle that headed to the radar site tumbled down from the access road
- Installation works were postponed again. At this moment there is no assured information about installation

3.4.5 Summary of Output

◆ AWS system is not working perfectly, it was an obstacle to implement the DiMCEP activit. In the 1st year, C/P could not make a maintenance plan, especially regular maintenance which is done by HQ, because AWS system had many defects and it was under the guarantee period. C/P did not accept the AWS data as an official meteorological observation data of DOM, because there were a lot of missing data in AWS data. C/P had to pay the VSAT communication fee and labor cost under this situation. It became clear that those were the big loads to C/P. A same condition was continued in the 2nd year of the project, even though it was gradually improved. Especially in the case of a heavy rainfall event, AWS 10 minute data and hourly data were very effective and neccesary for heavy rainfall monitoring and issuing warning, C/P became to understand this facts. C/P is using AWS data for realtime weather situation monitoring and preperation for warning, AWS data becomes essential information for weather services of DOM.

◆ Since the daily maintenance and regular maintenance are planned and conducted by C/P in the 3rd year, the 1st target was achieved. Although AWS system has not performed perfectly yet, the defect points were clarified and DOM continues the replacement and repairing one by one.

◆ The basic concepts of NWP are "Subjective forecast to objective forecast" and "Qualitative forecast to quantitative forecast", since this is the trend of modern weather forecast. C/P had a knowledge on NWP as one of the methods of a weather prediction, but C/P did not have any experiences in Sri Lanka. JICA expert introduced a principle of NWP method in the 1st year, installed NWP system in DOM and transferred basic knowledge and techniques, such as installation and unistallation, daily operation and maintenance, visualization method etc., through on-site training and training in Japan. JICA expert also

introduced a guidance formula as a method which utilize NWP result into a daily weather forecast and transferred how to develop point guidance and nation wide guidance in the 3rd year. At the same time, JICA expert showed the improvement of weather forecast hitting ratio. The result of this trial was presented by C/P in the annual seminar in the 3rd year. In order to introduce guidance method into actual daily weather forecast, C/P has to develop point guidance for other cities, verify and improve this method more.

- Followings are the points to improve NWP. The 2nd item has already been developed by C/P and the 1st item is able to be done by C/P. But C/P has a limit of knowledge and capability to improve 3rd and 4th items, more technical support are expected for these items.
  - Improvement of GSM data to finer grid size
  - Improvement of downscaling method
  - Data assimilation and utilization as initial input data
  - Improvement of parameters
- The basic concepts for warning are “Subjective warning to objective warning” and “Warning for specified area”. It seemed that DOM did not have a concept that “Weather forecast and regional warning for disaster prevention” at first. JICA expert introduced the case in Japan in the 1st year and instructed statistic analysis of raifall data as an objevtive method in the 2nd year. a tentative raifall warning standard for DOM principal meteorological stations were developed, which can be used as an actual warning standard, and it was trialed to actual heavy rainfall disaster event in 2012. JICA expert showed that it is possible to issue regional warning timely by using AWS data. The result of this trial was presented by C/P in the annual seminar in the 3rd year. In order to introduce new warning standard into daily weather forecast, C/P has to verify this standard in other areas and improve this standard more.

3.5 Output 3

3.5.1 Outputs, Activities and Objectively Verifiable Indicators Indicators

(1) Output 3

Analysis and monitoring capacity of NBRO is enhanced.

(2) Activities

3.1 Execution of cost effective sediment disaster measure techniques

3.2 Formulation and execution of sediment disaster monitor and evaluation approach

3.3 Foumulation and trial of sediment disaster warning standard

3.4 Formulation of "The Manual for Landslide Monitoring, Analysis and Countermeasure"

(3) Objectively Verifiable Indicators

3-1 Cost effective sediment disaster measures technique is executed in one place or more by Sri Lankan side own.

3-2 The results of the execution of the landslide risk evaluation and the behavior analysis brought together as a report.

(4) Counterparts in Charge of the Project

Responsible counterpart:

Mr.RMS Bandara, Head of Landslide Studies and Services Division, NBRO

Counterparts in charge of Output 2:

Mr. Mahesh Somarathe, Scientist and Gelogist, Landslide Studies and Serveices Division

Mr. Laksiri Indrathilaka, Scientist and Gelogist, Landslide Studies and Serveices Division

Mr. Nuwan Amarathunga, Scientist and Gelogist, Landslide Studies and Serveices Division

3.5.2 Concept of Output and Activities

(1) Concept of Output

- To manage the frequent landslide disasters, knowledge on countermeasures (restraint works, control works, and non-structural measures), experience, techniques (monitoring, analyzing, designing and constructing) and human resources is needed. Ideally, the counterpart will acquire these resources and enhance the capacity through this Project and countermeasures will be implemented on the basis of adequate budgeting and human resources.

- NBRO has already obtained the knowledge on countermeasures through overseas training and has been continuing their effort voluntarily, such as preparation of the landslide hazard zonation mapping, the issuance of landslide early warnings and promoting the awareness and training programs for the people living on hill slopes, and observation and countermeasure activities using the instruments and materials available in Sri Lanka. But these activities are implemented without appropriate surveying (including monitoring). Therefore, the countermeasures are not implemented properly.
- Within a limited budget, NBRO should consider what activities they will promote in the future, and how to allocate the budget effectively to implement the activities.
- In this Project, survey and observation (monitoring), evaluation and assessment, preparation of standards for landslide, early warning and cost-effective countermeasures for the pilot area will be instructed through the technology transfer. After the Project completion, NBRO is expected to continue and develop their activities voluntarily including the decision making and budget allocations.

(2) Concept of Activities and Indicators

- In this Project, the technical transfer will be provided for observation (monitoring), evaluation and assessment of hazards and risks, preparation of standards for landslide early warning and cost effective countermeasures. The main purpose is not only to implement monitoring or countermeasures, but to transfer techniques within a limited budget and time that may cause descrepancies on the counterparts' ability to readily determine the landslide behavior or to effectively manage and reduce the risk of landslides.
- It is expected that NBRO will refer to "The Manual for Landslide Monitoring, Analysis and Countermeasure," which will be prepared in this Project, for the future activities.

(3) Output Materials Prepared during Activities

"The Manual for Landslide Monitoring, Analysis and Countermeasure" is the main output. It will include hazard evaluation concepts and methods of monitoring which was conducted in this Project, as well as the built-up knowledge available in NBRO. The manual is expected to be practical and reflective of actual conditions in Sri Lanka, considering the examples of outputs and issues encountered in this Project.

3.5.3 Achivement of the Activities

(1) Achievement of the Indicators

Indicator 3.1 Cost effective sediment disaster measures technique is executed in one place or more by Sri Lankan side own.

- Initially, the plan was to implement the countermeasure works at the Mahawewa site under the direction of the consultant team, and the countermeasure works at the Galaboda site were to be conducted directly by the Sri Lankan side. Installation of monitoring equipment was conducted according to plan under the consultant team's direction at Mahawewa and

by the Sri Lankan side at Galaboda. However, at the Mahawewa site, a landslide occurred after the start of the Project, causing several monitoring devices to be broken. Also, it was found that the landslide was much larger and its mechanisms much more complex than initially envisaged. Under such circumstances, it was judged that with limited time and budget, even if low-cost countermeasures were proposed and constructed, it would be difficult to ascertain their effectiveness. Therefore, it was explained to the counterparts that these countermeasures would not be implemented in this Project and their agreement was obtained.

- At the Galaboda site, it was agreed amongst relevant parties that countermeasure works such as horizontal drilling and making drains for surface water run-off would be implemented, and a basic design was made. Surveying for the topographic map to be used for the design work was conducted in June 2011 and the completed map was received in August. However, because there was hardly any movement in the landslide, no slip surface could be detected by the ongoing borehole inclimeter monitoring. Also, because there is a need to confirm the groundwater level and movement on the sides of the landslide and the effectiveness of the countermeasure works, it was decided in July 2012 to implement additional boring and monitoring. The basic designs were revised based on these results and preparations were made to contract out the construction works; however, there was insufficient time to undertake the countermeasure works within the Project period.

Indicator 3.2 The results of the execution of the landslide risk evaluation and the behavior analysis brought together as a report.

- A draft of "The Manual for Landslide Monitoring, Analysis and Countermeasure" was made in July 2012. It was then submitted to NBRO, whereupon a series of discussions were held to make sure their opinions were sufficiently reflected in the manual. In the manual, in particular, the Galaboda case was included as a case study covering all of the works from initial surveys to countermeasure implementation. This manual will certainly be a useful guideline for NBRO to effectively implement all the processes as needed in future such as surveying, monitoring, analysis and countermeasures in hazardous areas.

(2) Achievement of the Target in the 3rd Year Activities

Target 1:The countermeasures are implemented at the Galaboda site and their effectiveness is confirmed.
Target 2:A series of activities in this Project is summarized in the manual.
Target 3:The recognition of the importance of the activities is shared among concerned organizations through the counterpart meetings, seminars and

Target 1:The countermeasures are implemented at the Galaboda site and their effectiveness is confirmed.

- Implementation of the countermeasures was originally planned; however, due to the time constraints, it was not implemented within this project. Therefore, in this project, design

and cost estimated fro the countermeasure works were carried out but one of the project targets; implementation of the countermeasures and its evaluation, was not achieved.

Target 2:A series of activities in this Project is summarized in the manual.

- "The Manual for Landslide Monitoring, Analysis and Countermeasure," which includes examples from this Project and typical landslide surveys and countermeasures, was made with NBRO.

Target 3:The recognition of the importance of the activities is shared among concerned organizations through the counterpart meetings, seminars etc..

- All of the Project activities were presented in the seminars, technical workshops within NBRO, at NBRO's annual symposium, etc. to raise the awareness of those involved in the importance of landslide surveys and measures.

3.5.4 Details of Activities

(1) Monitoring

- 1st Year Activities

From March 2010, field surveys were conducted at the two target sites, Mahawewa and Galaboda, in order to select sites for installing monitoring equipment, and boring and installation of equipment began. Monitoring began in Mahawewa in July 2010. In Galaboda, for training purposes, NBRO conducted the boring and installation of monitoring equipment by itself. Monitoring was started in Galaboda in October 2010. Also, various methods for basic monitoring were shown to NBRO such as using wooden stakes and pegs and using adjoining wooden boards to measure land movement. These were implemented in several locations at the two sites. Landslide movement was very active in Mahawewa from December 2010 until January 2011, and most of the installed monitoring equipment became unusable. After that, four of the five extensometers were re-installed and monitoring continued. All the processes from equipment installation and monitoring to organizing the data were explained to the counterparts in the first seminar in November 2010.

- 2nd Year Activities

Monitoring was continued at Galaboda and Mahawewa; however, there were many cases of theft and interference in Galaboda, and there were many cases of unrecorded data, due to the C/P being busy. NBRO was instructed on data acquisition, making graphs and interpretating them on several occasions. The draft design was prepared for the countermeasure for Galaboda site.

- 3rd Year Activities

When it came to implementing countermeasure works in Galaboda, it was judged too difficult to determine the effectiveness of the countermeasure works from the

data obtained so far. Therefore, a boring survey was implemented to install additional monitoring equipment and to get more detailed core observations. As much core as possible was needed to be obtained from this boring; therefore, a company capable of this needed to be selected. The additional boring was completed in July 2012 and monitoring started immediately after. Moreover, there was difficulty obtaining data in the previous year, so discussions were held with NBRO to remedy this by requiring a report to be submitted once a month and setting up a framework for data acquisition. Monitoring is now going smoothly.

(2) Landslide Analysis

- Mahawewa

Many of the monitoring devices in Mahawewa were damaged by landslide activity after being installed and some were unusable. However, the inclinometers and strain gauges installed in the boring holes showed some information on the depth of slip surfaces and the processes that triggered landslides, and were valuable for educating NBRO. After this, extensometers were re-installed and monitoring continued. Moreover, because the mechanisms of the Mahawewa landslides were found to be complicated, and the area is quite large, it was decided that the countermeasures which were initially planned were not implemented. Therefore, at this stage, countermeasure works are not implemented in this iste.

- Galaboda

In Galaboda, planimetric maps including extents of landslides and cross-sectional maps in the direction of landslide slip direction with landslide extent were made. Then, earth science engineering and geological methods of analyzing landslides were taught using these cross-sectional maps.

It was determined from the boring results that the slip surface is around a weak section at a depth of approximately 9 meters. As for groundwater, while rainwater infiltration is the main inducing factor, water is also coming in from the road above the landslide; therefore, it was judged that drainage measures to extract groundwater and surface water would be effective. Water level monitoring also showed that groundwater comes up to about two meters below ground level.

Moreover, the relationship between groundwater level and rainfall was ascertained from time series movement analysis using monitoring data. The inclinometer analysis results showed significant tilting in 2011 at the monitoring point at the top of the landslide.

Additionally, the C/Ps were instructed the basic concepts of stability analysis techniques, which are basic to landslide analysis and countermeasures, by

implementing the corrective Fellenius method. Principles of factors of safety (current conditions versus post-countermeasure) and how to set them were taught in technical meetings.

(3) Designing Countermeasures

NBRO was supported in developing a framework for planning, designing and implementing cost effective landslide countermeasure works in areas selected upon discussions with NBRO. Matters that need to be taken into consideration when designing countermeasures are shown in the following flow chart. Drawings are shown in Appendix 4-2.

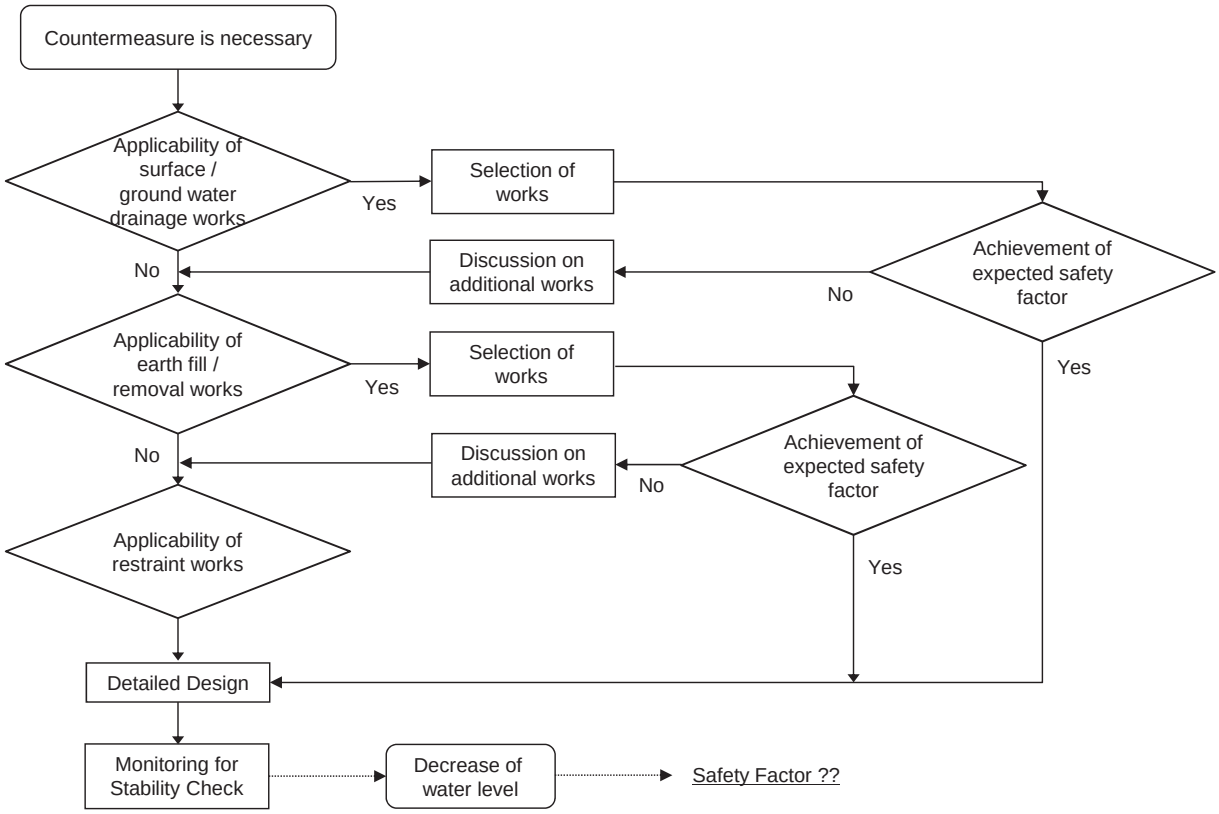


Figure 3.5.1 Flow Chart of Selection of Countermeasure Works

(Japan Road Association (2009): Highway Earthworks Manual for Cutting and Slope Protection)

- Considerations for Factor of Safety

One of the matters to consider is setting the factor of safety (force preventing landslide activity, namely resistivity versus the driving force of activity) and how to deal with the safety factors after countermeasures have been implemented. There are two types of safety factors, current safety factors and design safety factors. The current safety factor is set after survey analysis and before implementing countermeasures using a prescribed method (mostly back calculation method (Explanation of Policy on Landslide Prevention Techniques, Sabo Department,

Ministry of Transport, 2008)). If a landslide is not moving, the safety factor is set as Fs=1.00. The design safety factor sets a target for stability when planning countermeasure works. It is set at 1.10～1.20, after taking into consideration what needs to be protected in the landslide area. Various countermeasures (groundwater drainage, earth removal works, embankments, pile works, anchoring works and so on) are planned and implemented in order to achieve these improvement targets. Matters to consider and concepts regarding these were explained in technical meetings. In the future, NBRO will need to set design standards on its own using this knowledge.

- Confirmation of Effectiveness of Countermeasures

The effectiveness of the countermeasure works is confirmed by continued monitoring of groundwater and comparing data from before and after the countermeasures. The indicator of effectiveness is whether the groundwater level has decreased to below the level set to achieve the design safety factor. This is judged by analyzing water level peaks for each rainfall event and comparing the monitoring data (rainfall, groundwater level) from before and after the countermeasure works.

- Suitability to Sri Lankan technical level

The following measures should be taken into account when trying to apply Japanese countermeasure techniques in Sri Lanka.

1. Differences in geological and soil surveying technologies
2. Differences in construction machinery for surveying and countermeasure works
3. Differences in technical methodologies for countermeasure works and in perspectives on how they are applied

Regarding 1, differences in geological and soil surveying technologies, these are basic differences in thinking and approaches to surveying and countermeasure works. Because landslides are deeply related to several factors, namely the way colluvium has been deposited, the state of weathering, and how jointing and layering have developed in bedrock, it it is necessary for detailed geological observation and analysis techniques to be improved.

Regarding 2, in Japan, boring machines and surveying equipment are readily accessible. In Sri Lanka in recent years, there has been a great increase in surveying equipment and slope strengthening machinery (simple temporary machinery, pile drivers) for construction projects such as highways and ports. There needs to be more machinery that can conduct highly precise horizontal drilling to 50 ~ 60 m for groundwater drainage works.

Regarding 3, of utmost importance is how NBRO goes about the entire series of groundwater drainage works, from planning to implementation and monitoring. A

fundamental perspective regarding the factor of safety, is to include surveying and monitoring into the countermeasure works, and when necessary, planning and conducting additional countermeasure works. This approach or way of thinking is important for NBRO when conducting such measures. In the future, it will be necessary to use a combination of restraint works such as anchor works, shaft works and pile works.

(4) Study on Early Warning and Information Dissemination System

The early warning systemand and information dissemination system at the two pilot project sites were evaluated. Under the directions from DMC and NBRO, and using the standards for activities at the hazardous areas, the communities by themselves shall measure the daily rainfalls.

At the pilot areas, monitorings for the rainfalls or groundwater which may cause the landslides, ground mass movement as a result of landslides, and underground movement were conducted using; 1) rain gauge, 2) extensometers, 3) inclinometers, 4) stress gauges, and 5) groundwater level gauges. However, due to the limited timefor the monitoring activities, the standards for the warning system using the monitored data cannot be established within this project.

In this project, the warning standards which are used in Japan are introduced in the manual.

Table 3.5.1 Current Warning Standards

Rainfall Indicators	Activities
75mm/24hr	Cautions
100mm/24hr	Warning for preparing evacuations
150mm/24hr or 75mm/hr	Evacuations

(Proposals for the early warning system and information dissemination systems)

- At this moment, there is no real time monitoring system for use of the information disseminations to the NBRO nor communities for the landslide movement activities. Threfore, the above two pilot project sites, just like the other communities, shall seek for the judgements from NBRO or GN for the evacuations if any anomalies are found.
- The differences from the other communities include; the daily rainfalls are monitored consistently by the tea factory at Galaboda and a school at Mahawewa, and the monitoring data can be utilized for the risk evaluation by NBRO. Following is the proposal for the system;

Table 3.5.2 Early Warning / Information Dissemination Systems

Organization	Actions to be Taken
Community People	- Monitor daily rainfall amount, and inform NBRO if it exceeds the criteria - Inform NBRO for necessary actions, if precursory phenomenon or damage is found - Inform GN, DS or GA/DDMCU for necessary actions, if precursory phenomenon or damage is found - Receive warning message, evacuation instruction / order, or advise from GN, DS, GA/DDMCU, or NBRO - Take necessary actions
Tea Factory (Galaboda) / School (Mahawewa)	- Monitor daily rainfall amount, and inform NBRO if it exceeds the criteria - Inform NBRO for necessary actions, if precursory phenomenon or damage is found - Inform GN, DS or GA/DDMCU for necessary actions, if precursory phenomenon or damage is found - Receive warning message, evacuation instruction / order, or advise from GN, DS, GA/DDMCU, or NBRO - Take necessary actions
NBRO (Ratnapura / Nuwara Eliya Office)	- Receive information from Community People, Tea Factory or School - Receive information from GN, DS or DDMCU - Inform NBRO Head Office - Conduct field survey - Download data from monitoring equipments and analyze data - Discuss with NBRO Head Office and advise necessary action to Community people, Tea Factory, School, GN, DS or DDMCU
NBRO Head Office	- Receive information form NBRO Ratnapura / Nuwara Eliya Office. - Discuss with NBRO Ratnapura / Nuwara Eliya Office, issue warning if necessary, and disseminate it to DMC
GN	- Receive information from Community People, Tea Factory or School, and inform it to DS and NBRO Ratnpaura / Nuwara Eliya Office - Receive advise from NBRO Ratnapura / Nuwara Eliya Office - Receive warning message from DS, and disseminate it to Community People - Issue evacuation instruction / order if necessary or advise necessary action to Community People
DS	- Receive information from GN, Community People, Tea Factory or School, and inform it to GA / DDMCU and NBRO Ratnpaura / Nuwara Eliya Office - Receive advise from NBRO Ratnapura / Nuwara Eliya Office - Receive warning message from GA / DDMCU, and disseminate it to GN - Issue evacuation instruction / order if necessary or advise necessary action to GN
GA/DDMCU	- Receive information from DS, Community People, Tea Factory or School, and inform it to DMC and NBRO Ratnpaura / Nuwara Eliya Office - Receive advise from NBRO Ratnapura / Nuwara Eliya Office - Receive warning message from DMC, and disseminate it to DS - Issue evacuation instruction / order if necessary or advise necessary action to DS

- The above system is similar to the current system. There are some issues as follows;
  - Capability issues for the tea factory and school to comtinue the monitoring
  - The NBRO emploees may not ba able to reach to the office at the heavy rainfalls
  - Is it possible if the downloaded data can be analysed on site
  - Reliability of current warning standards

(Considerations for current warning standards)

- Several methods which can be used for considering the warning standards based on the rainfall monitoring data are introduced

- large scale landslides had occurred from November 2010 to January 2011 in Mahawewa area. As shown in the graph below, the daily rainfall and accumulated rainfall on December 8 2010 are 50mm and 400mm, respectively.

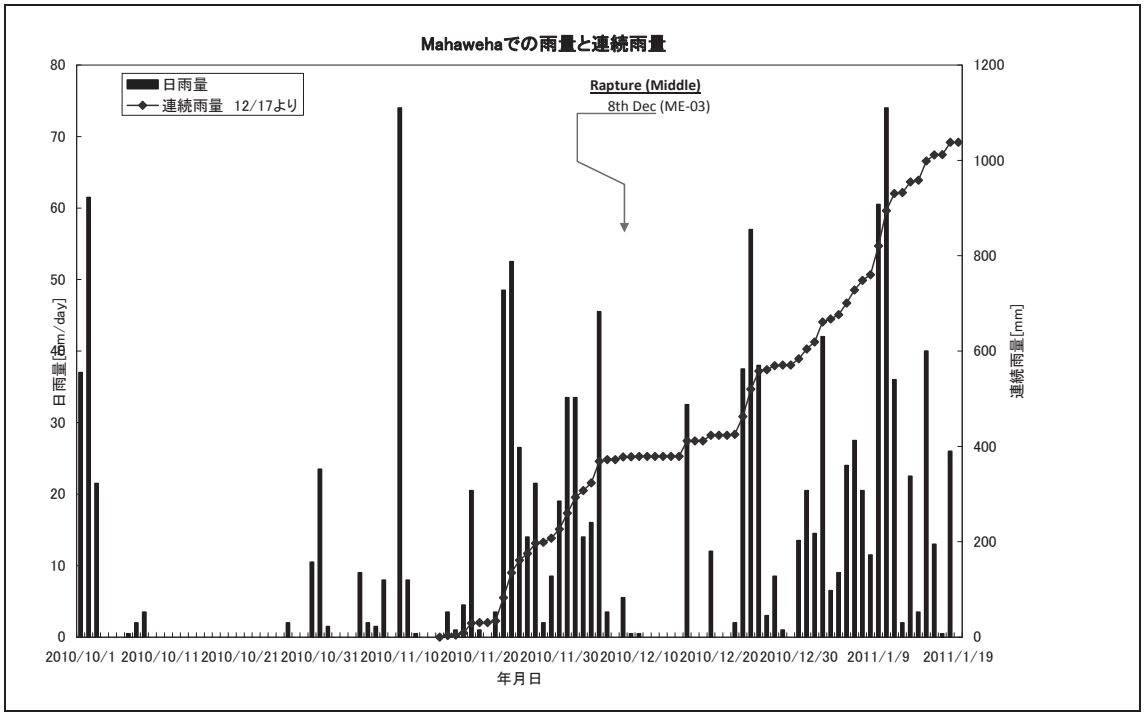


Figure 3.5.2 Daily and Accumulated Rainfall at Mahawewa

- In Galaboda, the safety factor for the groundwater level was estimated to be 1 from the stability analysis using the data obtained from monitoring of water level and extensometer. The water level within the motnitoring period and the actual rainfall are shown in the graph below. According to the graph, the actual rainfall which may cause the groundwater level of the safety factor 1 is approximately 150mm.

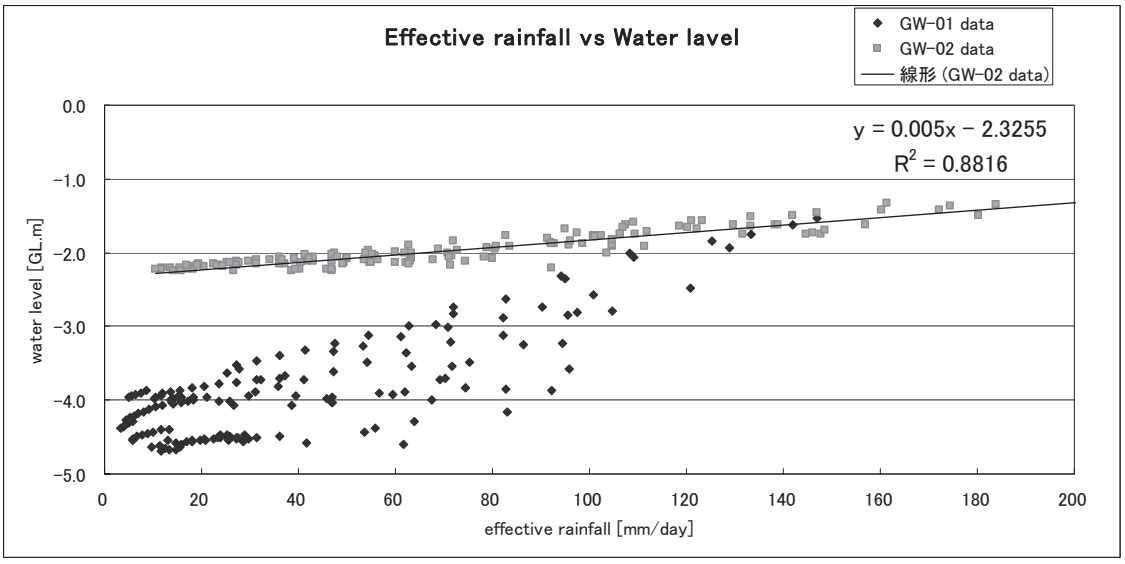


Figure 3.5.3 Actual Rainfall and Groundwater Level at Galaboda

The above graph is the monitoring data for evaluating the methods of warning standards. It is important to continue the monitoring in order to accumulate the data for more precise determinations.

(5) Making "The Manual for Landslide Monitoring, Analysis and Countermeasure"

- Support was given to produce "The Manual for Landslide Monitoring, Analysis and Countermeasure," which covers all of the activities conducted in Sri Lanka in this Project. In particular, attention was paid to ensure that it reflects the actual situation in Sri Lanka and that it encompasses all of the basic perspectives and procedures regarding landslide countermeasures and surveys. The intent, purpose and structure of this manual was fully explained to NBRO, and the work on compiling it was delegated between NBRO and the consultant team. Moreover, when each of the Japanese experts were on assignment, they communicated closely with their counterparts to ensure the Sri Lankan side's opinions were reflected in the manual as much as possible. Also, various technical standards and literature from Japan and other countries were referenced in each chapter of the manual. The Japanese experts completed their sections by July 2012 and the first draft was mostly completed by November.

- One point that must be mentioned is that it was necessary for the sections of this manual concerning making judgements on the effectiveness of countermeasures and monitoring and so on to be specifically about landslide disasters and therefore, these cannot be applied to all sediment disasters. This and the fact that it differs from hazard evaluation or countermeasure manuals on other sediment disasters such as slope failures, rock falls or sediment flows was explained to NBRO and is stated in the introduction of the manual. In particular, the survey and plan for the countermeasure works at Galaboda were compiled in a separate section.

- It was the first time that all of the equipment installed in this Project for monitoring, except for rain gauges, had been used in Sri Lanka. For this reason, the manual included a section on establishing a monitoring framework led by community members using basic monitoring devices, which explained easy monitoring methods used in Japan and at NBRO, so that the pilot monitoring can be spread to other regions. It also highlighted the importance of maintaining the monitoring equipment, noting the necessity of checking for damage, etc. when collecting data and looking for signs of possible equipment malfunction or incorrect readings in the data.

- The manual covers various general topics through to specifics such as the surveys and countermeasures conducted in Galaboda. It is hoped that this manual can be widely distributed in Sri Lanka. Moreover, in the future, the manual will need to be revised to include new ideas and methods and to make it easier to use.

3.5.5 Summary of Output

- The landslide monitoring was conducted with NBRO playing the main role; therefore, it is considered they understand the basic concepts of landslide monitoring. On the other hand, the

counterparts did not take a leading role much of the time when conducting regular maintenance, obtaining data at times of heavy rainfall, or for analysis work of the obtained data. One reason for this is that the counterparts are extremely busy and have a very high workload. In particular, when a sediment disaster occured during heavy rain, the counterparts were so busy responding to requests from the field that they couldn't collect monitoring data, and were unable to repair or reposition equipment disturbed by the landslide, therefore missing a valuable chance to obtain important data.

- In addition, with regard to monitoring data, there were many errors such as mistakes when obtaining data and problems resulting from lack of maintenance of equipment, so the importance of this was emphasized. Also, the C/P were requested to submit monthly reports on monitoring results to the consultant team; however, these were rarely submitted. In the future, regular downloading of monitoring data, data analysis, and evaluations of landslide activity need to be carried out thoroughly.

- Countermeasure works were planned for Galaboda; however, in the end, these were put off to a later date. It is hoped that this work can be conducted based on the various techniques and knowledge transferred in this Project so that it becomes a new model for Sri Lanka.

- The counterparts in NBRO have built up a basic knowledge of countermeasure implementation through overseas training, experts teaching them in the field, and training in Japan. In this Project also, two counterparts came to Japan for training and their level of understanding of sediment disasters visibly improved. Moreover, through the practical on-the-job training of problem solving during countermeasure implementation, their ability to deal with problems as they arise improved vastly. At NBRO's annual symposium on 13 December 2012, there were many presentations on sediment disasters. This clearly showed NBRO's positive attitude towards sediment disaster countermeasures.

- One organizational problem that became apparent in the course of this Project was that the counterparts have such a full and varied workload, that they cannot concentrate specifically on landslide surveys or countermeasure works. A challenge for the future in order to move forward with the workflow outlined in this Project is to increase the staff numbers at NBRO and to transfer skills and knowledge to other workers in relevant fields.

3.6 Output 4

3.6.1 Output, Activities, Objectively Verifiable Indicators

(1) Output

Disaster management information is regularly transferred.

(2) Activities

4.1 Development of rules on warning issuance and organization of information management training related to operation of early warning

4.2 Execution of disaster information transmission training

(3) Objectively Verifiable Indicators

4-1 Warning is transmitted to the pilot area according to the warning official announcement rule

4-2 Warning transmission training is executed one or more times in each pilot area

(4) Counterpart of the Output

Responsible Counterpart: Brig. N.B. Weragama, Director, Emergency Operation Centre
(Retired, no replacement)

Counterpart in charge: Mr. K.A.D.P.K. Kodippili, Assistant Director, Early Warning Division
Mr. J.M.A.R. Jayarathna, Assistant Director, Early Warning Division

3.6.2 Concept of Output and Activities

(1) Concept of Output

- The early warning system requires the formulation of the endangered zone to be alerted (e.g., preparation of the hazard map), observation and prediction for warning and warning issuance, warning information transfer and sharing, actions based on the warning message (including evacuation) and role allocation for the actions with complete accuracy. Accomplishing all these actions is ideal for the system and should be performed in the future.
- However, the ideal system cannot be performed by the current capacity of the GOSL (from the viewpoint of equipment, human resources, technical ability, etc.) in a short period. Thus, the Project has supported the improvement of accuracy on current possible activities by counterparts (observation items, accuracy and information transfer methods).
- As the overall goal, the activities of output are expected to be conducted by counterparts independently and promoted to other areas of the country.

(2) Concept of Activities and Indicators

- The Project implemented and improved the information transfer and sharing, which are necessary parts of the establishment of the early warning system.
- In particular, the possible activities by the existing equipment and human resources of Sri Lanka were clarified in order to determine what could be done with their current capacity. The activities were systematized as the rule so that the related organizations can share the common understanding. The information transfer exercise was implemented based on the rule and the rules were improved if necessary.

(3) Output Materials Prepared during Activities

The Project prepared the users guide of IGN and early warning and an information sharing manual. As Output 4, it is the goal to transfer the information properly based on the manual and implement the information transfer exercise. The manual is a tool for the output and its contents should be improved by reflecting the experience of the exercise and the actual disaster response. Output 4 is aimed at implementing the activities utilizing the manual and the formulation and improvement of the manual through the activities.

3.6.3 Achievement of the Activities

(1) Achievement of the Indicators

Indicator 4.1 Warning is transmitted to the pilot area according to the warning official announcement rule.

- The manual on warning issuance and information sharing for flood and landslide disasters was prepared. The disaster information such as a warning message was transferred according to the rule determined in the manual in pilot areas on 2nd October 2012.
- The warning message was issued by the Department of Meteorology, NBRO and the Department of Irrigation as a response to the heavy rain in southwestern Sri Lanka from late October to the beginning of November. It was confirmed by the interview survey in the pilot areas that the issued warning message was largely transferred following the rule stated in the manual.
- DMC implements information transfer exercise on tsunami twice or three times per year by themselves. The expert team conducted the evaluation of the information transfer on the exercise. The exercise itself is implemented without any trouble, though it is starting to be regarded as a routine event.

Indicator 4.2 Warning transmission training is executed one or more times in each pilot area.

- The information transfer exercise on landslides was implemented in July 2011. In addition to this exercise, the information transfer exercise on floods and landslides was conducted in

the three pilot areas in October 2012. In Ratnapura and Nuwara Eliya, the tabletop exercise on landslides was also implemented in January 2012.

- Information transfer exercise on tsunamis is conducted twice to three times in all districts every year. Kalutara district is included in the pilot areas of the exercise.

(2) Achievement of the Target in the 3rd Year

Target 1: Information transfer exercise is implemented and evaluated in the pilot areas at least one time. Target 2: The process of revision of the manual based on the exercise and the actual emergency response is announced at seminars and its importance is shared among the relevant counterparts. Target 3: Budget is secured for the operation and maintenance of IGN after the termination of the project.

(Target 1) Information transfer exercise is implemented and evaluated in the pilot areas at least one time.

- The information transfer exercise on flood and landslide was implemented mainly in the pilot areas on 2nd October 2012. The evaluation meeting was held and the evaluation report was prepared.

(Target 2) The process of revision of the manual based on the exercise and the actual emergency response is announced at seminars and its importance is shared among the relevant counterparts.

- Through the process of preparation of the manual and information transfer exercise, it is emphasized that the manual should be improved every time after the exercise and the actual disaster response. This explanation was included in the presentation material by the counterpart at the seminar and presented by the counterpart directly to the participants.

(Target 3) Budget is secured for the operation and maintenance of IGN after the termination of the Project.

- It was agreed at JCC held in July 2012 that the budget would be secured for operation and maintenance of IGN continuously.

3.6.4 Details of Activities

The activity of Output 4 is mainly the support of preparation of the warning issuance and information sharing manual, operation and maintenance of IGN and implementation of information transfer exercise on floods and landslides, evaluation of the tsunami information transfer exercise. The detail of each activity is as follows.

(1) Preparation of Warning Issuance and Information Sharing Manual (for flood and landslide)

[Background and Objectives]

- As the existing manual and SOP on information transfer, DMC has an SOP that was prepared with support by the Netherlands in 2009. The SOP is for internal use in DMC and categorizes the actions to be taken by staff at each level when receiving disaster information such as warning messages from relevant organizations according to the disaster types such as floods, landslides, tsunamis, etc.
- Generally, it is highly regarded that the tsunami warning message should be informed appropriately and accurately to the local people as a lesson learnt from the Indian Ocean tsunami in 2004. On the other hand, the DMC and regional government offices' awareness on the warning issuance to local people for flood and landslides that frequently occur in Sri Lanka is relatively low because of the inaccuracy of the warning message by the technical agencies.
- Basically, it is difficult for technical agencies to issue accurate warning messages on the precise area of floods and landslides since they usually occur only in a certain local area. On the other hand, the information on the local disaster such as heavy rain is still important information for the technical agencies. It is important for all relevant organizations to understand what kind of warning message the technical agencies can issue, what kind of information should be shared among the related organizations and what should be done by each organization.

[Role Allocation]

- Counterpart: discussion and determination of the contents of manual
- Japanese experts: proposal of the contents of manual, preparation of the manual, budgetary support (meeting and printing expenses)
- Local staff: support on the interview survey and preparation of the manual

[Contents of Activities]

- In the 1st year (2010), the expert team focused especially on understanding the current status of information transfer since the flood occurred and tsunami warning was issued during the Project period. In the 2nd year (2011), the expert team supported the implementation of the information transfer exercise in four districts and the tabletop exercise to collect the various comments from relevant staff in two districts in order to draft the manual for landslides.
- The following facts were found by the above-mentioned activities.
  - Since landslides occur locally, it is difficult for the current capacity of NBRO (its observation network and understanding of disaster mechanism) to cover the issuance of appropriate warning message to the affected area. In fact, there are some cases in

which disasters occurred without any warning message or disasters didn't occur after the warning message was issued. DDMCU and local people's uncertainty about the NBRO's warning sometimes discourages DDMCU to transfer the warning. On the other hand, NBRO is discontented with DMC's coordination since their warnings were not sometimes disseminated to the local people or broadcasted to the media.

- The areas vulnerable to landslides have their own defined actions by observing natural signals and rainfall observation. They evacuate voluntarily and coordinate with local government.

- Based on the information above, the warning issuance and information sharing manual on landslide explains the meaning of NBRO's warning (warning which NBRO can issue by their current capacity) and the bottom-up system by which national and regional governments take community-level disaster information as an early stage of top down information transfer from NBRO to local people. It is also explained that the community-level information taken by NBRO will improve the accuracy of NBRO's warning message. Additionally, information is divided to three categories as "community-level disaster information," "warning by NBRO" and "evacuation information" and providers and receivers of each type of information are shown in the manual. The expert team applied simple expressions so that anybody can modify the contents easily in the future.

- In the 3rd year (2012), the warning issuance and information sharing manual on floods and landslides were prepared based on the policy mentioned above. The information transfer exercise was conducted in the pilot areas employing the manual. After the exercise, the manual was revised based on the results of interviews with participating organizations. (Appendix 4-1: Warning Issuance and Information Sharing Manual for Flood and Landslide)

(Contents of the Manual)

- The targets of the manual are districts, divisions and GN that do not have such manuals. The framework of the manual consists of two parts, the manual which should be understood before disasters, and the SOP which can be utilized as a checklist in the actual information transfer.

- The manual explains the activity (information transfer), information type (community-level disaster information, information by technical agencies and evacuation information) and organizational roles as provider and receiver of the information.

- SOP describes each action in more detail than the manual so that the user can take appropriate actions. This part can be portable and utilized as a checklist or evaluation sheet at exercises and during actual emergencies.

(2) Operation and Maintenance of IGN

[Background and Objectives]

IGN was installed as information sharing system that connects 14 agencies: DMC, DOM, NBRO, DOI, the police, TV station, radio station and 7 DDMCU (Colombo, Gampaha, Kalutara, Galle, Matara, Kegalle and Ratnapura) by using a dedicated line, as a pilot project for the development study conducted from 2006 to 2009. However, operation and maintenance of IGN was stopped due to the delay of payment to the connection provider etc. after the termination of the development study.

- IGN has communication equipment such as telephone, FAX and PC (intra-net) by dedicated line. However, the merit of the dedicated line is not well recognized on a normal situation. In addition, DOI stopped operation of the hydrological observation system that could be viewed through the intra-net of IGN. Therefore, the counterpart's motivation on operation and maintenance of IGN decreased in this situation.
- Initially, the expert team confirmed the counterparts' motivation on the operation of IGN in future. The expert team supported the restart of IGN, enhancement of its function and awareness of related people.

[Role Allocation]

- Counterpart: Operation and maintenance of IGN, discussion and determination of the contents of manual
- Japanese expert: proposal on utilization of the system, suggestion and preparation of the contents of manual, budgetary support (expense for meetings and improvement of system, employment of local staff)
- Local staff: Support of operation and maintenance of system (regular maintenance of each equipment (by each organization), rehabilitation of the equipment, discussion with connection provider)

[Contents of Activities]

- In the 1st year, the expert team confirmed why the IGN had been stopped and the counterparts' opinions on the future operation and maintenance. The expert team coordinated the relevant staff to restart the operation. According to the counterpart, although the need for IGN was definitely high in an emergency, it was stopped because the budget for communication cost had not been secured after the termination of the development study. From 2011, the budget for communication was secured. The counterpart intended to support the restart of IGN and its operation and maintenance. Responding to this intention, related agencies held a meeting and agreed to restart the network by 7 central organizations (DMC, DOM, NBRO, Department of Irrigation, the police, TV station and radio station) excluding 7 DDMCU.

- In the 2nd year, the IGN Users Guide was prepared and the network was restarted by the 7 organizations. It is vital for users to be familiar with the operation of the system in normal times for the continuous operation and appropriate use of the system in an emergency. In order to get used to the system, the expert team proposed regular use of the equipment and adding extra value on the system. Therefore, daily and weekly maintenance of the equipment by counterpart is mandatory and regular patrol maintenance of each agency is requested for the maintenance company. Additionally, the system for sharing rainfall data of the maximum past 48 hours of AWS was established in IGN after discussion with DOM. (Appendix 4-2: IGN Users Guide)

- On 11th April 2012, IGN was utilized for transfer of warning message on the earthquake that occurred in Sumatra. On this occasion, the superiority of IGN was recognized again and the budget for its operation and maintenance was agreed to be prepared at JCC held in July as a result. At the information transfer exercise on flood and landslide conducted in October 2012, the utilization of IGN was mandated and IGN itself was recognized from the operators to director class. As the extra value of IGN, rainfall data collected by the AWS is used by NBRO and the Department of Irrigation. Additionally, the Department of Irrigation asked for support on establishment of the storage system of typed data of manual observation and display the observation data in IGN. The expert team also supported this activity.

(Contents of the Manual)

- In order to utilize the system continuously, simple sentences, tables and charts were added to the manual.
  - How to use IGN (Telephone, FAX, notice board, AWS)
  - Contact numbers of responsible persons in each organization
  - Emergency contact number for troubleshooting
  - The method and format of regular maintenance

(3) Implementation of Information Transfer Exercise (Flood and Landslide)

[Background and Objectives]

Information transfer exercises for floods and landslides were introduced at the JICA development study from 2006 to 2009. At that time, since DMC did not have any experience on implementing the exercises, the study team led the exercise. Learning from this experience, DMC implemented the tsunami information transfer exercise by themselves in 2009 and has since continued. On the other hand, the importance of information transfer on flood and landslide was not fully understood and it has not been implemented since the development study.

- Considering the background mentioned above, the Project implemented the information transfer exercise on flood and landslide for the following purposes.
  - Officers related to disaster management (especially the regional officer) learn the

process of information transfer through the exercise.

- The information transfer procedure written in the manual is confirmed and revised if necessary through the exercise.
- The capacity of DM is enhanced enough to conduct the exercise by themselves by experiencing the implementation process of the exercise.

[Role Allocation]

Counterpart: Determination, preparation and implementation (under the instruction of Japanese expert) of the exercise

- Japanese Experts: Proposal and support on preparation and implementation of the exercise and budgetary support
- Local staff: Support on preparation and implementation of the exercise (coordination with relevant organizations)

[Contents of Activities]

- In the 2nd year, a simple exercise was conducted to grasp the current situation of information transfer in Sri Lanka and prepare the early warning and information transfer manual. The details of the exercise are as follows.
  - Date: 1st August 2011
  - Target disaster: Landslide
  - Target Agencies (Central): DMC, NBRO
    (Regional): Kegalle, Ratnapura, Nuwara Eliya, Badulla district
    1 division and 1 GN are selected from each district.
  - Contents of the exercise: the warning message issued by NBRO is transferred through DMC, district, division and GN by phone and FAX.
- In addition to the exercise mentioned above, the tabletop exercises were conducted in Ratnapura and Nuwara Eliya to draft the manual. The information gained through the series of exercises is described in (1).
- In the 3rd year, the exercise was conducted by using the manual. Brief information on the exercise is as follows:
  - Date: 2nd October 2012
  - Target disaster: flood, landslide
  - Target agencies: (Central) DMC, DOM, NBRO, Department of Irrigation

(Regional)

District	DS	GN
Nuwara Eliya	Wallapane	Landupitha
Ratnapura	Kollona	Ranhotikanda
Kalutara	Millaniya	Paathakada

- Contents of the exercise: the exercise consisted of the five phases shown below. In Phase 1, the warning message by technical agencies is transferred through DMC to communities. In Phase 2, the situation in the community is reported to technical agencies. Phase 3 is the self evacuation exercise by communities. In Phase 4, the warning message is issued and transferred from technical agencies again. In Phase 5, the evacuation is reported to DMC.

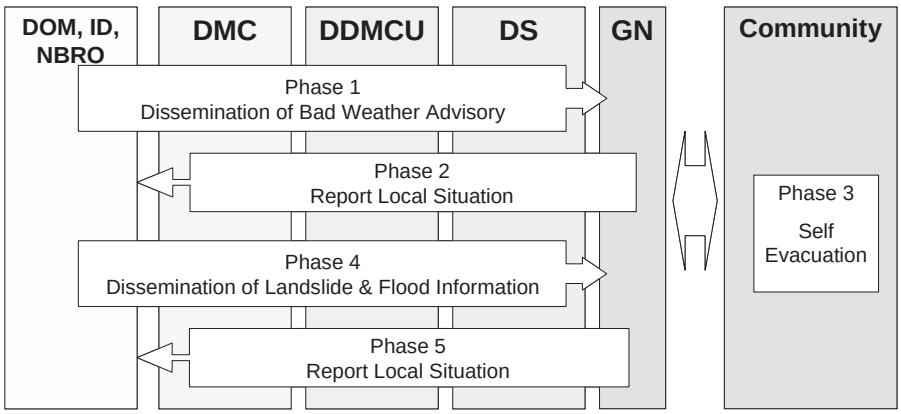


Table 3.6.1 Activity Flow of the Information Transfer Exercise

- The evaluation meeting was conducted with participants of the exercise to review the exercise on 5th October. The result of evaluation is summarized in the evaluation report. The main suggestion is as follows. (Appendix 4-3: Evaluation report on information transfer exercise)
  - The objectives of the exercise should be clear.
  - Early warning and information sharing are not difficult but are the first step of all emergency responses. Therefore, their importance should be recognized.
  - There should be consistency between the National Emergency Operation Plan and information transfer.
  - The contents of the community-based disaster management activities should be reconsidered from the view of voluntary evacuation by community.
  - The expression of warning message should be discussed with regard to the disaster type.
  - How to keep the accuracy of the transferred information should be discussed.

(4) Evaluation of the Tsunami Simulation Exercise

[Background and Objectives]

- As mentioned in (3), DMC has implemented information transfer exercises on tsunami warnings (including the evacuation drill by community) two or three times every year by themselves since 2009. In the exercise, a tsunami warning message announced by DOM is received by DMC as the first step. DMC transfers the message using the information

transfer equipment such as a tsunami tower (wireless network) and DEWN (short message service) and through DDMCU to the target community. Then, the community people evacuate based on the message. The exercise targets all the districts along the coastal line and one community selected by each district.

- The officers of DOM, NBRO and other agencies join the exercise as evaluators, though they do not cover the evaluation of the exercise in all local areas due to the shortage of human resources. Therefore, DMC asked the expert team for the support of evaluation in the local areas.

[Contents of Activities]

- The evaluation of tsunami simulation exercise was conducted twice, on 20th December 2011 and 22nd June 2012. On 20th December 2011, it targeted 4 districts: Puttalam, Gampaha, Colombo and Kalutara. On 22nd June 2012, it targeted 3 districts: Gampaha, Colombo and Kalutara.
- The result of the evaluation was submitted to DMC as a report. (Appendix 4-4: Evaluation report of tsunami simulation exercise) The main suggestions are as follows.
  - The objective of the exercise should be clearer.
  - The unofficial evacuation shelter is applied only for the exercise purpose. It should be discussed whether it is reasonable or not.
  - There is no manual or SOP for the district level. Although information transfer of tsunami warning is relatively simple, they are essential to give reasons for the exercise and its related activities. Therefore, the preparation of the manual and SOP is expected.
  - The tsunami simulation exercise targets all districts along the coastal line. However, it will be possible for officers of DMC headquarters to evaluate the exercise if certain districts are selected for the exercise. The resources should be concentrated.
  - The target community for the tsunami drill should be selected under the coordination with the pilot communities for CBDRM activities to avoid duplications.

(5) Preparation of Database of Manual Rain Gauges

[Background and Objectives]

DOM observes daily rainfall at approximately 400 cooperative observation stations (the tea factory and other organizations maintain the stations). The observation data is basically posted to DOM office every month. It is proposed to utilize some observers who reside at the stations for warnings on regional floods and landslides. However, since basic information of rain gauge stations such as the precise location of rain gauge stations, contacts of observers and managers are not well organized by DOM, it is difficult to utilize the rain gauge stations and related resources for disaster management. DOM has motivation to prepare the database. NBRO and other agencies also expect utilization of the database. Thus, the expert team

supported the survey on the cooperative rain gauge stations in several districts and preparation of the database.

[Contents of Activities]

- The database was made in four districts, Nuwara Eliya, Matale, Kandy and Ratnapura after discussing with the counterpart of the Department of Meteorology. Although the survey was conducted by the employed local staff, the counterpart attended most of the stations and updated the rain gauges and instructed on the observation method.
- The database attached in Appendix 4-5 shows the accurate locations and addresses, managers' names, telephone numbers, sketches and photos of the stations.
- The database was distributed not only to the Department of Meteorology, but also to DMC, NBRO and DDMCU.

3.6.5 Summary of Output

- It is revealed that the counterparts' business pressures interfered with their initiative implementation of the activity during the activity in the 1st year. Therefore, local staff were employed to support the counterparts' activity from the 2nd year in order to accomplish the output. As a result, the scheduled activities were all implemented and the original indicators and targets of the 3rd year were accomplished.
- From the view of capacity enhancement and technical transfer, active implementation of activities by counterparts was not achieved. Therefore, the level of their capacity may be under the expected level. However, the warning issuance and information sharing manual, IGN users guide and evaluation reports of the various exercises were prepared. In addition to these publications, activities such as the information transfer exercises, related meetings and seminars were conducted together with counterparts. The counterparts' capacity to implement the activities sustainably is enhanced and technical transfer for the activity was accomplished. The capacity will be also improved by continuing the activities.
- The improvement of the tight schedule of the counterpart is an issue to keep the activities sustainable. Currently, the tsunami simulation exercise is implemented regularly, though the contents of the exercise are becoming routine. The counterpart does not have time or resources to discuss its improvement. It is necessary to secure the appropriate human resources to apply the exercise to other types of disasters.

3.7 Output 5

3.7.1 Output, Activities and Objectively Verifiable Indicators

(1) Output 5

Disaster management capacities of districts, divisions and communities in pilot areas are improved.

(2) Activities

5.1 Enhancement of district capacity in pilot areas in managing the existing disaster management committees

5.2 Implementation of community-based disaster management promotion activities targeted districts in pilot areas

5.3 Implementation of community-based disaster management activities at districts in pilot areas (installation of simple water level sensor(s) and rain gauge(s), small-scale preventative work, organization of evacuation training)

(3) Objectively Verifiable Indicators

5.1 Number of topics of coordination meetings on disaster management organization and outputs from those meetings

5.2 A hazard map is made through the guidance of the local government organization in the communities of the pilot area

5.3 Regular evacuation training at the community level in the pilot area is executed through the guidance of the local government organization

(4) Counterparts in Charge of the Project

Responsible Counterpart:

Mr. Sugath Dissanayaka, Director, Training, Education & Public Awareness Division

Counterparts in charge of Output 5:

Mr. Palitha Bandara, Assistant Director, Training, Education & Public Awareness Division

3.7.2 Concept of Output and Activities

(1) Concept of Output

The ideal situation of enhanced capacity in disaster management at the sub-national level would be a situation in which each level of the sub-national government discusses, makes decisions, allocates a budget and implements disaster management activities under their own initiatives. However, in Sri Lanka, no full-time staff for disaster management are currently allocated in the District and Divisional

Secretariat and therefore, very limited disaster management activities can be implemented at the sub-national level.

In this Project, as the first step toward the ideal situation, the following are targeted for the pilot district.

- DDMCs in the pilot district are periodically organized by the initiative of the ADs, discussions are held and decisions on the facing issues in the district are made in the meeting. Also, it is expected that requests to solve the issues are made to the central government when necessary.
- Officials of divisional secretariat who are in charge of the implementation of CBDM in the pilot community understand the importance, contents and method of CBDM activities and become resource persons for expanding and replicating the CBDM activities to other areas of the division.
- In the pilot community, it is expected that the participants in the CBDM activity understand the community's characteristics on disasters, evacuation places and role in community in case of disaster. It is also expected that the community people will implement necessary and daily measures such as small-scale structural measures, monitoring, exercises, etc.

(2) Concept of Activities and Indicators

To achieve the above-mentioned outputs, the activities for enhancing the capacity in managing the committee (DDMC at each level) and promoting the CBDM in pilot areas are implemented.

The activities for enhancing the capacity to organize the disaster management committee at each level are:

1) Review of past DM committees
2) Preparation of activity plans for DM committees
3) Support to organize DM committee meetings including technical input on meeting agendas.

These activities will be discussed and evaluated mainly at the committee meetings.

On the other hand, the Project activities to illustrate CBDM activities were implemented with the involvement of the government officials at each level to get the CBDM to understand and prepare for expantion to other areas.

These activities will be evaluated by a) preparing community hazard maps under the guidance of government officials, and b) implementation of DM activities such as periodical implementation of evacuation drills in the pilot communities.

(3) Output Materials Prepared during the Activities

The output of "Output 5" is hazard maps that will be produced through a series of community activities. The hazard maps will be shared in the communities, utilized

for understanding hazard areas and evacuation places and as a tool for CBDM activities including evacuation exercises.

Small-scale measures (small-scale construction works, facility improvement, and procurement of equipment, etc.) implemented in the pilot communities are also an output of "Output 5" as these small-scale measures will be carried out as the prioritized needs of DM in the communities through the discussions with government officials and community people.

3.7.3 Achievement of the Activities

(1) Achievement of the Indicators

Indicator 5.1 Number of topics of coordination meetings on disaster management organized and outputs from those meetings

During the Project period, in addition to the regular DDMC meeting, the following committees were held in Ratnapura and Nuwara Eliya. The agendas of the meetings were specialized in terms of the items to be discussed in each DDMC meeting; therefore, it can be envisaged that there will be an increase in the number of topics in the meeting as mentioned in the index.

<u>DDMC meetings to discuss the priority activities in disaster management (Ratnapura & Nuwara Eliya)</u>

For both Nuwara Eliya and Ratnapura, the GA and AD of DDMCU discussed the priority activities to be carried out by the DDMC and concluded to conduct an "Awareness program for DDMC members (Nuwara Eliya)" and an "SAR and first aid training for community leaders and key government officials (Ratnapura)" as prioritized activities. The DDMC meetings were organized in the respective districts to discuss how to implement these activities.

JICA Experts participated in the process of implementation and provided necessary technical input and financial support to assist the activities. The programs were carried out in the second year of the Project.

<u>DDMC meetings to discuss the promotion of CBDM (Ratnapura & Nuwara Eliya)</u>

JICA Experts assisted the DDMC meetings in Ratnapura and Nuwara Eliya to discuss how to promote the CBDM activities. The meeting in Nuwara Eilya was scheduled to be held on December 20, 2012; however, it was postponed due to the disasters by heavy rainfall in Nuwara Eliya. In Ratnapura, the meeting was held in January 2013.

In Kalutara district, one of the pilot districts of the Project, due to the low intention of the AD, support activities to enhance the capacity in managing the DDMC could not be conducted.

DM Committee meetings at divisional level to discuss the promotion of CBDM (Kalutara and Ratnapura)

A meeting to discuss how to promote the CBDM activities was organized in Millanniya division, Kalutara on December 12, 2012. At the divisional level, in reality, DM Committee meetings are very seldom convened and the meeting was not an official DM Committee meeting. However, a DS was called for the meeting, key members of the DM Committee participated in the meeting and the JICA Expert assisted in organizing it.

In addition, in Kolonna division, Ratnapura, a similar meeting to the one held in Kalutara is being prepared in January 2013.

Indicator 5.2 A hazard map is made through the guidance of the local government organization in the communities of the pilot area.

Through the five community workshops in the pilot communities, the community hazard maps were developed, (photos, for example) and have been installed in public places. Therefore, it can be said that the performance indicators have been achieved.

Figure 3.7.1 Hazard Map Displayed in Ranhotikanda (Ratnapura District)

The officials of DMC headquarters always participated in the activities and the activities were conducted with the participation of the staff of DDMCU, Divisional Secretariat, and officials of DOI and NBRO as resource persons. Thus, the importance of CBDM is recognized and shared with these officials.

Indicator 5.3 Regular evacuation training at the community level in the pilot area is executed through the guidance of the local government organization

In the third year of the Project, evacuation exercises were conducted in the pilot communities. The officials of DMC HQ and DDMCU, GN, and community leaders were involved from the planning stage of the exercise; therefore, understanding on

exercise procedures is progressing. In addition, communities are discussing the future program for the exercise based on the previous exercise.

In view of the achievement of the indicator "regular drills are conducted," the current situation is not as expected. However, it can be said that the current situation is a situation ready for implementing regular exercises. The implementation of regular training with follow-up of DDMCU and DMC is expected.

(2) Achievement of the Target in the 3rd Year

Capacity Enhancement in Organizing DM Committee
Target 1: At least one DM Committee meeting in each pilot district is organized and the further promotion of the CBDM shall be included as one of the meeting topics. Further, a similar meeting will be held in one of the pilot divisions.
Community Based DM Activities in Pilot Communities
Target 2: Community hazard map is developed and shared with community people by posting in public areas where people gather such as the GN office and temples.
Target 3: Small-scale measures, which are agreed between community and local government, are implemented.

Target 1: As described in 3.7.4 (1), in both Nuwara Eliya and Ratnapura districts, DDMC meetings for each district to discuss the promotion of the CBDM are under preparation. In addition, a meeting that discussed CBDM promotion was held in Mirania division and will be organized in Kolonna division.

Target 2: As mentioned in 3.7.4 (1), the community hazard maps for five pilot communities have been developed and posted in public areas.

Target 3: Small-scale measures have been implemented to address the prioritized needs of DM in the pilot communities through the discussions and agreement with government officials and community people. The measures implemented are described in detail in 3.7.4.

3.7.4 Details of Activity

The activity of Output 5 is broadly divided into: 1) activities for enhancing the management capacity of the existing DM committee meeting, and 2) activities for promoting the CBDM activities.

(1) Activities for Enhancing the Management Capacity of the Existing DM Committee Meeting

[Background and Objectives]

JICA's technical assistance to the disaster management sector of Sri Lanka since 2006 focused mainly on capacity enhancement at the central government level. However, disasters are local events and therefore, it is also essential to enhance the capacities of officials of the sub-national government to mitigate damage from

disasters. Also, to enhance the community's capacity on disaster management, sub-national level officials always have to communicate with community people. In this sense, the capacity of the sub-national level government officials in disaster management has to be enhanced.

Under this background, as presented in 3.7.2, the Project activities aimed to achieve "DDMC in pilot districts are periodically organized under the initiative of the ADs, and discussions and decisions on the facing issues in the district are made in the meeting. Also, it is expected that requests for solving the issues are made to the central government when necessary."

[Role Allocation]

- Counterpart (DMC HQ): Discussion with district, such as proposed agenda and timing
- Counterpart (District): Necessary actions for organizing a meeting, and determining the agenda and content
- JICA Expert: Discussion about DDMC meeting (DMC HQ, District)
  Proposal of agenda and meeting contents, documentation, and funding
- Local Employee: Support on necessary actions for organizing meetings, documentation, etc.

[Contents of Activities]

Actual activities for enhancing the management capacity of the existing DM committee meeting are:

1) Understanding the existing capacity of DDMCU in the pilot district
2) Analysis of past DDMCU meetings (date, agenda, participants, etc.)
3) Assistance in organizing DM committee meetings
4) Evaluation of disaster response activities at the district level

1) Understanding the existing capacity of DDMCU in the pilot district

In the first year of the Project, a survey to understand the existing capacity of DDMCU was carried out. Each DDMCU of the pilot district has one Assistant Director (AD) who is a responsible officer of DDMCU, one or some assistant coordinators and some other staff in general. This situation did not change throughout the Project even though some ADs were replaced.

All ADs and assistant coordinators have secondary level education and understand the regional characteristics of disasters and the role of DDMCU. In particular, ADs who were dispatched from the armed forces have experience in officer-level positions and sufficient capacity and leadership in the field of disaster response.

On the other hand, the coverage area of DDMCU is usually wide and roads are often in unfavorable conditions; it sometimes take a several hours to reach the target areas. Also, available staff and vehicles are limited in DDMCU. Considering these facts, it is difficult for DDMCU to provide a detailed patrol and service to the community in normal situations let alone flexible disaster response in disaster situations.

2) Analysis of past DDMCU meetings (date, agenda, participants, etc.)

An analysis of the past DDMCU meetings (date, agenda, participants, etc.) was conducted to obtain basic information to support the disaster management committee meetings. For analyzing the past meetings, records of the meetings of the past few years were collected and interviews with the ADs and other staff of DDMCU were conducted.

The major findings from the records of 2010 and 2011 were as follows:

- Although DMC HQ instructed holding the DDMC meeting before the rainy season, in some cases (Ratnapura: 2011, Kalutara: 2010), the meeting became a meeting for disaster response due to the occurrence of disaster in some areas.
- The agenda of the meetings were limited to the issues that the DDMC members were facing. In the only case that had intervention from outsiders, the meeting took the topics as the meeting agenda (once for each of Ratnapura and Nuwara Eliya).
- When a disaster occurred, meetings related to disaster response were held.

From these facts, regular meetings to "prepare for disaster season" are organized in all the pilot districts, and the meetings for “disaster response” were held as the occasion arose. However, such conditions of the DDMC meetings shows that DDMC, at present, cannot carry out the disaster management activities other than disaster response under their own initiative.

On the other hand, ADs of each DDMCU considered that DDMC is working well. Therefore, in this Project, rather than supporting the holding of regular DDMC meetings, it was decided to support holding of DDMC meetings that are dedicated to the issues facing the pilot district and implement an actual program to address the issues. The Project also focused on getting the DDMC members to understand their role and responsibility in disaster management through the discussion and the program.

3) Assistance in organizing DM committee meeting

<u>Assistance in organizing DM committee meeting in Nuwara Eliya (1): Implementation of Priority Program</u>

GA and AD of DDMCU in Nuwara Eliya had awareness on the following issues.

1) DDMC members were not in the system that jointly responded during the disaster situation.

2) DDMC meetings were rarely held. Once a meeting was held, the meeting was usually combined with another meeting and members could not dedicate the discussion to issues on disaster management.

These issues are considered to be caused by the low awareness of the DDMC members, and thus, it was concluded that a training program to enhance the knowledge on disaster management and build cooperation between members of the DDMC should be implemented as a priority program of the district.

The program was carried out as 5-day (3 actual days) program in February 2012 with the participation of 48 DDMC members (Program, see Table 3.7.1). In preparation of this awareness program, a DDMC meeting was held on November 17, 2011.

Table 3.7.1 Program of Activities of Training

	Program of Activities
Day 1	Evening: Arrival of Participants
Day 2	Disaster Management (general) Knowledge Enhancement on different types of disasters
Day 3	First Aid, S&R Training, Team Building
Day 4	Team Building, DM Action Plan
Day 5	Morning: Leave for home

Assistance in organizing DM committee meeting in Ratnapura (1): Implementation of Priority Program

GA and AD of DDMCU in Ratnapura had common understanding on issues regarding the necessity of provision of training to local government officials and community leaders to enhance knowledge of first aid and rescue.

Therefore, the capacity enhancement for organizing the DM committee meeting was done through the process of realization of the priority program based on this common understanding of issues, technical input to the discussion at the DDMC meeting and funding assistance for the implementation of training by JICA.

A DDMC meeting on the implementation of training was held on December 19, 2011. The DDMC members agreed to the above-mentioned training as priority activities in the district and participants for the training were selected by the divisional secretary. A two-day first aid and rescue training program (Table 3.7.2) was held in March 2012 with 100 participants.

Table 3.7.2 Items for First Aid and Rescue Training

Day 1	◆ Disaster Management introduction ◆ First Aid (basic medical treatment principles, life support and CPR) ◆ Introduction about Search & Rescue (SAR) ◆ Ropes and Knots ◆ Personal Protective Equipment

Day 2	◆ Water Rescue ◆ Stretcher and Ladder ◆ Casualty transport ◆ Boat riding

Assistance in organizing DM committee meeting in Nuwara Eliya (2): Promotion of CBDM

A DDMU meeting to discuss the promotion and sustainability of the CBDM activities was scheduled to be organized on December 20, 2012. However, due to the continuous bad weather and heavy rains from a few days before the scheduled date, several landslides and floods occurred in various parts of the district, and the meeting was postponed. As of the beginning of January 2013, the DDMCU is still in a situation of disaster response, and the date for the next DDMC meeting has not yet been fixed.

Assistance in organizing DM committee meeting in Ratnapura (2): Promotion of CBDM

A DDMC meeting similar to the DDMC meeting of Nuwara Eliya was also planned in Ratnapura. The meeting is under preparation and will be held in January 2013.

Assistance in organizing DM committee meeting in Millanniya (Kalutara): Promotion of CBDM

A meeting to discuss how to promote the CBDM activities was organized in Millanniya division, Kalutara on December 12, 2012. At the divisional level, in reality, it is very rare to convene the DM Committee meetings and the meeting was not an official DM Committee meeting. However, DS was called for the meeting and key members of the DM Committee participated in the meeting. The JICA Expert assisted with organizing it.

In the meeting, a) contents of the CBDM activities, b) small-scale measures that were proposed by the community people, c) sustainability of the CBDM activities in the pilot community, and d) expansion of the CBDM activities to other communities were discussed. The DM Committee members of the division are hoping to continue and expand the CBDM activities, and decided to make a request to DMC for further promotion of the CBDM activities.

In addition, a DDMC meeting in Ratnapura and a DM related meeting in Kolonna division, Ratnapura are under preparation and scheduled to be held in January 2013.

4) Evaluation of disaster response activities at district level

Evaluation of Disaster Response Activities in Nuwara Eliya (Jan. & Feb., 2011 Disaster)

To assess the disaster response activity, a survey including data collection and interviews was conducted. The items of the survey are a) organizations for response, b) information transfer, c) status of meetings related to response activities, d) response system, etc.

As a result, the following were pointed out as the points that need to be discussed.

- At this time, information about disaster evacuation is never transmitted from the government organizations to the community, and the decision on evacuation in the event of a disaster has been made by the community. Therefore, the following points: a) self-evacuation and its criteria and b) provision and collection of information by government organizations, need to be discussed.
- Additionally, if the government organization forces self-evacuation of the community people, the following also need to be discussed:

  a) Disaster response system that should be prepared at district and division levels to support the self-evacuated people.
  b) Role and responsibility of DDMC members for effective support to the affected people.

- At the disaster site, communication and decision making for self-evacuation took place based on past experience or by an ad-hoc system created at the site. To address this situation and improve toward effective disaster response, a discussion on the development of an SOP/manual is also required.

In addition, the AD of Nuwara Eliya who conducted the disaster response transferred to another DDMCU in the fall of 2012, and the AD position was vacant for a while. Therefore, the discussion about the challenges and improvements in disaster response has not yet taken place.

(2) Activities for Promoting the CBDM Activities

[Background and Objectives]

JICA carried out a CBDM activity in 15 communities in the previous project, and developed a CBDM manual and a "Fliptation (combination of Flip chart and Presentation)" as a tool for the CBDM activity.

In Sri Lanka, there is a growing interest in disaster management; however, the implementation of proactive and structural measures is still insufficient. Therefore, enhancement of the community's capacity in disaster management and further promotion of the CBDM activity is required.

Under these circumstances, as presented in 3.7.2, the Project activities aimed to achieve "officials of divisional secretariat who are in charge of the implementation of CBDM in the pilot community understand the importance, contents and method of CBDM activities and become resource persons for expanding and replicating the CBDM activities to other areas of the division," and "in the pilot community, it is expected that the participants in the CBDM activity understand the community's characteristics on disasters, evacuation places and roles in community in case of disaster, and expect the community people to implement necessary and daily measures such as small-scale structural measures, monitoring, exercises, etc."

[Role Allocation]

- Counterpart: Determination of activity, participation to the community activity
  Consideration of the promotion of the CBDM activities
- Expert Technical input and feedback on the CBDM activity, promotion of the CBDM activity
- Sub-Contractor: Consideration of actual method for workshops and activities
  Implementation of the CBDM activities including logistics, etc.

[Contents of Activities]

Activities to promote the CBDM consist of the following:

1) Review of the CBDM activities that were carried out in the JICA Development Study (survey on 15 communities)
2) Implementation of the CBDM activities in pilot communities
   - ❑ Selection of pilot communities
   - ❑ Baseline survey for the pilot communities
   - ❑ Conduct of community workshops (Total 5 times)

1) Review of the CBDM activities that were carried out in the JICA Development Study

Before the implementation of the CBDM activity, a review (including an interview survey and data collection) of the CBDM activity that was conducted in the previous JICA project was done. Based on the information from the review survey, the following points were considered for implementation of the CBDM activities.

- Since it is difficult to continue the CBDM activity without follow-up activities, the intervention period to the community is to be as long as possible, and an increased frequency of workshops is considered to maintain awareness in the community.
- To show objectives of the workshop and expected role of the participants clearly to the participants.
- Further considerations in the way of workshop facilitation, material preparation, etc.

2) Implementation of the CBDM activities in pilot communities

Selection of pilot communities

A total of seven communities were selected as shown in Table 3.7.3. Sittandi (Batticaloa) and Nawapadeniya (Matale) were added as pilot communities in 2011 about one year after commencement of the Project.

Table 3.7.3 Pilot Commnities

District	DS	GN	Type of Disaster
Kalutara	Millanniya	Paathakada	Flood
Nuwara Elya	Hanguranketha	Deraoya	Landslide
	Walapana	Landupita	
	Ambagamuva	Vidulipura South/North	
Ratnapura	Kolonna	Ranhotikanda	
Batticaloa	Batticaloa	Sittandi	Flood
Matale	Dambulla	Nawapadeniya	

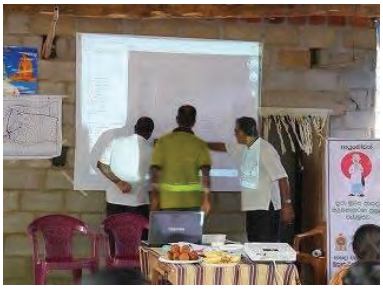
Baseline survey for the pilot communities

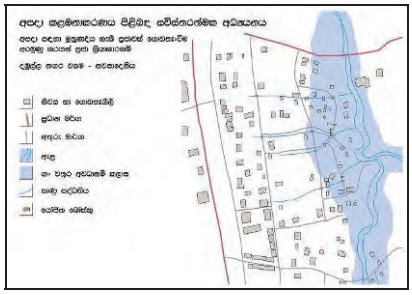
A baseline survey covering the following items was conducted before commencement of the community activity. The results of the survey were used as the basic information.

- Community profile
- Profile of community organizations (CBO)
- Governance and decision-making (informal mechanism)
- Hazard profile of the community/Local capacities (post disaster)
- Disaster Management Education
- Existing disaster management mechanism
- Social Capital
- Capacities of DDMCU & Staff

Implementation of Community Workshop (5 times)

Table 3.7.4 Contents of Each Workshop

	Contents of Workshop
1st Workshop (WS)	- Awareness program (Hazard, Disaster, Risk, Vulnerability, etc.) - Disaster in community - Preparation of "town watching"  
2nd WS	- "Town watching" - Drafting community hazard map based on "town watching"  

	Contents of Workshop
3rd WS	- Finalization of community hazard map - Discussion of community level disaster management (DM) organization and DM plan   
4th WS	- Evacuation exercise   
5th WS	- Discussion and implementation of small-scale mitigation measures (Community level DM activities)  

The officials of DMC headquarters always participated in the activities, and the activities were conducted with the participation of the staff of DDMCU, Divisional Secretariat, and officials of DOI and NBRO as resource persons.

The workshops were organized to involve community people as much as possible and maintain the frequency of involvement with the community. Table 3.7.5 and 3.7.6 show the dates of community workshops and the selected priority small-scale measures.

Table 3.7.5 Dates of Community Workshop

District	Community	1st WS	2nd WS	3rd WS	4th WS	5th WS
Kalutara	Paathakada	Nov. 28, 2010	Sep. 4, 2011	Jan. 8, 2012	Nov. 17, 2012	Nov. 17, 2012
Nuwara Elya	Deraoya	Dec. 13, 2010	Aug. 21, 2011	Dec. 18, 2011	Sep. 22, 2012	Dec. 7, 2012
	Landupita	Dec. 12, 2010	Aug. 20, 2011	Dec. 19, 2011	Oct. 2, 2012	Dec. 7, 2012
	Vidulipura	Dec. 11, 2010	Aug. 22, 2011	Dec. 20, 2011	Sep. 21, 2012	Nov. 23, 2012
Ratnapura	Ranhotikanda	Jan. 7, 2011	Sep. 12, 2011	Jan. 13, 2012	Oct. 2, 2012	Nov. 22, 2012
Batticaloa	Sittandi	Jan. 24, 2012	Jan. 29, 2012	Feb. 7, 2012	Nov. 20, 2012	Mar. 11, 2012
Matale	Nawapadeniya	Jan. 23, 2012	Feb. 1, 2012	Feb. 20, 2012	Feb. 25, 2013	Mar. 1, 2012

Note : Community activities in Batticaloa and Matale were added in 2011 and the activities were concentrated from January to March 2012 due to the contract between JICA and the consultant team of the Project.

Table 3.7.6 Small-Scale Measures

District	Community		Small-Scale Measures
Kalutara	Paathakada		Improvement of Evacuation Center (Procurement of Equipment: Boat & Life Jacket, Siren, Kitchen Utensils, Well and Toilet, etc.)
Nuwara Elya	Deraoya		Improvement of Drainage System Procurement of Equipment for Evacuation
	Landupita		Improvement of Community Hall (Evacuation Center) and Procurement of Equipment Improvement of Evacuation Route
	Vidulipura	South	Improvement of Drainage System Improvement of Evacuation Center
		North	Improvement of Evacuation Center
Ratnapura	Ranhotikanda		Establishment of a DM Unit (Equipment Storage, Resource Centre) and Procurement of Equipment Training of Community Leaders Foresting
Batticaloa	Sittandi		Improvement of Evacuation Center (Procurement of Equipment: Boat & Life Jacket, Siren, Kitchen Utensils, Well and Toilet, etc.)
Matale	Nawapadeniya		Improvement of Drainage System

3.7.5 Review of Activities and Recommendations

(1) Disaster Management Committee

In general, DDMC meetings are held on a regular basis, for example, before the rainy season; however, the topics discussed in the meetings were limited to those such as disaster response, and did not allow for discussion on disaster management issues in the district as a whole. Also, GAs convene and chair the DDMC meeting and therefore, GA's awareness on disaster management is largely influenced by the frequency and content of discussions of the DDMC meeting while the role of AD of DDMCU is important to the DDMC meeting.

In addition, the DDMC do not have a sufficient budget to implement the activity by their own decision. The budget for cross-sectoral disaster management issues is limited and funds for district-level disaster management activities are obtained by each section of the district secretariat. This leads to difficulty in making a decision on implementing measures in the DDMC meeting.

Under such circumstances, in this Project, GAs and ADs were targeted for organizing DDMC meetings. When considering only organizing the meeting, this would be correct; however, in order to make the meeting active and realize the measures, it is important to gain the understanding of disaster management by DDMC members who are responsible for the actual activities and obtaining the budget.

From this point of view, it would be effective to conduct awareness programs for the DDMC members like that conducted in Nuwara Eliya during the Project period for strengthening the capacity of members and activation of DDMC. DMC should actively conduct this kind of activity in the future.

(2) CBDM Activity

The CBDM activity of this Project, as a whole, was smoothly carried out. For conducting the CBDM activities, the findings from the review of the previously conducted CBDM activity, such as difficulty in continuing the CBDM activity without follow-up activities and further improvement by way of workshop facilitation and using materials, were incorporated and contributed to smooth implementation of the activity.

In the fifth workshop, priority measures for community-level disaster management were discussed among the community people. In the discussion, the community people proposed to train community leaders by using the budget for small-scale measures.

This example revealed the increased awareness of the community and shows the effects of the CBDM activity. Moreover, it secures the leading personnel of the CBDM activity in the community for the future by training the leaders, and it will be effective for the sustainability of the CBDM activities.

It was found that the community people consider solutions in their own way from various viewpoints and perform management when the budget was allocated. Therefore, a budget that can be managed by the community should be allocated when the CBDM activity is carried out. After that, training on budget management should be done along with providing DM training to the community leaders.

3.7.6 Summary of Output

(1) Capacity Enhancement of Disaster Management Committee

- Through the Project activities, more than one DDMC meeting was held in Nuwara Eliya and Ratnapura district, and priority activities and CBDM in the district were discussed in the meeting. Further, divisional-level DM committee meetings that were not official but were convened by DS were held in some divisions and officers related to disaster management gathered and discussed how to promote CBDM in their divisions. From these results, the objective to enhance the management capacity of the DM committee meeting was achieved to a certain extent.
- On the other hand, it was revealed that improvement of management capacity of DDMCU meeting largely depends on the awareness of the AD of DDMCU. In the districts in which ADs actively worked on the issues, the DDMC members discussed and implemented the priority programs to address the facing issues. However, in the district where the AD had lower awareness on further activation of the DDMC, DDMC meetings were only held as in the past and no remarkable changes were observed in the capacity of DDMC members.
- The authority to convene DDMC meetings is held by only GA while the AD of DDMCU can advise on calling the meeting. Therefore, the awareness on disaster management and the DM committee of the GA and the relationship between the AD and the GA largely

influence the frequency and content of the discussions at the DDMC meeting. In Sri Lanka, disaster management systems at the sub-national level are weak in general, and considering this situation and the effectiveness and efficiency of external assistance, if a capacity enhancement project is conducted in the future, the activity should focus on the district in which GA and ADs have high awareness of disaster management.

- The budget related to disaster management at the district level is only provided by the Ministry of Disaster Management to DDMCU, and no cross cutting of DM-related budget is allocated to the GA office. Therefore, when a DM-related project is planned to be implemented at the district level, it is necessary to obtain the funds from the central government through related offices of the District Secretariat. This might be an obstacle of DM-related activity through the DDMC.
  In fact, in the case where some funds for implementation of disaster management activities were prepared by the Project, regarding disaster management issues in the district, matters that needed to be discussed in the DDMCU meeting differed from the opinions on disaster management of the GAs and ADs. This confirms that there are many challenges in the district. Therefore, in parallel with the strengthening of DDMC, it would be important to conduct activities to help the central government organizations understand the importance of disaster management and allocating the funds for it.

- ADs and other staff of DDMCU in the pilot districts were very busy with their ordinary work due to the insufficient resources in terms of staff, budget and equipment, and the GAs of the pilot district were also busy with their work. Therefore, it was very unfortunate that there was not enough time to discuss disaster management among the GA, AD and JICA Experts.

(2) CBDM Activity in Pilot Community

- The CBDM activity carried out in this Project is positioned to illustrate the actual CBDM activity for promotion and expansion to other areas. In this perspective, the CBDM activities will be expanded if DMC and other related agencies prepare proper plans and allocate an appropriate budget for CBDM as the importance of CBDM is already shared among the related agencies as repeatedly mentioned in the previous sections. However, as the officials in DDMCU and/or the Divisional Secretariat may not be able to conduct the workshops by themselves, it is necessary to deploy consultants or NGOs for some time.

- The CBDM activity was carried out using the manuals that were developed in the previous JICA project. The DMC officer in charge of Output 5 was also involved in the CBDM activity of the previous JICA project at a certain level, and his level of understanding on the manual was sufficient. On the other hand, the NGO representative who actually carried out the CBDM workshop and activities successfully completed the expected activities by utilizing the manual and the fliptation, even though he had little experience in the disaster management sector. These facts confirm the effectiveness of the manual and other tools.

- The DMC officer in charge of Output 5 participated in almost all the community workshops. The officer has sufficient knowledge on both community activity and disaster management, and is expected to continue the CBDM as a core member.
- Through the implementation of community activities, the community's awareness on disaster management has been increased. This can be confirmed by the fact that the community people desired disaster management training for the leaders in the discussion of the small-scale disaster management measures. Also, the community members discussed priority measures and managed the given budget to address the facing issues. It was also confirmed that awareness in participation and ownership of the discussion were increased if their ideas lead to actual solutions.

Chapter 4 Overall Summary of the Project

4.1 Significance of the Project

(1) Meaning of the Project for Disaster Management in Sri Lanka

- After the Indian Ocean tsunami disaster in December 2004, GOSL has proceeded with disaster management such as preparation of the Disaster Management Act, establishment of the National Council for Disaster Management, the Ministry of Disaster Management, and the Disaster Management Centre. Through use of the budget of GOSL and support by donor agencies including JICA, the formulation of the necessary plan for appropriate disaster management activities, installation of the equipment and development of human resources has been enabled.
- However, the national disaster management plan and national emergency operation plan that are essential for the disaster management countermeasures and emergency response have not been prepared yet. Although several necessary plans were formulated, some of those plans have not been implemented. Additionally, some of the installed equipment has not been operated or maintained well. DMC's coordination capacity and the technical agencies' technical ability still need to be improved. These factors are the issues to be overcome.
- The Project has supported capacity enhancement of the DMC on preparation of the national emergency operation plan and regional disaster management plan as Output 1, and on operation and maintenance of the early warning system as Output 4. In addition, Outputs 2 and 3 covered the enhancement of the technical capacity of technical agencies including support on operation and maintenance of necessary equipment. The coordination capacity of regional agencies was also enhanced as Output 5.
- Therefore, the activities of the Project do not focus on formulation of the new plans or installation of the new systems, but on the follow-up of the disrupted preparation of the plans, review and activation of the existing plans, appropriate operation of the existing system, effective operation and maintenance of the existing equipment, and enhancement of the basic capacity of technical agencies. It is definitive that the Project implemented the activities that were required by counterparts successfully, though the activities themselves were not so attractive to the public.

(2) Meaning of JICA's Support for Disaster Management in Sri Lanka

- In response to the effort on disaster management by GOSL, JICA has been conducting various types of support on both structural and non-structural measures. JICA has conducted "Comprehensive Study on Disaster Management in Sri Lanka" and "The Project for Improvement of Meteorological and Information Network" to improve the disaster management system in Sri Lanka by utilizing the lessons and experiences from the disasters in Japan. The flood control master plan, early warning and evacuation plan, hydrological information system and intra-governmental network system, equipment for

community-based disaster management activities, an automatic weather station system, etc. have been prepared and introduced through these studies and projects. This Project was conducted to follow up and improve the technology and systems installed by the previous projects.

- Additionally, Output 2 and Output 3 focused on technical support for the technical agencies on which Japan has superiority. This support is being conducted only by Japan and is expected to be continued in Sri Lanka.

(3) Meaning of the Project in International Disaster Management Framework

- As an international framework of disaster management, the "Hyogo Framework for Action 2005-2015" (HFA) was endorsed at the World Disaster Reduction Conference held in Japan in January 2005. The Hyogo Framework for Action specifies the five priorities and priority actions that should be implemented by countries. The following chart shows the relation between the outputs / activities of the Project and the priority actions of HFA. The chart shows that the all outputs and activities of the Project correspond to the priority actions of HFA, and the Project followed the international disaster management framework. Additionally, all activities correspond to "Priority Action 5: Strengthen disaster preparedness for effective response at all levels" and it shows that the Project prioritized the activities for disaster preparedness. Activity 1-5 (Development and implementation of disaster management training program targeting of DMC staff) and Output 5 (Improvement of the disaster management capacities of districts, divisions and communities) cover three priority actions and can be defined as important in an international framework.

Table 4.1.1 Relation between Outputs / Activities of the Project and Priority Actions of HFA

Output/Activities	Priority Action1	Priority Action 2	Priority Action 3	Priority Action 4	Priority Action 5
Activity 1-1	(i)a.	-	-	-	b.
Activity 1-2	-	-	-	-	a., b.
Activity 1-3	-	(i)c.	-	-	b.
Activity 1-4	-	-	-	(ii)f., (iii)o.	b.
Activity 1-5	(ii)e.	-	(ii)k.	-	a., b.
Activity 1-6	-	-	-	-	b., c., d.
Activity 2	-	(ii)e., (iii)i., (iii)k, (iv)l.	-	-	b.
Activity 3	-	(iii)i., (iii)k	-	(i)b., (ii)f.	b.
Activity 4	-	(ii)d., e., f., (iii)k	-	-	a., b., d.
Activity 5	(i)a., (iii)g.	-	(i)a., (ii)l.	-	a., b., c., d.

Hyogo Framework for Action 2005-2015(Appendix 5-1)

(4) Relevance to Climate Change

- In Sri Lanka, the signs of climate change such as the increase in heavy rain and droughts and blurring of the boundary between the rainy and dry season is often mentioned by people. Generally, the disaster risk is growing due to climage change and Sri Lanka will also be one of the affected countries. Development activities are proceeding rapidly in Sri

Lanka. It has been reported that the disaster vulnerable areas are being developed but countermeasures for the areas are scarcely prepared. These activities can be factors that increase the disaster risk.

- Under these circumstances, it is necessary to promote the disaster management activities more often or continuously and improve the activities thoroughly and effectively. Thus, the steady efforts by the Project such as support on operation and maintenance of the existing system and improvement of the existing plans are vital and effective. In particular, the DIA system promoted by Activity 1-4 can respond to the risks that may be increased by the effect of climate change in the near future.

4.2 Results of Technology Transfer and Issues to Overcome

- Results of technology transfer and issues with regard to each output and activity are shown in Chapter 3. They are summarized as follows:

Table 4.2.1 Result of Technology Transfer by Each Output / Activity and Issues

Output/Activity	Result of Technology Transfer	Issues to Overcome
Activity 1-4	・ The system to evaluate and mitigate the possible disasters due to development was established. ・ Counterpart of DMC understands the flow of preparation of the system and has high motivation to undertake the next steps. ・ RDA joined system preparation with strong expectations derived from their past experience. RDA has the understanding and capacity to continue the activities and the motivation to introduce the system to other sectors.	・ Sustainability of the activity after Project termination is an issue. It is necessary to secure the budget and human resources. Additionally, periodical monitoring and technical input by Japanese experts are expected.
Activity 1-6	・ As a response to the flood that occurred in 2011, the evaluation, review and improvement of the Disaster Management Plans of Batticaloa and Matale Districts were conducted. ・ The DMC counterpart was positively involved in the activity and understands its method. The improved DDMP has been distributed to the districts of northeastern regions as a sample to help them prepare the plans independently. ・ In the chapter on emergency response, the role allocation of each relevant agency is mentioned and the smooth emergency response by them is expected.	・ Currently, only the role allocation of each agency is mentioned in DDMP, though it is not mandatory. The detailed activity for each role is not explained. Legalization of the Plan should proceed, and the guidelines (manual) that state the detailed activities by agencies also need to be prepared. Japanese experts are expected to support these activities.
Output 2	・ Operation and maintenance of AWS, short-term weather forecasting by NWP and preparation of regional warning standards were supported by the Project. ・ The DOM counterpart understands and has the capacity to continue the activity.	・ The accuracy of the short-term weather forecast and regional warning standards is still low because the Project supported only the basic activities regarding these. ・ Steady efforts for operation and maintenance of AWS and continuity of the activity to improve the accuracy are expected. Periodical dispatch of Japanese experts is necessary for the monitoring, support and introduction of the activity to other DOM staff.

Output 3	・ Output 3 aimed to cover the installation of the landslide monitoring equipment, observation and analysis by the equipment, design, implementation of the structural countermeasures, and confirmation of their effect. Although the implementation of structural countermeasures and confirmation of their effect were not accomplished, other activities were conducted with NBRO counterparts. For the implementation of the structural countermeasures and confirmation of their effect, the Project team prepared a manual showing a series of necessary actions.	・ Implementation of structural countermeasures based on scientific analysis is expected in other areas. Budget securement and continuous capacity enhancement on the process are necessary. Continuous support by Japanese experts is expected.
Output 4	・ The manual for early warning was prepared. A series of activities was conducted on technology transfer, implementation of the information transfer exercise and its evaluation, and revision of the manual based on the evaluation.	・ The DMC counterpart understands the process of the activity, though they tend to only repeat the implementation of the exercises as they are busy. Full understanding of the evaluation process and improvement for the next exercises is relatively poor. Continuous support by Japanese experts is required.
Output 5	・ Disaster management capacity of regional officers was enhanced through the support on enhancement of operation capacity of district disaster management committees and community level disaster management activities. Both activities motivated the counterparts and community people's positive discussion and consideration on their disaster management by providing the technical support and necessary budget. The counterpart and community people gained successful disaster management experience through the Project activities, which gave them a deeper understanding and a sense of ownership regarding disaster management.	・ The DMC officer understands the process of the activities and needs to promote his experience to staff of other areas. Sustainable implementation and promotion of the activities requires a certain budget. A system for regional agencies to secure the budget under their own initiative is necessary for appropriate implementation of the activities. Continuous monitoring and support by Japanese experts are expected.

- The five outputs of the Project link with each other, while each output targets different counterparts and was conducted independently. As a result, it was not avoidable that the input of the Japanese expert and the budget became smaller for each counterpart agency. The counterpart also insisted on minimal input of the Japanese expert at the terminal evaluation of the Project. On the other hand, compared to the original role of the agencies, the number of staff and the capacity of the counterparts are low and are not adequate for accepting the Project. Due to this situation, the counterpart could not take the initiative to conduct the Project activities and the technology transfer might not be accomplished as originally expected. However, as mentioned above, most activities were implemented as scheduled and the counterpart of each output/activity experienced the whole process of the activities. Therefore, at least, now they have the technical capacity to implement and voluntarily continue the activities.
- Sustainability of the Project activities is one of the issues. Although the counterparts gained the technical capacity to implement the activities as mentioned above, their high motivation and securement of human resources and a budget are vital to continue the activities. Chapter 2

shows the required input of human resources and equipment, and expenses required to conduct the Project activities. Preparation of the necessary budget and continuance of the activities are expected, as referred to in Chapter 2.

- Additionally, the technology transferred by the Project is only one of the techniques that counterpart agencies have required. The following chart shows the techniques that are difficult for the counterpart to enhance independently. Continuous support by JICA is highly expected.

Table 4.2.2 Necessary Techniques to be Gained in the Future and Types of Support

Output/Activity	Necessary Technique	Type of Support
Activity 1-4	・ Discussion on the checklist items by other sectors ・ Discussion on the approval system by a third party ・ Continuity of the Project activities (monitoring and instruction by Japanese)	・ Japanese experts ・ Financial support
Activity 1-6	・ Discussion on legalization of the regional disaster management plan ・ Preparation of the manual on detailed activities based on the role allocation determined in the plans	・ Japanese experts
Output 2	・ Succession of the Project activities (monitoring and instruction by Japanese experts), promotion to other DOM officers	・ Japanese experts, training in Japan
Output 3	・ Succession of the process consisted of installation and observation of the equipment, analysis, design, implementation of the countermeasures and confirmation of their effect (continuous support by Japanese experts)	Japanese experts, pilot projects, training in Japan
Output 4	・ Evaluation of the exercises, and improvement of the next exercises based on the evaluation	・ Japanese experts
Output 5	・ Succession of the Project activities (monitoring and instruction by Japanese experts) and promotion to other areas.	・ Japanese experts

4.3 Lessons and Ideas on Implementation of the Project

- As mentioned above, the counterpart could not take full initiative on the Project activities. Originally, JICA expected the DMC counterparts to work by themselves. However, the DG of DMC insisted the way to outsource the works to subcontractors instead of making the DMMC officers do the works by themselves and to enhance the capacity to instruct and evaluate the outsourced output. Under these circumstances, the Project activities were conducted mainly by Japanese experts and local staff hired by the Project team assisted with the works.

- From the viewpoint of technology transfer to counterparts, the Project team urged the counterparts to understand the concept, process and progress of each output and activity by sharing the progress of activities at suitable times, giving them the chance to chair the counterpart meetings and make presentations at seminars.

- For the sustainability of the Project activities, the Project team organized and explained the items and expenses on the actual activities to counterparts to ensure budget for the future. The Project team also spoke with the DG and secretary to share the understanding on the

importance of sustainability, aiming at a top-down management. For the counterpart officers, the Project team appealed the outputs of activities externally to inspire their motivation.

- As support to DMC, Activity 1-1 (support to NDMCC), Activity 1-2 (support on preparation of NEOP) and Activity 1-4 (support on establishment of DIA system) had some parts that overlapped with support by UNDP. Firstly, this overlapping occurred partly because six months had passed before starting the Project after the Detailed Planning Survey. At a project formulation stage, the counterpart usually requests the same support from multiple donors until the project starts, since the counterpart expects the support on activities that can result in outputs in a relatively short period. UNDP can usually flexibly support counterparts' requests. Therefore, it is necessary for JICA to shorten the period between the detailed planning survey and the start of a project as much as possible, formulate a project as a part of the mid-term plan, etc. Secondly, there is a difference regarding the stance on assistance by JICA and UNDP. The implementation policy of the Project is based on JICA's principles on technical cooperation and aimed at supporting DMC's voluntary implementation technically, while UNDP aimed at undertaking DMC's tasks. How to utilize the merits of both JICA's technical input and UNDP's physical input to conduct the Project effectively should be considered and coordinated.

4.4 Recommendation for Promoting Disaster Management in Sri Lanka

- Three actions, "establishment of disaster management policy and securement of budget," "clarification of role allocation of relevant agencies" and "capacity enhancement for each agency to fulfill its own responsibility" are important for GOSL to promote disaster management. Each action is explained as follows.

(1) Establishment of Disaster Management Policy and Securement of Budget

- Since the war in Sri Lanka, rehabilitation and development have been rapidly proceeding in Sri Lanka. The budget is secured not for disaster management, but rather for development. On the other hand, a concept of disaster management will be required for development to avoid the increase of disaster risk due to unregulated development. While economic development often changes people's attitude toward their environment, effective structural measures can also help people adjust their attitudes toward both the environment and disaster management. Additionally, countermeasures that include both structural and non-structural measures will be essential to tackle the increase of disaster risk due to climate change. Until now, countermeasures such as enhancement of the disaster management system and early warning system, and community disaster management activities were mainly conducted since they were relatively low in cost. However, in the future, not only the present countermeasures, but also structural measures will be promoted. The structural measures should be implemented at the time when the development activity is proceeding, since they will cost more after damage by disasters. However, as is stated above, the budget is secured mainly for development, it is difficult to secure the necessary budget for disaster management.

- As one of the solutions to overcome this situation, establishment of a “disaster management policy” based on the understanding of the necessity for disaster management can be effective. The Project team proposes establishment of a policy that puts the priority on the disaster management sector and securing the necessary budget through the President or higher level’s strong initiative. Input to and policy dialogue with higher ministerial levels can be effective.
- The second solution is mainstreaming of disaster management. It is recommended that budget securement for all development is mandatory. Although this solution also requires strong initiative by higher ministrial levels, it can be feasible since the budget will not have to be secured separately for disaster management.

(2) Clarification of Role Allocation of Relevant Agencies

- NDMP, NEOP and regional disaster management plans should be finalized and activated as soon as possible. According to these plans, role allocation for relevant organizations on the basis of disaster management activities is clarified and each agency can take clear responsibility on their disaster management activities.
- If the responsibilities on structural measures against floods, landslides, cyclones, etc. are clearly determined for each agency, the implementation of structural measures for a vulnerable area should be conducted under the responsible agency. At present, some agencies may try to avoid being involved in the implementation of countermeasures because role allocation is only ambiguously determined.

(3) Capacity Enhancement of Each Agency to Fulfill Its Own Responsibility

- After clarification of role allocation of related agencies, it is necessary to clarify the necessary competency of the officers to fulfill the agency’s role and train the officers based on the defined necessary competency. Off course, it can take time, however it is recommended that DMC take the initiative to prepare a human resource development plan for disaster management and promote the human resource development with other relevant agencies. The human resource development plan can be effective for applying support by each donor agency.
- For example, the responsible agency on implementation of countermeasures in (2) can prepare and propose the budget appropriately by the officers who possess the necessary competency for the agency’s responsibility. Additionally, if the budget is to be secured as mentioned in (1), and the responsible agencies can implement their activities promptly.