



Flood Response Preparedness Plan of Bangladesh, June 2014



Prepared by
Department of Disaster Management
Ministry of Disaster Management and Relief

Abbreviations

ADB	Asian Development Bank
DFAT-Australia	Department of Foreign Affairs and Trade - Australia
BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorological Department
BWDB	Bangladesh Water Development Board
CBS	Cell Broadcast System
CCDMC	City Corporation Disaster Management Committee
CDMP	Comprehensive Disaster Management Programme
CFAB	Climate Forecast Applications in Bangladesh
CFIS	Community Flood Information System
CSD	Central Supply Depot
DANIDA	Danish International Development Agency
DC	Deputy Commissioner
DDM	Department of Disaster Management
DDMC	District Disaster Management Committee
DFID	Department for International Development
DMIC	Disaster Management Information Centre
DoF	Department of Food
DRRO	District Relief and Rehabilitation Officer
EC	European Commission
ECHO	European Commission Humanitarian Aid and Civil Protection
EKN	Embassy of the Kingdom of the Netherlands
EWS	Early Warning System
ERF	Early Recovery Facility
FAO	Food and Agricultural Organization
FCD/I	Flood Control, Drainage and/or Irrigation
FFWC	Flood Forecasting & Warning Centre
GBM	Ganges, Brahmaputra & Meghna
GOB	Government of Bangladesh
GWP	Global Water Partnership
HCTT	Humanitarian Coordination Task Team
HYV	High Yielding Varieties
ILO	International Labour Organization
IMDMCC	Inter-Ministerial Disaster Management Coordination Committee
IOM	International Organization for Migration
IVR	Interactive Voice Response
IWM	Institute of Water Modeling
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
JNA	Joint Needs Assessment
KOICA	Korea International Cooperation Agency
LCG-DER	Local Coordination Group- Disaster Emergency Response
LGED	Local Government Engineering Department

LSD	Local Supply Depot
MoDMR	The Ministry of Disaster Management and Relief
MSL	Mean Sea Level
NDMC	National Disaster Management Council
NDRCC	National Disaster Response Coordination Cell
NEOC	National Emergency Operation Centre
NGOs	Non-Government Organizations
NOAA	National Oceanic and Atmospheric Administration
PDMC	Pouroshava Disaster Management Committee
PIO	Project Implementation Officer
RIMES	Regional Integrated Multi-Hazard Early Warning System
SDC	Swiss Agency for Development and Cooperation
SMS	Short Message Service
SOD	Standing Orders on Disaster
SWMC	Surface Water Modeling Centre
UDMC	Union Disaster Management Committee
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
UzDMC	Upazilla Disaster Management Committee
VGD	Vulnerable Group Development
VGF	Vulnerable Group Feeding
WARPO	Water Resources Planning Organization
WASH	Water , Sanitation & Hygiene
WB	World Bank
WHO	World Health Organization
WMO	World Meteorological Organization

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Executive Summary

Flood is the most common single hazard and phenomenon in Bangladesh. The country is quoted as 'living with flood'. Every year, nearly 18% of the country gets flooded on an average. The worst flood of Bangladesh history is the 1998 flood when nearly 65% of the country affected by flood severely. In last in last 25 years, Bangladesh faced four severe flooding which shows that every 5-10 years' time, a severe flooding occur.

The overall objective of this Emergency Preparedness Plan is to strengthen the existing capacity of the Government to lead and ensure an effective, timely, and coordinated response that will mitigate the risks and reduce the impact of disaster on the communities. The response preparedness plan should be able to address the current needs and issues, which are implementable at all levels from national, local and agency levels and cover all the phases of Humanitarian Response and Recovery.

Any plan requires the active participation of the stakeholders in planning stage as well as in implementation **stage of activities including the post- disaster stage when a review process to be undertaken to identify the effectiveness of plan operations and new challenges.** The Flood Response Preparedness Plan 2014 has been developed through the active participation of disaster management stakeholders and practitioners. Ministry of Disaster Management & Relief (MoDMR) provided necessary leadership in the process through Department of Disaster Management (DDM) to review and update the Flood Response Preparedness Plan 2013. DDM coordinated and facilitated the process to update the plan with technical support of ERF-UNDP. The plan process has started with a letter from DG, DDM to all stakeholders informing the development of response preparedness plan 2014. A template was attached with the letter requesting all stakeholders to provide information about the prepositioning for emergency response in 2014. After consolidation of the information from stakeholders, the Flood Response Plan 2014 was shared with Donors, HCTT, UN, INGOs, CDMP, IFRC-BDRCS, NGOs, AFD and other relevant government departments in a workshop dated 6th July 2014. The workshop was chaired by the Director General, DDM. The Plan was also present to LCG-DER on 10th July 2014. Based on the information, feedbacks, suggestion and comments provided by all stakeholders, the Flood Response Preparedness Plan 2014 is finalized for wider circulation.

In this plan, hazard risks to vulnerable population have been analyzed based on past trends and the FFWC warnings and BMD Flood Prediction for July-September 2014. Two risk scenarios of flood impact on vulnerable population have been projected to estimate the tentative number of population vulnerable to floods in 2014.

According to the BMD 3-months projection, there is a possibility of flooding in the northern districts of Bangladesh. Poverty is one of the key underlying vulnerability factors of people of northern districts. They are also vulnerable to flood and other multiple hazards such as cold wave, riverbank erosion, tornado, etc. on regular basis. A large number of populations of northern Bangladesh depend on daily wage labor. Lack of regular employment and lower wage income increase the economic vulnerability of the population. As a result, their coping capacity towards disasters such as floods is very low.

Based on the analysis of risks, vulnerability and flood prediction, the projected humanitarian support to cover vulnerable people of 33 districts has been developed to be prepared for any flood emergency. For the projected two scenarios of flood, two separate spatial need-based projection of humanitarian assistance given to cover the humanitarian needs during flood.

This plan also consolidated the available prepositioning of the government, INGOs, IFRC-BDRCS, UN and other stakeholders to meet the Humanitarian need in 2014. It also gives a clear picture of available resource and predicted need at the community level in case of flooding. Based on the analysis of existing resource and predicted need, different stakeholders will be able to develop a robust resource mobilization strategy in advance.

Flood (except flash flood) happens in a relatively slower pace with a good chance of early warning. However, there is a good scope to improve the flood early warning mechanism to make it more people centric. Although stakeholders and community in Bangladesh are quite capable of responding to events such as floods, cyclones etc., there is a need for conducting flood response preparedness planning in advance. One reason for conducting response preparedness planning is because it will facilitate a *rapid emergency response* by allowing planners more time for advance preparedness measures for response. Time becomes more valuable once an emergency occurs, so planning before the emergency is very important, when workloads may be less and institutions involved are more flexible in accommodating the needs. Using this Flood Response Preparedness Plan, in advance of Flood emergency, stakeholders will be able to:

- Consider the likely consequences of a flood emergency before it occurs
- Consider different risk scenarios to identify spatial response needs to suit prepositioning
- Conduct capacity assessment to identify the key resources, both human and physical, needed for any flood emergency response.
- Identify the critical areas for immediate action

Another benefit to response preparedness planning is that, before an emergency, there is comparatively more time to consider all the aspects of problems that are likely to arise. Once the emergency has occurred, it may be very difficult to bring all of the players together to discuss the needs. Agreement on policies & procedures in the response preparedness planning stage may help clarify applicability and resolve contradictions that may occur. It will help in filling the policy gaps in providing institutional mandates where needed. *Rapid decision making* on operational issues after an emergency is important because delays may cost lives.

A good Flood Response Preparedness Plan ensures better preparedness for any emergency that may occur, even one that is very different from the scenarios in the plan.

Section I: Introduction and Physical features

1.1 Introduction

Bangladesh is one of the most flood prone countries in the world, which is situated in south Asian sub-continent. A location map of Bangladesh is given in figure 1. Because of its unique geographical location and topography, flood of different magnitudes and types occurs every year. During the last half century at least 8 nos. of extreme flood events occurred affecting 50% of land area. Since early sixties of the last century the country has adopted different kinds of measures for flood management with mixed experiences.

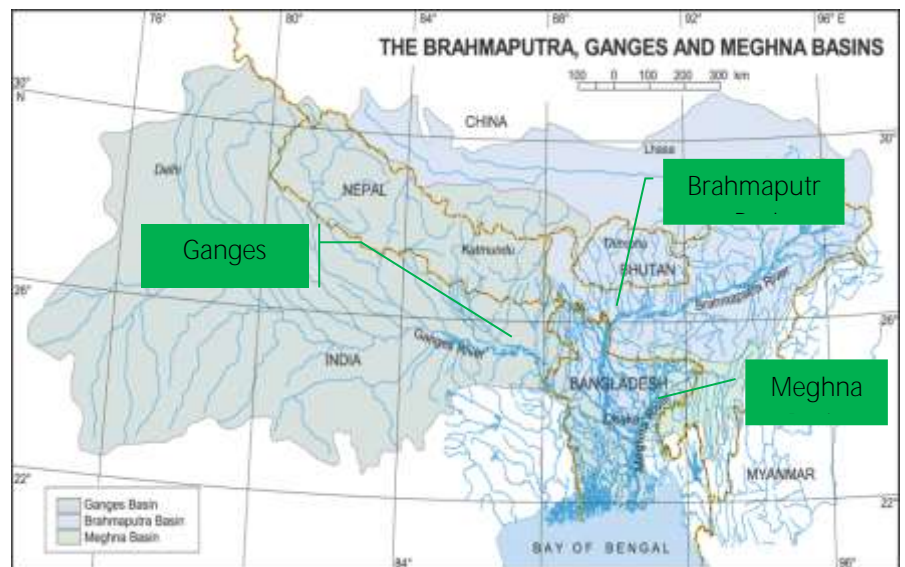


Figure 1: Ganges Brahmaputra and Meghna (GBM) Basin

1.2 Physical Features

1.2.1 Climatic Condition: Bangladesh lies between 20°34" and 26°38" north, between 88° 01", and 92° 41" east. Its climate is tropic and humid. It has mainly four seasons, e.g. Pre-monsoon (March to May), Monsoon (June to September), Post-monsoon (October to November), Dry (December to February). Its climate is influenced by the Indian monsoon. Average rainfall is 2200-2500 mm but the range of which is between 1200 to 6500 mm. 80% of the rainfall occurs during monsoon i.e. from June to September. Average temperature is around 30°C except during the dry season.

1.2.2 Topography: Topography is mostly flat excepting some part in the northeast and southeast, which are hilly. Entire country was formed due to sedimentation of the large river systems e.g. Ganges, Brahmaputra & Meghna. Land Elevation ranges from -3m to 60 m in the plains and in the hilly areas land elevation varies from 100 to 1000 m.

1.3 River Morphology

Bangladesh has 230 rivers of which 57 are trans-boundary Rivers. In all most all cases Bangladesh is a



Figure 2: Hydrological Regions of Bangladesh

lower riparian country. A picture of its river network is also given in the fig. 3. Three large rivers systems e.g. Ganges, Brahmaputra and Meghna, in the world covering a combined total catchments area of about 1.7 million sq. km. extending over Bhutan, China, India and Nepal, flow through this country. Out of these huge catchments only 7% lies in Bangladesh. Rivers are classified into three broad categories depending on the flow range and are as follows:

- i. Major Rivers: 300 to 120,000 cumec e.g., Ganges, Brahmaputra, Padma, Meghna
- ii. Semi major Rivers: 100 to 15000 cumec e.g. Old Brahmaputra, Dhaleswari, Gorai, Arial Khan, Surma, Kushiyara, Teesta etc.
- iii. Minor River: 1 to 1000 cumec e.g. Sitalakhya, Buriganganga, Khowai, Manu, Gumti, Dharla, Dudkumar, Karnafuli, Halda, Sangu etc.

The rivers both big and small gradually became incapable of draining the huge quantity of silt-laden run-off passing through them during the monsoon period and cause floods. Inundation to the extent of 20% area of the country is beneficial for crops and ecological balance. But the flood more than 20% cause direct and indirect damages and considerable inconveniences to the people. The country is extremely flat with low land relief with only a few hills in the southeast and the northeast part of the country. Generally ground slopes of the country extend from the north to the south and the elevation ranging from 60 meters to 1 meter above Mean Sea Level (MSL) at the boundary at Tentulia and at the coastal areas in the south.

1.4 Land Types

Seasonal flooding regime has been characterized by means of inundation land types. Usually, it is classified into 5 categories and detailed description of land type with the area coverage is given in Table 1.

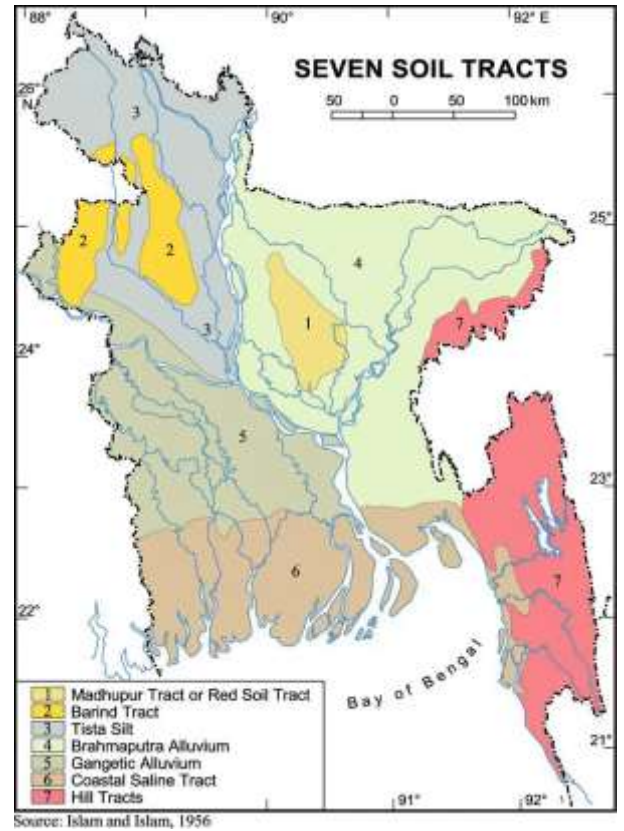


Figure 3: Topography of Bangladesh



Figure 4: River Morphology of Bangladesh

Table 1: Land Types, Description & Area of Bangladesh

Land Type	Description	Area in ha	% Area
High Land	Land above normal inundation	4 199 952	29
Med. High Land	Land normally inundated up to 90 cm deep	5 039 724	35
Med. Low Land	Land normally inundated up to 90-180 cm deep	1 771 102	12
Low Land	Land normally inundated up to 180-300 cm deep	1 101 560	8
Very Low Land	Land normally inundated deeper than 300 cm	193 243	1
Total Soil Area		12 305 581	85
River, Urban etc.		2 178 045	15

Source: *Integrated Flood Management Case Study Bangladesh: Flood Management (Sep 2003 WMO, GWP)*

From the land types it is evident that except high lands all other land types are subjected to flood inundation to different degrees. Normally, 20-25% of the country is inundated during every monsoon from June to September. In case extreme flood events 40-70% area can be inundated, which was amply proved during the extreme flood events of 1954-55, 1974, 1987-88 and 1998. All kinds of land type are distributed all over the country. High lands are situated in some parts of the western, south central, northeastern and southeastern regions of the country. Excepting very low lands, human settlements can be found in all other land categories. Of course population density is high in the Medium High and Medium Low Lands. People live in the Low Lands building earthen mounds.

1.5 Flood Management in Bangladesh

Bangladesh tries to live with flood and disaster with structural and non-structural measures. Systematic structural measures began by implementing flood control projects in sixties after the colossal flood of 1963. Non-structural measures have introduced in seventies which includes early warning system, capacity building of communities and institutions etc. Flooding is a natural phenomenon, which cannot be prevented. Complete flood control is not in the interests of most Bangladeshi farmers. The flood control measures and policies need to be directed to mitigation of flood damage, rather than flood prevention. Resources should be allocated to help people adopt a life style that is conformable to their natural environment. Indigenous solutions such as changing the housing structures and crop patterns can help reduce flood damage. Moreover, good governance, appropriate environmental laws, acts and ordinances will be necessary to achieve sustainable economic development and to reduce any environmental degradation. In addition, implementation of an improved real-time flood and drought control warning system can reduce the damage caused by floods. In recent years, improved forecasting & early warning system and preparedness measures have helped to reduce the number of lives lost and impact on livelihoods by flood.

Section II: Types of Floods in Bangladesh

Basic Factors of Flood in Bangladesh

- Bangladesh has to drain out runoff of an area which is 12 times larger than its size. Only 7% of the combined catchment areas of the Ganges, Brahmaputra and Meghna rivers (i.e., 0.12 Mkm² out of 1.76 Mkm²) are within Bangladesh. The remaining 93 % are distributed over Nepal, India, China and Bhutan.
- Annually, 1,360,000 million m³ of discharge originate outside Bangladesh. About 85 per cent of this discharge is generated between June-October.
- The amount of water which passes over the country can create a pool having a depth of about 9 meters.
- Besides water the rivers also carry high loads of silt from the steep and denuded upstream - an estimated 1.2 to 2.4 billion tons of sediments are carried annually to the Bay of Bengal. The combined, annual sediment load of the Ganges and Brahmaputra is estimated to, be 1185 million tons. Their respective share is 38 % and 62 %.
- About 1/3 of Bangladesh or 49,000 sq. km. area are influenced by tides, in the Bay of Bengal.

The term flood is generally used when the flows in the rivers and channel cannot be contained within natural or artificial river banks. By spilling the river banks, when water inundates flood plains and adjoining high lands to some extent or when the water level in the river or channels exceeds certain stage, the situation then termed as flood (Hossain, 2004).

Floods are annual phenomena, with the most severe occurring during the months of July and August. Regular river floods affect nearly 20% of the country on an average, increasing up to 68% in extreme years. Approximately 37%, 43%, 52% and 68% of the country is inundated with floods of return periods of 10, 20, 50 and 100 years respectively (MPO, 1986). Four types of flood experienced in Bangladesh – Flash flood, River flood, Rain-fed flood and Coastal flood. Area affected by these four types of flood is shown in fig. 5.

2.1 Flash Floods

Flash floods caused by overflowing of hilly rivers in eastern and northern Bangladesh (in April-May and September-November). Flash flood prone areas of the Bangladesh are at the foothills and Haor basin. Intense local and short-lived rainfall often associated with mesoscale convective clusters is the primary cause of flash floods. These are characterized by a sharp rise followed by a relatively rapid recession. Often with high velocities of on-rush flood damages crops, properties and fish stocks of the wetland. Flash flood can occur within a few hours. In the months of April and May flash floods affect the winter rice crop at the harvesting stage, and are common in the districts of Northeast and Southeast regions of the country. In the year 2002, 2004, 2007, 2009 and 2010, flash flood devastated the only winter crop of northeast Haor region severely. Sylhet, Moulvibazar, Sunamganj, Habiganj, Kishoreganj, Netrokona, Rangamati, Bandarban and Khagrachari are main flash flood prone districts.

2.2 River Floods

The word flood is generally synonymous with river flood. River flood is a common phenomenon in the country caused by bank overflow. Of the total flow, around 80% occurs in the 5 months of monsoon from June to October (WARPO, 2004). A similar pattern is observed in case of rainfall also. As a consequence to these skewed temporal distribution of river flow and rainfall, Bangladesh suffers from abundance of water in monsoon, frequently resulting into floods and water scarcity in other parts of the year, developing drought conditions (IEB, 1998). Climatologically, the discharge into Bangladesh, from upper catchments, occurs at different time of the monsoon. In the Brahmaputra maximum discharge occurs in early monsoon in June and July whereas in the Ganga maximum discharge occurs in August and September. Synchronisation of the peaks of these rivers results in devastating floods. Such incidents are not uncommon in Bangladesh. The rivers of Bangladesh drain about 1.76 million sq km area of which 93% lies outside its territory in India, Nepal, Bhutan and China. The annual average runoff of the cross boundary rivers is around 1200 cubic kilometres (WARPO, 2004). All the districts of GBM catchment area are prone to normal flooding during the monsoon.

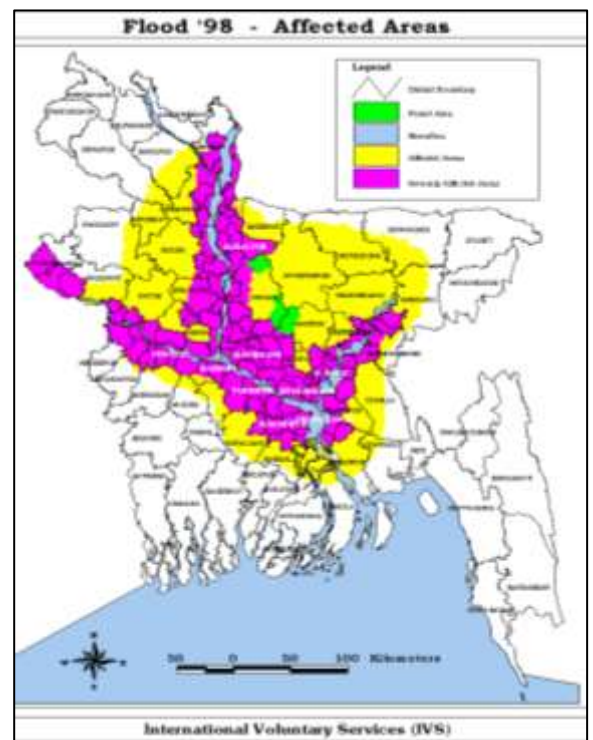


Figure 6: Map of 1998 Flood

2.3 Rain-fed Flood

This kind of flood generally occurs in many parts of the country but is mainly prevalent in the south-western part of the country. This kind of flood also occurs in the flood plains where natural drainage systems have been disturbed either due to human interferences e.g. construction of unplanned rural roads and encroachment of river courses etc. or due to gradual decay of the natural drainage system. When intense rainfall takes place in those areas, the natural drainage system cannot carry the run-off generated by the storm and causes temporary inundation in many localities. This kind of rain-fed flood is increasing in the south-western part and major urban areas. 9 Upazilla of Satkhira, Jessore and Khulna district are facing rain-fed flood and severe water logging from 2000. Major flood and waterlogging crisis occurred in 2000, 2004, and 2011. Dhaka and Chittagong city are regularly facing the urban flooding due to rain-fed situation. In the year 2004, Dhaka urbanites faced a severe urban flooding that lasted for a week. In 2014,



Figure 7: Waterlogging map of 2012 (JNA)

Chittagong city dwellers faced flooding situation due to heavy rain in June 2014.

2.4 Coastal Floods

This kind of flood mostly occurs along the coastal areas of Bangladesh over a coastline of about 800 km along the southern part. Continental shelves in this part of the Bay of Bengal are shallow and extend to about 20-50 km. Moreover, the coastline in the eastern portion is conical and funnel like in shape. Because of these two factors, storm surges generated during any cyclonic storm which is comparatively high compared to the same kind of storm in other parts of the world. During super-cyclones (category 5) maximum height of the surges were found to be 10-15 meter, which caused severe flooding in the entire coastal belt. The worst kind of such flooding occurred in last 45 years were on 12 Nov 1970, 29 April 1991, and 15 November 2007 which caused loss of 300,000 , 138,000 and 3,406 human lives respectively (FFWC, 2011). Coastal areas are also subjected to tidal flooding during the months from June to September due to the southwest monsoon wind over Bay of Bengal.



Figure 8: Map of Coastal Flooding Areas

During super-cyclones (category 5) maximum height of the surges were found to be 10-15 meter, which caused severe flooding in the entire coastal belt. The worst kind of such flooding occurred in last 45 years were on 12 Nov 1970, 29 April 1991, and 15 November 2007 which caused loss of 300,000 , 138,000 and 3,406 human lives respectively (FFWC, 2011). Coastal areas are also subjected to tidal flooding during the months from June to September due to the southwest monsoon wind over Bay of Bengal.

Types of Flood	Period of Occurrence	Mar	Apr	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
		Early Flood			Peak Flood			Late Flood			
Flash Flood	Early	██████████									
	Mid			██████████							
	Late						██████████				
River Flood	Early			██████████							
	Mid					██████████					
	Late							██████████			
Coastal Flood	Early			██████████							
	Mid						██████████				
Rain-fed Flood	Mid						██████████				
	Late								██████████		

Figure 9: Flood calendar of Bangladesh

Table 2: Some notable rain and monsoon induced flood events in the past

Event	Impact
1974 flood	<ul style="list-style-type: none"> ○ Inundated 36% of the country (FFWC, 2005) ○ estimated damages US\$ 57.9 Million ○ over 28,700 deaths
1987 flood	<ul style="list-style-type: none"> ○ Inundated over 57,000 sq-km area ○ estimated damage US\$ 1.0 billion and ○ human death 2055 (The World Bank, 2002)
1988 flood	<ul style="list-style-type: none"> ○ Inundated 61% of the country, persons affected 45 million ○ deaths 2300 ○ damage worth about US\$ 1.2 billion (The World Bank, 2002)
1998 flood	<ul style="list-style-type: none"> ○ Inundated 100,250 sq-km (68%) of the country, persons affected 31 million ○ deaths over 1100 ○ damaged 500,000 homes, 23,500 km roads and 4500 km embankment, destroyed crops of 500,000 ha of land, damage worth about US\$ 2.8 billion (The World Bank, 2002)
2004 flood	<ul style="list-style-type: none"> ○ Inundated 38% of the country, persons affected 36 million ○ deaths 750 ○ damaged 58,000 km roads and 3,100 km embankment, crop damage 1.3 million ha, damage worth about US\$ 2.2 billion (ADB-World Bank, 2004)
2007 Flood	<ul style="list-style-type: none"> ○ Inundated nearly 43% of the country, persons affected 13.3 million ○ Death 831 ○ 81000 houses completely destroyed, a million housing structure severely damaged. Crop damaged approximately 8.9 million ha and thousands of livestock died. 3619 km of roads completely damaged, and 25104 km of road partially damaged. 88 km of embankment washed away while partially damaged 1002 km. 1770 bridge/culverts destroyed. 557 educational infrastructures completely and 7592 partially damaged. 1673 flood shelters damaged, worth of 1.8 billion USD (DMIC SitRep, 22 September 2007).

Source: Bangladesh Water Development Board (BWDB), World Bank, Asian Development Bank, DMIC, Department of Disaster Management.

Section III: Disaster Management System in Bangladesh

3.1 Disaster Management Institutional Framework in Bangladesh

The National Disaster Management Institutional Framework in Bangladesh includes a series of inter-related institutions, at both national and sub-national levels have been created to ensure effective planning and coordination of disaster risk reduction and emergency response management.

The process below illustrates the DM Institutional Framework of Bangladesh.

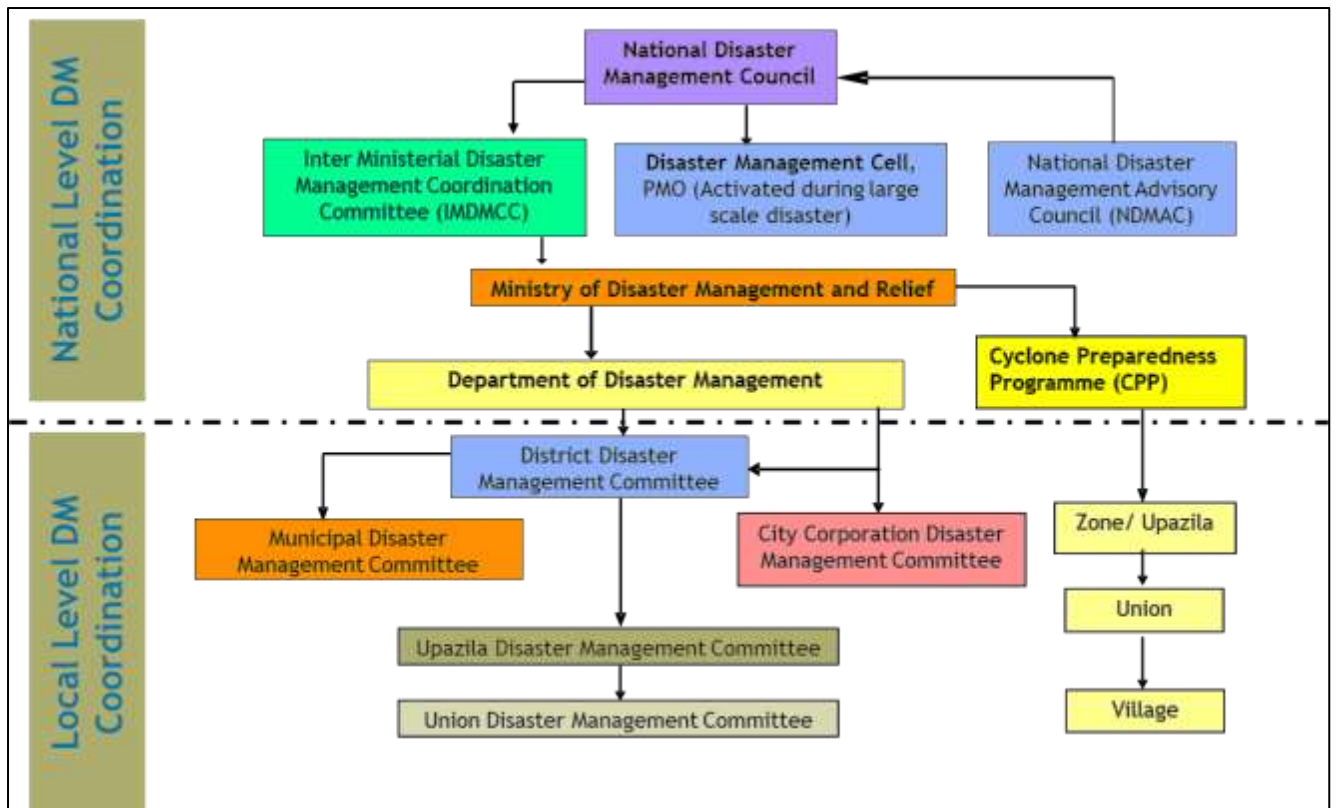


Figure 10: Disaster Management Framework in Bangladesh

At the national level

1. National Disaster Management Council (NDMC) headed by the Honorable Prime Minister to formulate and review the disaster management policies and issue directives to all concerns.
2. Inter-Ministerial Disaster Management Co-ordination Committee (IMDMCC) headed by the Hon'ble Minister in charge of the Ministry of Disaster Management and Relief (MoDMR) to implement disaster management policies and decisions of NDMC / Government.
3. National Disaster Management Advisory Committee (NDMAC) headed by an experienced person having been nominated by the Honorable Prime Minister with 8 members of parliament as its members advises the ministry and DDM to formulate management policies to face the disasters.
4. National Platform for Disaster Risk Reduction (NPDRR) headed by Secretary, MoDMR and DG, DDM functions as the member secretary. This platform coordinates and provides necessary facilitation to the relevant stakeholders.
5. Earthquake Preparedness and Awareness Committee (EPAC) headed by Honourable minister for MoDMR and DG, DDM act as member secretary

6. Cyclone Preparedness Program Implementation Board (CPPIB) headed by the Secretary, MoDMR to review the preparedness activities in the face of initial stage of an impending cyclone.
7. Cyclone Preparedness Programme (CPP) Policy Committee headed by Honourable Minister, MoDMR and Secretary, MoDMR act as member secretary. Disaster Management Training and Public Awareness Building Task Force (DMTATF) headed by the Director General of Department of Disaster Management (DDM) to coordinate the disaster related training and public awareness activities of the Government, NGOs and other organizations.
8. Focal Point Operation Coordination Group of Disaster Management (FPOCG) headed by the Director General of DDM to review and coordinate the activities of various departments/agencies related to disaster management and also to review the Contingency Plan prepared by concerned departments.
9. NGO Coordination Committee on Disaster Management (NGOCC) headed by the Director General of DDM to review and coordinate the activities of concerned NGOs in the country.
10. Committee for Speedy Dissemination of Disaster Related Warning/ Signals (CSDDWS) headed by the Director General of DDM to examine, ensure and find out the ways and means for the speedy dissemination of warning/ signals among the people.

At sub-national levels

1. District Disaster Management Committee (DDMC) headed by the Deputy Commissioner (DC) to coordinate and review the disaster management activities at the District level.
2. Upazila Disaster Management Committee (UzDMC) headed by the Upazila Chairman to coordinate and review the disaster management activities at the Upazila level.
3. Union Disaster Management Committee (UDMC) headed by the Chairman of the Union Parishad to coordinate, review and implement the disaster management activities of the concerned Union.
4. Pourashava Disaster Management Committee (PDMC) headed by Mayor of Pourashava (municipality) to coordinate, review and implements the disaster management activities within its area of jurisdiction.
5. City Corporation Disaster Management Committee (CCDMC) headed by the Mayor of City Corporations to coordinate, review and implement the disaster management activities within its area of jurisdiction.

3.2 Ministry of Disaster Management & Relief (MoDMR)

The Ministry of Disaster Management and Relief (MoDMR) has been given the mandate to drive national risk reduction reform programmes. Its mission relative to this agenda is: **“To achieve a paradigm shift in disaster management from conventional response and relief to a more comprehensive risk reduction culture, and to promote food security as an important factor in ensuring the resilience of communities to hazards”**. MoDMR has the responsibility for coordinating national disaster management efforts across all agencies. In January 1997 the Ministry issued the Standing Orders on Disaster (SOD) which was revised in 2010 to meet the need of the time and to guide and monitor disaster management activities in Bangladesh. Ministry also developed and ensured enactment of Disaster Management Act 2012 through a series of discussion, revision and endorsements.

The revised SOD 2010 has been prepared with the avowed objective of making the concerned department/agencies understand their duties and responsibilities regarding disaster management at all levels, and accomplishing them. All Ministries, Divisions/Departments and Agencies shall prepare their own

Action Plans in respect of their responsibilities under the Standing Orders for efficient implementation. The National Disaster Management Council (NDMC) and Inter-Ministerial Disaster Management Coordination Committee (IMDMCC) will ensure coordination of disaster related activities at the National level. Coordination at District, Upazilla and Union levels will be done by the respective District, Upazilla and Union Disaster Management Committees. The Department of Disaster Management under MoDMR will render all assistance to them by facilitating the process.

3.3 Department of Disaster Management (DDM)

The Department of Disaster Management under the Ministry of Disaster Management and Relief was set up in September 2012 following the enactment of the Disaster Management Act 2012. The Department has the mandate to implement the objectives of the Disaster Management Act by reducing the overall vulnerability of the population from different impacts of disasters by undertaking risk reduction activities; by increasing the efficiency of these activities and by strengthening and coordinating programmes undertaken by various government and non-government organizations related to disaster risk reduction and emergency response. The Department is responsible for executing the directions and recommendations of the Government of Bangladesh concerning disaster management, for advancing the national disaster management principles for implementing the national disaster management planning efforts and for implementing social safety net programmes to enhance the capacity poor and disadvantage through ensuring food security.

Functions and Responsibility of DDM during Flood

- a) To reduce the overall vulnerability from different impacts of disasters by undertaking risk reduction activities
- b) To conduct different activities efficiently boosting the moral and rehabilitation programmes
- c) To strengthen and coordinate programmes undertaken by various government and non-government organizations related to disaster risk reduction and emergency response
- d) To execute the directions, recommendations by government in connection to disaster management
- e) To execute the national disaster management principles and national disaster management planning
- f) To undertake any programme that deems fit supporting the effective disaster management infrastructure for all kinds of disaster.
- g) To implement social safety net programmes in order to enhance the capacity of the poor and disadvantage

3.4 LCG-DER & Humanitarian Coordination in Bangladesh

Multilateral and bilateral Bangladesh based donors and UN agencies are organized under the umbrella of the Local Consultative Group (LCG), to engage in dialogue on development issues with the Government of Bangladesh. There are 18 thematic working groups aligned to the Sixth Five Year Plan. The LCG Working Group on Disaster and Emergency Response (LCG-DER) includes representation of all key stakeholders and is the central forum for Government and its development partners to take strategic decisions and share ideas and information on disaster management. Being one of the 18 thematic working groups of the LCG, the DER is mandated to ensure effective coordination of the national and international stakeholders in the broader scope of disaster management (risk reduction, preparedness, relief/response, and recovery/rehabilitation). The LCG-DER is Chaired by the Secretary, Ministry of Disaster Management and Relief; and Co-Chaired by the UN Resident Coordinator.

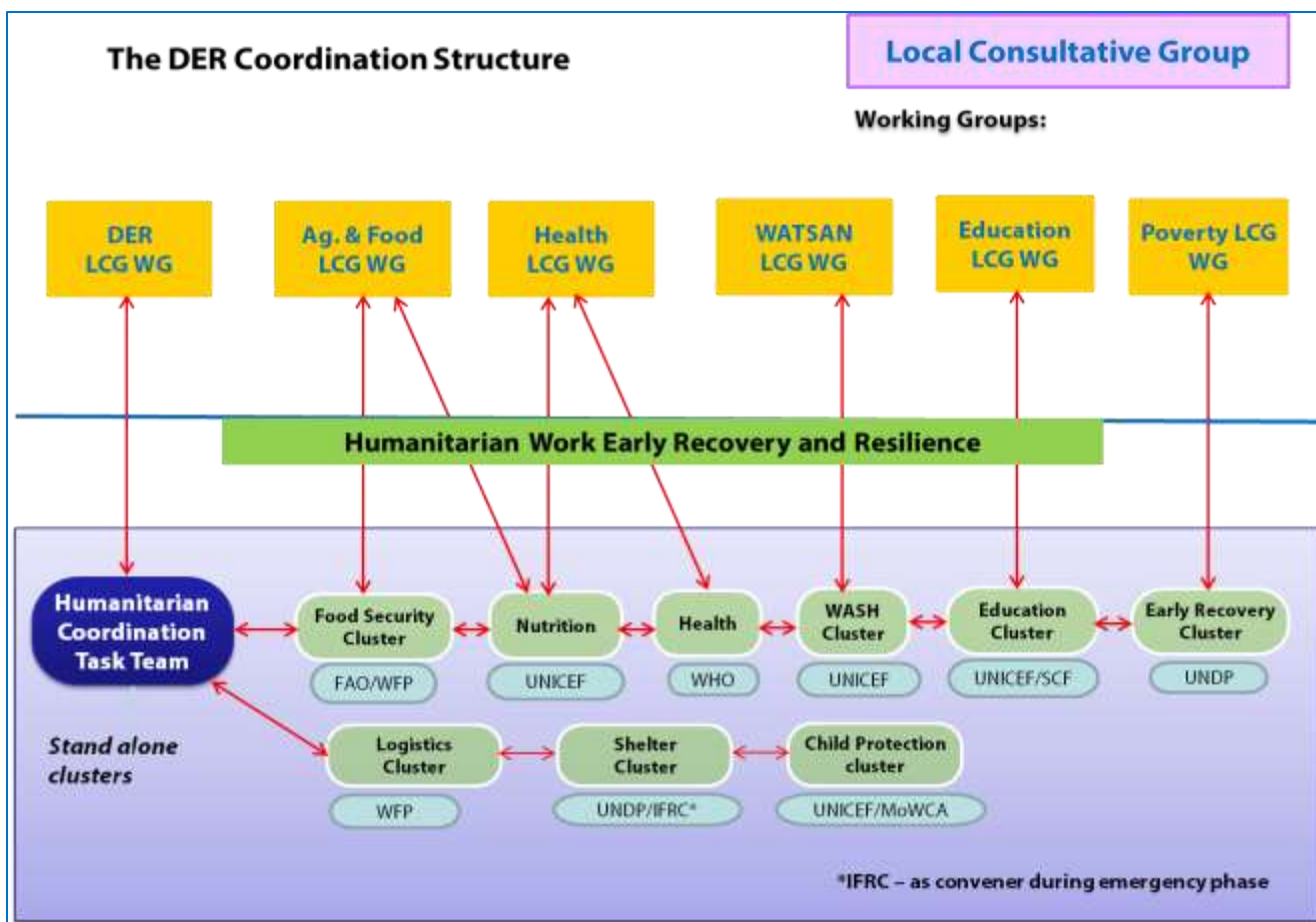


Figure 11: LCG-DER Coordination Structure in Bangladesh

In January 2012, following an in-depth review of the humanitarian coordination system in Bangladesh, a reformed Humanitarian Coordination structure was approved by the LCG-DER. This reformed structure includes the Humanitarian Coordination Task Team (HCTT) with its eight humanitarian clusters (Food Security; Nutrition; Health; WASH; Education; Shelter; Early Recovery; and Logistics). Recently the Child Protection cluster formed under the coordination structure of HCTT. The 09 humanitarian clusters and the respective Government agencies related to these clusters are given below.

Table 3: Humanitarian Clusters and relevant Government Ministry

Cluster	Cluster Lead Agency	Government Linkage
Food Security	WFP and FAO	Ministry of Food
Nutrition	UNICEF	Ministry of Health
Health	WHO	Ministry of Health
WASH	UNICEF	DPHE
Education	UNICEF and Save the Children	Ministry of Education
Shelter	UNDP and IFRC	Ministry of Disaster Management and Relief
Early Recovery	UNDP	Ministry of Disaster Management and Relief
Logistics	WFP	Ministry of Disaster Management and Relief
Child Protection	UNICEF	Ministry of Women and Children Affairs

Each cluster lead agency is tasked with ensuring a coordinated, timely and inclusive response among partners in their respective sectors, in close collaboration with the relevant line ministries and in support of the Government response plan.

LCG-DER act as coordination platform to strengthen the collective capacity of government, national and international actors to ensure effective humanitarian preparedness for, response to, and recovery from the impacts of, disaster in Bangladesh. The HCTT acts as an advisory group to the LCG-DER providing advice, taking forward agreed actions on behalf of, and feeding back to, the wider LCG-DER group.

Section IV: Information Management for Flood Response

Information management for hazard is a key non-structural measure to mitigate loss of lives, livelihoods, assets and properties. For flood, key function of information management is to generate and disseminate flood early warning on time.

4.1 Flood Forecasting and Early warning

The importance of the flood forecasting and warning is widely recognized as a vital non-structural measure to aid mitigating the loss of lives, crops and properties caused by the annual flood occurrence. There are four stages of flood forecasting and Early warning system: Monitoring, Generating, Dissemination and Response.

4.1.1 Monitoring and generating Flood Early Warning

The Flood Forecasting and Warning Centre (FFWC), under the Directorate of Processing and Flood Forecasting Circle, Hydrology, BWDB carries out monitoring of 86 representative water level stations and 56 rainfall stations throughout the country. Bangladesh Meteorological Department (BMD) also provide necessary data on regular rain fall and consolidated long term (one month and three months) rain and flood forecast.

Flood Forecasting and Warning Centre (FFWC)

Flood Forecasting and Warning Centre (FFWC) of BWDB is mandated for preparation of flood forecasting, early warning and its dissemination in Bangladesh (BWDB Act-2000). FFWC was established as a permanent entity at 8th floor WAPDA building, Motijheel, Dhaka, in 1972. It is headed by a Chief Engineer (Hydrology). Currently FFWC is implementing a 5 year consolidation and strengthening programme with DANIDA support.

Major Functions of FFWC are as follows:

- A. Data collection through Satellite Imagery:
- C. Real Time Data Management, and
- D. Flood Forecast Modeling

Flood forecasting models of FFWC are developed on MIKE 11, one-dimensional modelling software used for the simulation of Water Levels and discharges in the river network and flood plains. Presently early warning on floods provides a lead time of 24, 48 and 72 hours for short duration and medium term **experimental 5 days' deterministic flood forecast (see more in www.ffwc.gov.bd)**.

Medium range 10-day lead time probability based flood forecast to a limited number of places (only 18 points) on experimental basis has been initiated under a project of FFWC (available in www.ffwc.gov.bd)

Bangladesh Meteorological Department (BMD)

Bangladesh Meteorological Department (BMD) is the Government agency under the Ministry of Defense. The functions of BMD include: to observe and collect meteorological information for the entire country; to issue early warnings on weather; to provide weather forecasts and climate services; and warnings to the general public and to Government and private sector users including Agriculture, Shipping, Environment, Civil aviation authority, Water resources and Disaster management agencies.

Bangladesh Meteorological Department provides one month and three months' rain and flooding prediction (see more in www.bmd.gov.bd).

4.1.2 Dissemination of Flood Early Warning message:

For dissemination of flood early warning, NDRCC and DMIC are two key functions at national level. These two key functions are well linked to local level and communities through DMCs, NGOs, volunteers and CBOs.

National Disaster Response Coordination Centre (NDRCC)

An Emergency Operation Centre (EOC) at national level is an important prerequisite for effective and coordinated response to any disaster emergency. For this a National Emergency Operation Centre (NEOC) has been setup at Secretariat of the Ministry of Disaster Management and Relief which operates 24x7 to manage information, resources and activities. The Standing Order on Disaster provides that the NEOC is to provide secretarial support to the National Disaster Response Coordination Group (NDRCCG). For the purpose of better communication, it is decided to use the National Disaster Response Coordination Centre (NDRCC) to be equivalent to the NEOC. The NDRCC is situated in building no. 4, room no. 415, Bangladesh Secretariat, Dhaka.

Disaster Management Information Centre (DMIC)

The Disaster Management Information Centre is the information hub of the Ministry of Disaster Management and Relief for risk reduction, hazard early warnings and emergency response and recovery activities.

There are three stages in the early warning dissemination system:

- Disseminating early warning messages from the source agencies (FFWC and BMD) to NDRCC and DMIC/DDM;
- Disseminating early warning messages from NDRCC and DMIC – DDM to DMCs at district, Upazilla and Union level and other stakeholders at national level
- Dissemination of EW from DMCs to NGOs, representatives of the volunteers, community-based organizations and communities and HHS;

Following media are used to disseminate Flood early Warning from national to community level:

4.1.3 Dissemination Media

Internet

Warning messages being disseminated with web portal of Flood Forecasting and Warning Center (www.ffwc.gov.bd)

Email/ Fax/ Telephone / Wireless

Warning message being dispatched via Email/ Fax/ Telephone / Wireless to concerned governmental department

Community Flood Information System (CFIS)

CEGIS has designed Community Flood Information System (CFIS) as a pilot operational system. The function of the system is to reduce vulnerability and enable people to save their assets by producing accurate and

timely flood information using easily understandable mobile SMS.

People-Oriented Area-Specific Flood Warning Dissemination Procedure

FFWC and DHI– Institute of Water Environment jointly introduce people-oriented flood warning dissemination procedure for Upazila and Union level disaster management committee (UzDMC/UDMC) at Union of Khaspukuria under the Upazila of Chowhali in the district of Sirajganj.

Interactive Voice Response (IVR)

In test basis IVR system introduced for disseminating early warning messages on weather forecast, flooding situation, cyclone by cell phone. All telecommunication operators currently operating IVR system to disseminate hazard warning at community level. The messages can be heard by dialing 10941 from any cell phone. IVR system is patronized by Bangladesh Meteorological Department (BMD), FFWC and CDMP.

Community Radio

Short range community radio is a broadcasting system established by the efforts of a specific community, operated by the community **for the purpose of the community's welfare**. **Government licensed 14** community radio stations (two proposed) across the country. Medium radius armature radios are most useful in disseminating flood disaster early warning messages. During flood disaster emergencies it effectively play role in facilitating disaster emergency response in terms of providing information about local actors conducted response programme i.e. supplying serving life savings logistic and 4W(Who, Work, Where, When to do), health hazards related (epidemic) information, safeguarding croplands(pushing saline waters back to sea), safer garbage disposal, improving local drainages, perishing died animals (see more detail in Annex 13)

Section V: Flood Hazard and Risk Analysis for 2014

5.1 Analysis of flood hazard and population at risk in Bangladesh

1998 flood was the worst kind of flooding ever occurred in Bangladesh that affected more than 65% of the country. Based on the past trend of flood in Bangladesh (Table 2) and flood hazard mapping done by CDMP (reference: Hazard Mapping by CDMP in 2013), population of the country is divided into four categories of vulnerability to flood: very highly, high, medium and normal.

A list of very high and high vulnerable population vulnerable to flood is given below:

Table 4: Population vulnerable to flood hazard

District Name	Population				Vulnerability Rank
	Household	Population	Male	Female	
Barisal	513,673	2,324,310	1,137,210	1,187,100	high
Bogra	867,137	3,400,874	1,708,806	1,692,068	high
Brhamanbaria	538,937	2,840,498	1,366,711	1,473,787	Very high
Chandpur	506,521	2,416,018	1,145,831	1,270,187	high
Comilla	1,053,572	5,387,288	2,575,018	2,812,270	high
Dhaka	751,987	3,137,938	1,623,990	1,513,948	Very high
Faridpur	420,174	420,174	420,174	420,174	high
Gaibandha	612,283	2,379,255	1,169,127	1,210,128	high
Gazipur	196,677	825,470	414,083	411,387	high
Gopalganj	249,872	1,172,415	577,868	594,547	Very high
Habiganj	83,574	443,358	220,191	223,167	high
Jamalpur	563,367	2,292,674	1,128,724	1,163,950	Very high
Kishoreganj	627,322	2,911,907	1,432,242	1,479,665	Very high
Kurigram	508,045	2,069,273	1,010,442	1,058,831	high
Kushtia	477,289	1,946,838	973,518	973,320	Medium
Madaripur	252,149	1,165,952	574,582	591,370	Very high
Magura	205,902	918,419	454,739	463,680	Medium
Manikganj	324,794	1,392,867	676,359	716,508	Very high
Maulvibazar	361,177	1,919,062	944,728	974,334	high
Munshiganj	313,258	1,445,660	721,552	724,108	high
Mymensingh	1,155,436	5,110,272	2,539,124	2,571,148	Medium
Naogaon	655,801	2,600,157	1,300,227	1,299,930	high
Narail	162,607	721,668	353,527	368,141	Medium
Narayanganj	675,652	2,948,217	1,521,438	1,426,779	high
Narsingdi	477,976	2,224,944	1,102,943	1,122,001	high
Natore	423,875	1,706,673	854,183	852,490	high
Nawabganj	357,982	1,647,521	810,218	837,303	high

District Name	Population				Vulnerability Rank
	Household	Population	Male	Female	
Netrokona	136,135	644,309	323,472	320,837	Very high
Noakhali	247,952	1,308,495	622,003	686,492	Medium
Pabna	590,749	2,523,179	1,262,934	1,260,245	high
Pirojpur	256,002	1,113,257	548,228	565,029	Medium
Rajbari	238,153	1,049,778	519,999	529,779	Very high
Rajshahi	534,213	2,145,441	1,076,916	1,068,525	high
Shariatpur	247,880	1,155,824	559,075	596,749	high
Sherpur	341,443	1,358,325	676,388	681,937	high
Sirajganj	714,971	3,097,489	1,551,368	1,546,121	Very high
Sunamganj	440,332	2,467,968	1,236,106	1,231,862	Very high
Sylhet	596,081	3,434,188	1,726,965	1,707,223	high
Tangail	870,102	3,605,083	1,757,370	1,847,713	high
Total	18,551,052	81,673,038	40,618,379	41,474,833	

Data Source: BBS Census Survey 2011 & * Flood Zone data FFWC, DWDB, Sep 9, 1998

5.2 Analysis of existing vulnerabilities of the population of Bangladesh

Apart from the exposure to flood and other hazards, persistence of poverty is one of key underlying factor of vulnerability of rural households in the disaster-prone areas of Bangladesh. Flood is one of the factors and processes that have prevented certain groups of people in ecologically vulnerable areas escaping from extreme poverty. Flood refers to the state of seasonal unemployment and deprivation, especially in the northern districts and middle part of Bangladesh. At the same time, the populations of those areas are exposed to other hazards, such as, cold wave, river bank erosion, tornado, hail storm and drought like situation. Impacts of multiple hazards increase the existing vulnerability of the population to a certain level that any small or medium disasters crunched them easily. Other socio-economic conditions such as lack of non-agro based employment, landlessness, malnutrition and lower level of education prevent these population to reduce vulnerabilities. Lack of access to health service, educational institutes, market and other institutions create a progressive vulnerability for these population

5.3 Community Coping Mechanism

Bangladesh is well reputed across the global community for her resilience capacity. Community of the disaster vulnerable Bangladesh has been showing their resilience to cope with the shock of disaster year after year. Community coping mechanism comes into the centre of disaster reduction discussion based on the reality of increasing disaster impact; sharp deficit in supply of public goods and support system; and recognition in the strength of local capacity in coping with such impact. Community coping is understandable within the broad social process, as community and individual apply similar skills, resources, and knowledge and value system to cope with disasters. In Bangladesh, like past community coping strategy is associated with social capital followed by fellow feelings during the crisis. It is evident from the past disaster events that, affluent class in the society rush with assistance what they have within their ability and stand beside the disaster affected community.

Flood-prone zones are the worst off among different disaster prone areas in terms of food shortages, the incidence of extreme poor, insufficient income, illiteracy, and a high concentration of wage labourers. Therefore, as expected, access to government programs like the VGD/VGF is the highest in the flood-prone zones. On the contrary, infrastructural services particularly that of roads, are more prevalent in the ecologically favourable areas.

5.4 Planning Assumptions

- A large proportion of the affected population living under national poverty line. The baseline socio-economic status including access to health, education and other services are low. Kurigram, Lalmonirhat, Gaibandha, Rangpur, and some other districts are historically *multi-hazard* prone (livelihood insecurity lead to food insecurity).
- The immediate humanitarian consequences of the flood include damage to housing, transportation and communication networks, disruption of water systems and sanitation facilities, damage of are loss of livelihoods, destroyed food stocks, disruption to the eco-system and food sources.
- As a result of destroyed crops and livelihoods and possible increases in disease incidence, a rise in acute food shortage and malnutrition is forecast.
- Increased vulnerability of children, women and elderly people, the disabled and chronically ill.
- The priority immediate needs are potable water, rehabilitation of water sources, food assistance, medical services, temporary shelter and search and rescue services.
- Repair and rehabilitation of damaged embankment to stop further flooding is also needed.

5.5 Projection of priority humanitarian needs

Two scenarios of flooding and population at risk are taken into consideration for response preparedness plan 2014 considering the prediction of BMD (July –September 2014)¹. Two scenarios, along with humanitarian consequences and priority needs, are elaborated in the following section.

Scenario 1



Flood situation covering 10 districts of Bangladesh which are very severe and moderate level vulnerable to flooding. According to the vulnerability rank of the districts, more than 600,000 HHs (approximately 2.9 million people) are highly vulnerable to flood in the north part of Bangladesh.

Projected need for Scenario 1

Analysis based on poverty index, past trend of floods and other vulnerability indicators, it is predicted that more than 600,000 people will be affected by flood in Bangladesh. Of them, 100% families will need food, WASH and Health support. On the other hand, more than 200000 people will need emergency shelter kits and family kits support.

¹ BMD Bulletin dated 03.07.14 (see www.bmd.gov.bd)

District Name	District wise total Household	% Extreme poor/ Lower poverty ²	District wise vulnerability index to Flood ³	Total Affected Household ⁴	Needs Analysis				
					Family Food Packages ⁵	Emergency Shelter Kit ⁶	Family Kit ⁷	Water & Sanitation ⁸	Emergency Health Kit ⁹
Jamalpur	215,970	47.1	Severe	86,388	86,388	28,508	28,508	86,388	86,388
Tangail	196,117	27.2	Moderate	39,223	39,223	12,944	12,944	39,223	39,223
Bogra	211,534	31.1	Moderate	42,307	42,307	13,961	13,961	42,307	42,307
Lalmonirhat	91,444	36.4	Severe	36,578	36,578	12,071	12,071	36,578	36,578
Kurigram	220,171	53.2	Severe	88,068	88,068	29,063	29,063	88,068	88,068
Rangpur	287,532	49.9	Severe	115,013	115,013	37,954	37,954	115,013	115,013
Gaibandha	183,203	38.5	Severe	73,281	73,281	24,183	24,183	73,281	73,281
Sirajganj	226,736	36.6	Severe	90,694	90,694	29,929	29,929	90,694	90,694
Sylhet	39,837	5.8	Moderate	7,967	7,967	2,629	2,629	7,967	7,967
Sunamganj	139,193	28.2	Moderate	27,839	27,839	9,187	9,187	27,839	27,839
Grand Total	1,811,737			607,358	607,358	200,428	200,428	607,358	607,358

 Highly Vulnerable District as per 1998 Flood
 Very Highly Vulnerable District as per 1998 Flood

Scenario 2

Flood situation, covering 17 districts of Bangladesh which are ranked as severe and moderate level vulnerable to flooding. More than 700,000 HHs (approximately 3.5 million people) are highly vulnerable to flood in these districts of Bangladesh.

Projected need for Scenario 2

Again, based on analysis of poverty index, past trend of floods and vulnerability indicators of population, it is predicted that more than 700,000 people will be affected in 17 districts. Among the affected people, 100% will need food, WASH and Health care support while nearly 250,000 people will need shelter kits and family kits support.

² Data taken from World Bank, WFP & BBS, 2005

³ Based on flood vulnerability and % of extreme poor with reference to national poverty rate

⁴ Total affected households = 20% of the moderately affected households, and 40% of the severely affected households

⁵ Need for Family Food Package = 100% of the total affected households


⁶ Need for Emergency Shelter Kit = 33% of the total affected households

⁷ Need for Family Kit = 33% of the total affected households

⁸ Need for Water and Sanitation Support = 100% of the total affected households

⁹ Need for Emergency Health Kit = 100% of the total affected households

District Name	District wise total Household	% Extreme poor/ Lower poverty ¹⁰	District wise vulnerability index to Flood ¹¹	Total Affected Household ¹²	Needs Analysis				
					Family Food Packages ¹³	Emergency Shelter Kit ¹⁴	Family Kit ¹⁵	Water & Sanitation ¹⁶	Emergency Health Kit ¹⁷
Faridpur	130,082	34.0	Severe	52,033	52,033	17,171	17,171	52,033	52,033
Jamalpur	215,970	47.1	Severe	86,388	86,388	28,508	28,508	86,388	86,388
Manikganj	73,822	26.5	Moderate	14,764	14,764	4,872	4,872	14,764	14,764
Munshiganj	54,357	18.8	Moderate	10,871	10,871	3,588	3,588	10,871	10,871
Rajbari	63,827	30.4	Moderate	12,765	12,765	4,213	4,213	12,765	12,765
Shariatpur	55,017	23.8	Moderate	11,003	11,003	3,631	3,631	11,003	11,003
Tangail	196,117	27.2	Moderate	39,223	39,223	12,944	12,944	39,223	39,223
Chandpur	90,359	18.7	Moderate	18,072	18,072	5,964	5,964	18,072	18,072
Laxmipur	64,672	18.7	Moderate	12,934	12,934	4,268	4,268	12,934	12,934
Bogra	211,534	31.1	Moderate	42,307	42,307	13,961	13,961	42,307	42,307
Lalmonirhat	91,444	36.4	Severe	36,578	36,578	12,071	12,071	36,578	36,578
Kurigram	220,171	53.2	Severe	88,068	88,068	29,063	29,063	88,068	88,068
Rangpur	287,532	49.9	Severe	115,013	115,013	37,954	37,954	115,013	115,013
Gaibandha	183,203	38.5	Severe	73,281	73,281	24,183	24,183	73,281	73,281
Sirajganj	226,736	36.6	Severe	90,694	90,694	29,929	29,929	90,694	90,694
Sylhet	39,837	5.8	Moderate	7,967	7,967	2,629	2,629	7,967	7,967
Sunamganj	139,193	28.2	Moderate	27,839	27,839	9,187	9,187	27,839	27,839
Grand Total	11,719,359			739,802	739,802	244,135	244,135	739,802	739,802

 Highly Vulnerable District as per 1998 Flood
 Very Highly Vulnerable District as per 1998 Flood

¹⁰ Data taken from World Bank, WFP & BBS, 2005

¹¹ Based on flood vulnerability and % of extreme poor with reference to national poverty rate

¹² Total affected households = 20% of the moderately affected households, and 40% of the severely affected households

¹³ Need for Family Food Package = 100% of the total affected households

¹⁴ Need for Emergency Shelter Kit = 33% of the total affected households

¹⁵ Need for Family Kit = 33% of the total affected households

¹⁶ Need for Water and Sanitation Support = 100% of the total affected households

¹⁷ Need for Emergency Health Kit = 100% of the total affected households

Section VI: Response & Recovery Preparedness in advance to Flood 2014

6.1 Flood Response Preparedness Objectives

The Disaster Management Act (2012) outlines the following directives concerning declaration of a “disaster” and directives concerning the disaster area:

Government can direct the relevant ministries, department, sections, semi government organizations and committees formed under this act to execute the following tasks whenever any area is declared as in a state of disaster as per section 22 and sub section (1)

- To ensure the availability of the stock of assets under government and non-government custody in the disaster affected area
- To ensure availability of additional assets if needed
- To ensure the safety and security of common people and rule of laws
- To undertake effort in reducing damage of properties and lives
- To undertake every effort needed as per the local disaster management planning

Officers from relevant government ministries, departments, sections as well as non-government organizations are obliged to execute the directives under sub section (1)

The overall objective of this Flood Response Preparedness Plan is to strengthen the existing capacity of the Government to lead and ensure an effective, timely, and coordinated response that will mitigate the risks and reduce the impact of disaster on the vulnerable communities.

6.2 Process of developing the Flood Response Preparedness Plan 2014

Any plan requires the active participation of the stakeholders in planning stage as well as in implementation **stage of activities including the post- disaster stage** when a review process to be undertaken to identify the effectiveness of plan operations and new challenges. The Flood Response Preparedness Plan 2014 has been developed through the active participation of disaster management stakeholders and practitioners. Ministry of Disaster Management & Relief (MoDMR) provided necessary leadership in the process through Department of Disaster Management (DDM) to review and update the Flood Response Preparedness Plan 2013. DDM coordinated and facilitated the process to update the plan with technical support of ERF-UNDP. The plan process has started with a letter from DG, DDM to all stakeholders informing the development of response preparedness plan 2014. A template was attached with the letter requesting all stakeholders to provide information about the prepositioning for emergency response in 2014. After consolidation of the information from stakeholders, the Flood Response Plan 2014 was shared with Donors, HCTT, UN, INGOs, CDMP, IFRC-BDRCS, NGOs, AFD and other relevant government departments in a workshop dated 6th July 2014. The workshop was facilitated by DG, DDM. The Plan was also present to LCG-DER on 10th July 2014 to get feedback and suggestions. Based on the information, feedbacks, suggestion and comments provided by all stakeholders, the Flood Response Preparedness Plan 2014 is finalized for wider circulation.

6.3 GOB Standard Operating Procedures (SOP) for Emergency Response

Government of Bangladesh (GOB) has developed a SOP to ensure timely emergency response to any hazard including flood and cyclone. The table 6 describes the responsibilities and activities of GOB at national and local level for first three months any emergency situation (Source: Cyclone Emergency Preparedness Plan 2013, DDM).

Table 5: Standing Operating Procedure (SOP) – adopted from Cyclone Emergency Preparedness Plan 2013

Timeline	Actions	Responsible
0-24 hours (after declaration of Flood situation as Emergency by concerned authority)	<ul style="list-style-type: none"> o Initial data collection through SOS form o Report to the MoDMR through DDM-DRRO-PIO o As per SOD, DDMC calls emergency meeting where responsibilities of relevant district level officials define in responding to disaster emergency. Similarly, UZDMC and UDMC meetings convene. o Provide initial first-hand information on loss and damage to the NDRCC/DMIC o Set up control room at district, Upazilla and union level o Step towards allocation of immediate lifesaving relief items o Initiation for undertaking search and rescue operations 	PIO, UNO DRRO, DC DDM, MoDMR Relevant Departments at district and Upazilla level
24-72 hours	<ul style="list-style-type: none"> o Undertake detailed loss and damage assessment through D-form o Report to the MoDMR through DDM-DRRO-PIO o Emergency relief allocation (GR Rice, GR Cash, Emergency shelter materials) upon receipt of demand from the concerned DC and distribution o Monitor the relief distribution o Coordinate with relevant officials for deployment of medical team and fire service and civil defence o Supervise first aid, search and rescue operations 	PIO, UNO DRRO, DC DDM, MoDMR Relevant Departments at district and Upazilla level
1 week - 4 week	<ul style="list-style-type: none"> o Analyze and authenticate findings of D-form o Completion of D-form and determine allocation of recourses towards working out rehabilitation programme o Follow-up the implementation of decisions taken in the DMC at local level o Relief and recovery coordination engaging relevant ministries and departments o Coordination at the local level as to ensure proper distribution avoiding duplication of efforts o Send out monitoring team from DDM to oversee the response work on ground o Should require external assistance, arrange meeting at the national level (Headed by Prime Minister or headed by the Minister of Disaster Management and Relief as per SOD) o Provide vehicle support to the DC, UNO for proper monitoring of emergency response o Prepare response report and send back to the MoDMR 	PIO, UNO DRRO, DC DDM, MoDMR Relevant Departments at district and Upazilla level

Timeline	Actions	Responsible
2 month - 3 month	<ul style="list-style-type: none"> ○ Undertake rehabilitation activities (livelihood, housing and others) ○ Coordinate with other relevant departments (livestock, health, DPHE, Education, Agriculture and so on) for joint efforts in rehabilitation ○ Arrange DMC meeting at district, Upazila and union level ○ Undertake monitoring visit ○ Coordinate with non-government organizations working on response and recovery ○ Prepare response and recovery report and send back to the MoDMR 	PIO, UNO DRRO, DC DDM, MoDMR Relevant Departments at district and Upazila level

6.4 Need assessment: tools and approach

In line with the Disaster Management Act 2012, DDM is mandated to coordinate all activities related to disaster management, including needs assessments. During and after a crisis, strategic and operational decision-makers need reliable information to help them set priorities, identify gaps, and respond to the needs. The DDM uses the SOD (2010) prescribed SOS Form and D-Form for assessing the damage, losses, and needs following disaster events. DDM utilizes its field officials based at the district (DRRO) and Upazila level (PIO), and concerned departments at district and Upazila level for collecting damage and loss information right after¹⁸ disaster using SOS-form and D-Form.

The SOS-Form provides an initial scope of the disaster and the need for response – an approximate number of people affected and initial needs. It is to be completed within one hour by DMC after the event and sent to DDM and NDRCC through sub-district authority.

The D-Form provides initial quantitative estimates of the magnitude of a disaster's impact on people, property, infrastructure and livelihoods.

Joint Needs Assessment¹⁹

In response to uncoordinated assessment practice that took place during the water-logging in July and August 2011, the November 1st 2011 meeting of the LCG-DER formed a Task Force on Joint Assessment methodology. The meeting identified the urgent need to standardize assessment tools, approaches and methodologies for coordinated assessment. On 24th May 2012, the LCG-DER adopted the Joint Needs Assessment (JNA) methodology to be led by the Government operated in several key stages: Phase 0 for preparedness for assessments; Phase 1 in the initial 72 hours; Phase 2 during two weeks after a disaster event. The JNA focuses on humanitarian needs and ensures that the specific needs of affected people are responded to in real time and as part of a process of joint assessment and response. As illustrated below (Figure 10), the JNA uses quantitative data from the SOS-Form and D-Form received from the respective DMCs. Based on the Phase 1 and Phase 2 Joint Needs Assessment findings, decision is made whether or not to undertake further in-depth sector specific needs assessment.

¹⁸ Refer to the GOB SOP above

¹⁹ (by the HCTT <http://www.lcgbangladesh.org/HCTT.php>)

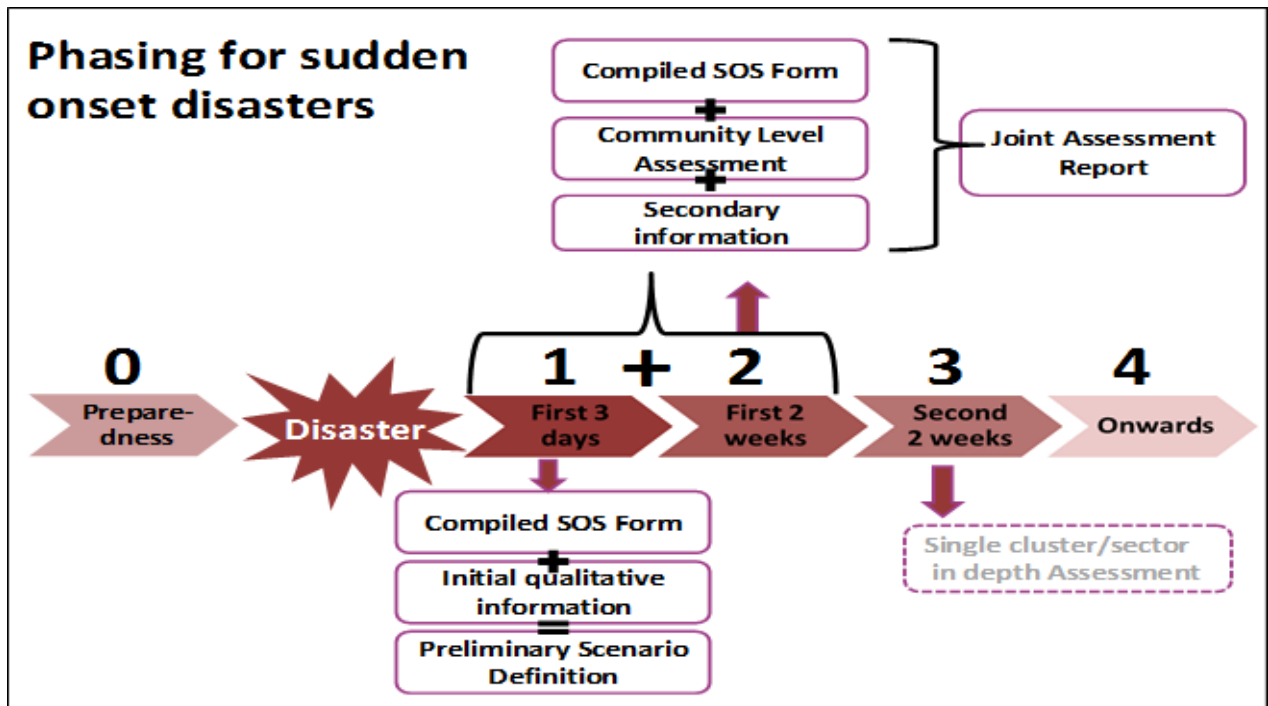


Figure 12: Phase 1, Phase 2 and Phase 3 Assessment Process

Key Lessons Learned from JNA

- The JNA conducted in 2012 provided timely and high quality analysis for response planning.
- Participating stakeholders need to be prepared and skilled in order to facilitate and conduct an effective JNA.
- A dissemination strategy for the assessment results that has been identified during the planning stage will speed up the sharing of information and promote ownership and inclusion by all stakeholders.
- In line with the approved JNA methodology, Government leadership and participation in JNA to be ensured.

6.5 Local level Preparedness

- DMC meetings at district level: As part of preparedness for flood, Deputy Commissioner of the flood vulnerable district organizes DMC meeting to start preparation for flood season and pre-positioning of relief items and other preparedness as necessary.
- DMC meetings at Upazila level: As part of preparedness for flood, Upazila Nirbahi Officer (UNO) organizes DMC meeting to start preparation for flood season. UP Chairman in the flood vulnerable Unions communicate the message to their respective villages.
- Emergency contact list: DDM has recently updated emergency contact address of the concerned officials at the field level.
- Pre-positioning of emergency relief items: Government and non-government actors have some emergency relief items pre-positioned as preparedness for all hazards including flood. A detail list of contingency stock is given in Table 7 and prepositioning is given in Annex 9.

The current statistics confirm that, there are 99 flood shelter centers in the flood prone districts in Bangladesh (Figure 18). Detailed information on the location of the flood shelter is provided in Annex 7.

6.6 Pre-positioning of Relief Items

As part of readiness ahead of flood in 2014, the Government of Bangladesh and other relevant stakeholders (national and international) have started taking stock of relief and other materials so as to embark upon response right after flood. Based on information collected, a table below represents the current stock readily available with the different actors including the government of Bangladesh:

Table 6: Contingency Stock for Humanitarian Crisis for the year 2014/15 by GoB and Other Humanitarian Agencies for the year 2014

Items	Stock by GoB (July 2014- June 2015)	Stock by other Humanitarian Agencies (January – Dec 2014)	Total Contingency Stock
Cash	BDT 200,000,000	BDT 37,016,377	Cash BDT 237,016,377
Food Items	GR Rice 80,000 Metric tons	Cash BDT 2,500,000 Food Packages for 2,000 households Dry Food for 2,350 households Wheat 280 Metric tons Vegetable Oil 29 Metric tons Peas 14 Metric tons	Cash BDT 2,500,000 GR Rice 80,000 Metric tons Food Packages for 2,000 households Dry Food for 2,350 households Wheat 280 Metric tons Vegetable Oil 29 Metric tons Peas 14 Metric tons
Non-Food Items	-	Cash BDT 2,500,000 Non Food Items 16,155 packages Blankets 7,000 pieces Clothes 15,594 pieces Mobile kitchen 03 number Kitchen kits 9,005 sets Bathroom kit 2,500 sets Polyoven bag 500 pieces Earth and Debris Removal Tools 03 sets Safety Equipment 16 sets Life Jacket 50 pieces Boya 45 numbers Boat 21 numbers Generator 02 numbers Warehouse 03 numbers	Cash BDT 2,500,000 Non Food Items 16,155 packages Blankets 7,000 pieces Clothes 15,594 pieces Mobile kitchen 03 number Kitchen kits 9,005 sets Bathroom kit 2,500 sets Polyoven bag 500 pieces Earth and Debris Removal Tools 03 sets Safety Equipment 16 sets Life Jacket 50 pieces Boya 45 numbers Boat 21 numbers Generator 02 numbers Warehouse 03 numbers
Emergency Shelter	Cash BDT 140,000,000 CI Sheet 46,650 Bundles	Cash BDT 2,500,000 Emergency Shelter 2,014 numbers Tarpaulin 12,440 pieces Plastic Sheet 2,219 pieces CI Sheet 200 bundle Shelter Toolkit 2,013 sets Rope 11,030 rolls Mosquito net 10,000 pieces	Cash BDT 142,500,000 Emergency Shelter 2,014 numbers Tarpaulin 12,440 pieces Plastic Sheet 2,219 pieces CI Sheet 46,850 bundle Shelter Toolkit 2,013 sets Rope 11,030 rolls

Items	Stock by GoB (July 2014- June 2015)	Stock by other Humanitarian Agencies (January – Dec 2014)	Total Contingency Stock
		Bamboo 170 pieces	Mosquito net 10,000 pieces Bamboo 170 pieces
Water and Sanitation	-	Cash BDT 10,081,400 Water Treatment Plant 32 numbers Water Tank 40 numbers Water Purifying Tablet 19,750 pieces Water Purifying Powder 1,134,860 packets Water Jerri Can 13,889 pieces Hygiene Kits 3,974 sets Tube well kits 2,182 sets Sanitation Kits 3,003 sets Latrine Kits 400 sets Soap 11,283 pieces Buckets 2,500 pieces Mug 1,000 pieces Bathing Corner 10 numbers	Cash BDT 10,081,400 Water Treatment Plant 32 numbers Water Tank 40 numbers Water Purifying Tablet 19,750 pieces Water Purifying Powder 1,134,860 packets Water Jerri Can 13,889 pieces Hygiene Kits 3,974 sets Tube well kits 2,182 sets Sanitation Kits 3,003 sets Latrine Kits 400 sets Soap 11,283 pieces Buckets 2,500 pieces Mug 1,000 pieces Bathing Corner 10 numbers
Education	-	Cash BDT 2,500,000 Education Materials 18,025 sets	Cash BDT 2,500,000 Education Materials 18,025 sets
Emergency Health	-	Cash BDT 10,081,400 Medical Camp 12 numbers Satellite Clinic 48 numbers Emergency Medicine for 2,000 households Menstrual Kits 4,000 sets First Aid Box 08 numbers Skilled Health Service Providers 74 persons Breastfeeding Corner 10 numbers Medical team and adequate medicine of WHO all the upazillas and district Health Complexes	Cash BDT 10,081,400 Medical Camp 12 numbers Satellite Clinic 48 numbers Emergency Medicine for 2,000 households Menstrual Kits 4,000 sets First Aid Box 08 numbers Skilled Health Service Providers 74 persons Breastfeeding Corner 10 numbers Medical team and adequate medicine of WHO all the upazillas and district Health Complexes

Source: Information Collected through 3W Matrix by DDM

Emergency Food

Department of Food (under Director General of Food) is the custodian of stockpile of food grain across the country. DoF having infrastructures of comprehensive storage facilities with CSD, Silos and LSD godown in all over the country (for detail list, see Annexure 12) and figure 16 map showing location of CSD & Silos. On

disaster onset 1,000,000 (10 lac) MT food grain made readily available for emergency relief and response through local LSDs. During any emergency situation for flood, DDM forwards request to DoF to allocate GR and other food assistance. DoF immediately provide the allocation to DDM which are distributed under supervision of DCs of districts from LSDs. As a part of Response Preparedness, in 2014, DDM has made allocation of GR to 64 districts through DoF.

Emergency Health

The Ministry of Health has established a National Health Crisis Management Centre and Control Room to respond to crisis. Surveillance Medical Teams with necessary equipment are also in place. With the support of WHO, district and Upazilla level health centers have emergency stock of 44 essential life-saving drugs and medicine for any emergency response which are regularly replenished.

Emergency Communication

Recognizing the vitality of strong telecommunications networks for humanitarian relief efforts, MoDMR and DDM are working to establish a robust emergency communications program that brings resources and mobile technology infrastructure to support the critical role of communications in disaster response. MoDMR is currently entrusted with the Disaster Management Information Network (DMIN), a web portal, is linked with all DMCs, other government agencies, NGOs and private citizens with risk reduction and emergency response resources hosted in an internet portal. DMIN portal is coordinated by Disaster Management Information Center (DMIC) at DDM. DMC at District, Upazilla are connected by internet.

Search and Rescue

Currently 31 active rescue boats with capacity to accommodate 25 to 30 people during flood rescue. Figure 18 Map showing district wise distribution of rescue boats and details provided in Annexure-14.

Section VII: Resource Mobilization Strategy

7.1 Government sources for financing disaster relief and recovery

The 2012 Disaster Management Act constituted Disaster Management Fund at national level (National Disaster Management Fund) and at district level (District Disaster Management Fund). Resource also mobilized from prime Minister's Fund, private sector and individual contribution. Besides this as per the SOD, Ministry of Finance ensures quick allocation of fund meeting Relief and recovery as per request of NDMC during any disaster

Currently funds are mobilized by MoDMR from annual budget of GoB. For 2014-15, MoDMR mobilized BDT 34,00,00,000 (approximately USD 4.3 million) as cash support and 80,000,000 metric tons of rice as GR support for the for the disaster events during the fiscal year from July 2014 to June 2015. Following table elaborates the allocation for fiscal year 2014-2015 from GoB:

Table 7: Annual Allocation of Resource by MoDMR and DDM for the fiscal year July 2014- June2015

Sl. no.	Item of Humanitarian Assistance	Amount
1.	Gratuitous Rice (GR)	80,000,000 metric tons
2.	GR Cash	20,00,00,000.00 BDT
3.	Corrugated Iron sheet	46,650 bundle
4.	House repairing support	14,00,00,000.00 BDT

MoDMR through DDM allocated BDT 7,900,000.00 (approximately USD 100,000.00) as GR Cash and 3,900,000 metric tons of GR rice to DCs of 64 district for primary emergency response as per the Humanitarian assistance Guideline 2012-2013 of GOB.

7.2 Non-government sources for financing disaster Response and Recovery

There are several humanitarian organizations that proactively join the Government in supplementing humanitarian efforts and provide support for emergency response and early recovery. These include:

- *Multilateral and bilateral donors such as the World bank, ADB, ECHO, DFID, EC, USAID, SDC, DFAT-Australia, JICA, EKN, KOICA, WB, ADB*
- *UN Agencies: WFP, UNICEF, UNDP, FAO, WHO, ILO, IOM*
- *Red Cross and Red Crescent: IFRC, BDRCS*
- *International and national NGOs: NGOs working in Disaster Risk Management and Emergency Response*
- *Private Sector: Banks, corporate sector, industrial sector*

7.3 Resource Mobilized by GOB and other humanitarian stakeholders for 2012 and 2013

Following table shows the total amount of resource allocated by stakeholders including GOB, UN, IFRC-BDRCS and NGOs in Bangladesh for the year 2012 and 2013.

Table 8: Resource Mobilization from different sources in 2013 and 2012

Resource Mobilisation by Different Organisation	Response in 2013		Response in 2012	
	Value in BDT	Percentage	Value in BDT	Percentage
GoB Response	2,450,861,400	65.29	8,522,905,838	71.47
NGOs Response	826,313,294	22.01	2,511,697,297	21.06
UN Response	226,142,711	6.02	747,648,000	6.27
IFRC and BDRCs Response	250,382,144	6.67	143,528,195	1.20
Total	3,753,699,549	100.00	11,925,779,330	100.00

7.4 Lessons learned from last two years resource mobilizations

There are number of lessons drawn from resource mobilization efforts of humanitarian actors in Bangladesh. Here, two lessons are drawn from the Bangladesh Report 2013 – Disaster Preparedness, Response and Recovery (source: DDM, MoDMR).

- a) Disaster management fund need to be established at district level according to the commitment of DM Act 2012 to enable local government to respond in any emergency timely and efficiently.
- b) Investment in immediate humanitarian response is essential to save lives and to prevent outbreak of diseases but equally indispensable is an increased effort by the government and development partners to allocate adequate resource to ensure an affected community's smooth transition from relief to recovery and eventually to resilience.

Annex 1: Organizations engaged on Flood Management

Organizations and their responsibilities as regards flood management are given below:

- Water Resources Planning Organization: Macro planning of water resources Management;
- Bangladesh Water Development Board: Feasibility Studies, Implementation, Operation and Maintenance of Flood Management Projects, Real Time Data Collection for Flood Forecasting and Warning Services, Dissemination of Flood information at national and regional levels;
- Local Government Engineering Department (LGED): LGED engaged in construction/reconstruction, maintenance of local government infrastructures (rural/urban) mainly road, small bridge/culverts, water control structures etc. LGED also maintain disaster damage database on local level infrastructures.
- Joint River Commission: To conduct negotiation for data and information exchange on Trans-boundary rivers;
- Bangladesh Meteorological Department (BMD): Long, medium and short range weather forecasting and dissemination.
- Local Government Engineering Department: Implementation. O&M of Small Scale FCD projects;
- Disaster Management Bureau (DMB): Dissemination of all information on natural disaster including flood information at community level, Flood Preparedness awareness building etc.
- Directorate of Relief: Conducting Relief and Rehabilitation operation in flood hit areas;
- Local Government Institutions (LGI): Implementation and O&M of small scale flood management project, Flood Information Dissemination, Relief and Rehabilitation of flood victims;
- Non-Government Organizations (NGO): Advocacy for flood management, Relief and Rehabilitation of flood victims.

Water Resources Planning Organization (WARPO)

Water resources planning in Bangladesh dates back to 1964 when a 20 year Master Plan was prepared by the then EPWAPDA (Now BWDB). Several important studies were undertaken after the severe flooding in 1954 and 1955; Krug Mission Report of 1957, General Hardin's Report of 1963 and Professor Thijsse's Report of 1964 are the most important among them. The Master plan of 1964 had emphasis on large-scale flood control, drainage and irrigation projects to enhance agricultural production which shaped the water sector development till 1975. Water Resources Planning Organization (WARPO) was established in 1992 to carry out the task of national water planning as a continuing exercise.

Routine Core Functions of WARPO:

1. Monitoring implementation of the National Water Management Plan (NWMP) and its impact
2. Upkeep of water resource assessments
3. Maintenance, updating and dissemination of the National Water Resources Database (NWRD) and MIS
4. **Functioning as a "clearing house"**
5. Secretariat to the National Water Resources Council (NWRC) and the Executive Committee of the National Water Resources Council (ECNWRC)
6. Responding to the NWRC/ECNWRC requests for information and advice

Institute of Water Modelling (IWM)

Institute of Water Modelling (IWM) provides world-class services in the field of Water Modelling,

Computational Hydraulics & Allied Sciences for improved integrated Water Resources Management. The applications of IWM modelling tools cover a wide range of water related areas such as: flood control, flood forecasting, irrigation and drainage, river morphology, salinity and sediment transport, coastal hydraulics, port, coast and estuary management, environmental impact assessment, bridge hydraulics and related infrastructure. IWM owes its genesis to the Surface Water Simulation Modelling Programme (SWSMP) launched in 1986 by the Ministry of Water Resources under the Master Planning Organization to develop a high level of analytical capabilities by use of state-of-the-art mathematical water modelling.

By the end of 1996, SWMC was transformed into an independent organisation under the Trust Act. From the 1st of August, 2002 Surface Water Modelling Centre (SWMC) has been renamed as Institute of Water Modelling (IWM) in matching with its research and learning status created in its user community

IWM services are offered through six divisions. These are: Irrigation Management, Water Resources Planning, River Engineering, Flood Management, Survey and Data, and Coast, Port and Estuary Management. The central functions are managed through a number of units. These are : Human Resource Development, Research and Development, Quality Management, System Management, GIS and Information Technology.

IWM has developed a very comprehensive database covering almost the entire country for a long period; the database is computerized and is maintained online.

Flood Forecasting and Warning Center (FFWC)

The importance of the flood forecasting and warning is widely recognized as a vital non-structural measures to aid the mitigating the loss of lives, crops and properties caused by the annual flood occurrence. The Flood Forecasting and Warning Centre, under the Directorate of Processing and Flood Forecasting Circle, Hydrology, BWDB carries out monitoring of 86 representative water level stations and 56 rainfall stations throughout the country. The principal outputs are the daily statistical bulletin of floods, river situation, a descriptive flood bulletin, forecast for 24, 48 & 72 hours about 52 monitoring points, production of Upazila Status Map, Satellite Imageries, special flood report along with different graphical and statistical presentation during the monsoon season. The Centre is also involved in preparation of flood status report on National level, a weekly bulletin during dry season and monthly and annual flood reports. The Centre is responsible to act as a focal point in respect of flood from the month of April to November as per Government order for formulating the flood forecasts that are issued with the river situation bulletin and also provide support services to DMB, BMD and SPARRSO during cyclonic disaster.

Annex 2: Causative Factors of Flood in Bangladesh

Climatologically, the country has two distinct seasons, a dry season from November to May and the wet (flood) season from June to September (or October). Over 80% of the rainfall occurs during the monsoon or rainy season when flooding normally occurs.

Floods in Bangladesh occur for number of reasons. The main causes are excessive precipitation, low topography and flat slope of the country; but others include:

Monsoon downpour: An increased amount of precipitation can cause flooding. An above normal monsoon downpour in the Ganges-Brahmaputra-Meghna drainage system is thought to be the primary cause of the 1988 flood in Bangladesh (GOB and UNDP, 1989; Brammer, 1990).

The geographic location and climatic pattern: Bangladesh is located at the foot of the highest mountain range in the world, the Himalayas, which is also among the highest precipitation zone in the world. This rainfall is caused by the influence of the south-west monsoon. The confluence of three major rivers, the Ganges, the Brahmaputra and the Meghna and the runoff from their vast catchments (about 1.76 million km²) passes through a small area. Only 7% of these catchments lie within Bangladesh. During the monsoon season the amount of water entering Bangladesh from upstream is greater than the capacity of the rivers to discharge in to the sea.

Bangladesh is a land of rivers: there are about 230 major and minor rivers in the country. Most of the rivers flow from north to south direction while some of those flow from east to west to keep a natural balance of water flow along the catchment areas. The total annual runoff of surface water flowing through the rivers of Bangladesh is about 12,000 billion cubic meters.

Man-made environment: the construction of embankments in the upstream catchments reduces the capacity of the flood plains to store water. The unplanned and unregulated construction of roads and highways in the flood plain without adequate opening creates obstructions to flow from north to south and east to west. As a result, most of the east-west bound rivers died or dried out due to obstructed natural flow. Damming of a river reduces the velocity of water flow downstream from the dam. As a result of reduced velocity, the sediments carried by the river start to settle down faster on the riverbed, causing riverbed aggradation and in turn reducing the water carrying capacity of the river (Shalash, 1982).

The influence of tides and cyclones: the frequent development of low pressure areas and storm surges in the Bay of Bengal can impede drainage. The severity of flooding is greatest when the peak floods of the major rivers coincide with these effects.

Long term environmental and climate changes: climate changes influence the frequency and magnitude of flooding. A higher sea level will inhibit the drainage from the rivers to the sea and increase the impact of tidal surges. Deforestation in hilly catchments causes more rapid and higher runoff, and hence more intense flooding. The Springtides of the Bay of Bengal retards the drainage of floodwater into the sea and locally increases monsoon flooding. A rise of MSL at times during the monsoon period due to effect of monsoon winds also adversely affect the drainage and raise the flood level along the coastal belt. The rate of local relative sea level rise is 7 mm/year around the coastal areas of Bangladesh (Emery and Aubrey, 1990). The backwater effect caused by sea level rise can result in more flooding of land from "piled

up" river water inland (Warner, 1987). This certainly seems to be one of the reasons for the increase in flood intensity in recent years in Bangladesh.

Riverbed aggradation: Riverbed aggradation is most pronounced for the Ganges and its distributaries. From the border with India to the point where the Ganges meets the Brahmaputra River, the riverbed has aggraded as much as 5 -7 meters in recent years (Alexander, 1989b). According to a study done by Kalam and Jabbar (1991), the average width of the Ganges has decreased from 1.27 km in 1973 to 1.01 km in 1985. Riverbed aggradation is so pronounced in Bangladesh that changes in riverbed level can be observed during one's lifetime. For example, the Old Brahmaputra River was navigable for steamers only about 30 years ago, and is presently an abandoned channel. This situation is true for many other distributaries of the Ganges and Meghna Rivers, such as the Madhumati, Bhairab, Chitra, Ghorautra Rivers, etc. Riverbed aggradation reduces the water carrying capacity of rivers, causing bank overflow. This recent increase in riverbed levels has undoubtedly contributed to the increased flooding propensity in Bangladesh.

Soil erosion: Ploughing makes the land surface more susceptible to soil erosion. Surface run-off can easily wash away the topsoil from cultivated lands. This surface erosion reduces land elevations, which in turn increase flood intensity in an area. According to the Report of the Task Forces (RTF) on Bangladesh Development Strategies for the 1990s (1991), soil erosion is a serious problem in many parts of Bangladesh. Hilly areas in Sylhet, Chittagong, and Chittagong Hill Tract districts are more susceptible to soil erosion. About 55% of Chittagong Hill Tract area is highly susceptible to soil erosion (RTF, 1991). Heavy monsoon showers remove the surface soil through runoff. Eroded sediments are deposited on the riverbeds, reducing the water carrying capacity and increasing flooding propensity in a watershed. Soil erosion also reduces land elevations and increases elevations of riverbeds, contributing to increased flood depths. The land elevations in other parts of Bangladesh must have been reduced over time due to soil erosion. Aside from this, the tilling on the mountain slopes of the Himalayas is thought to be responsible for massive soil erosion in Nepal (Dregne, 1987; Thapa and Weber, 1991; Sharma, 1991), which eventually causes rapid riverbed aggradation in Bangladesh (Alexander, 1989a). Moreover, construction sites in cities can contribute to soil erosion if silt fences or retention ponds are not employed properly (Allen, 1999). In Bangladesh, no such measures are in practice at construction sites.

Local Relative Sea Level Rise: The ultimate destination of all rivers is the ocean. The land elevation is measured with respect to sea level in an area. Therefore, any change in sea level causes land elevation to change. At the present time sea level is rising globally (Pilkey et al., 1989). If sea level rises in an area at a rate faster than the rate of land aggradation due to sedimentation, then land elevation decreases. Any decrease in land elevation can cause increased inundation by rivers overflowing at bank full stage.

Inadequate Sediment Accumulation: The only way for land to counter the effects of a rising sea is for sediment to accumulate at a rate that is sufficient to keep pace with the rate of sea level rise. Limited data show that the average sediment accumulation rate for the last few hundred years in the coastal areas of Bangladesh is 5-6 mm/year, which is not enough to keep pace with the rising sea level (Khalequzzaman, 1989). As a result, net land elevations must have been decreasing over time, resulting in more flood inundations.

Subsidence and Compaction of Sediments: Sediments on a delta plain are rich in decomposed organic matter, and are subject to compaction due to dewatering and the weight of the overburden. Most deltas subside due to the weight of the thick sediment layer. Subsidence along with compaction reduces land

elevation with respect to the rising sea level (Pilkey et al., 1989). Even though the rate of subsidence and compaction are not yet well documented, based upon our knowledge about processes active in other deltas it can be assumed that Bangladesh's delta is also undergoing subsidence and compaction.

Deforestation in the Upstream Region: A rapid increase in population in the Indian Subcontinent over the course of the present century has resulted in an acceleration of deforestation in the hills of Nepal to meet the increasing demand for food and fuel wood (Bajracharya, 1983; Ives, 1989; Sharma, 1991). Deforestation of steep slopes is assumed to lead to accelerated soil erosion and landslides during monsoon precipitations. This in turn is believed to contribute to devastating floods in the downstream regions such as in Bangladesh (Hamilton, 1987; The NY Times, 1988; Alexander, 1989a).

Specific Physical/Natural causes of flooding in Bangladesh

Bangladesh is a very low lying country, with 70% of its land area being less than 1m above sea level and 80% of it being floodplain.

- Bangladesh receives large amounts of water passing through it with two major rivers (the Ganges and Brahmaputra) converging and forming a huge delta (see figure 4) formed from silt deposited by the river as it enters the sea. Both rivers have large volumes of water flowing through them to the sea as they have large drainage basins which increasing the flood risk;
- The main cause was the above average and long period of heavy rain which caused all 3 rivers to have their peak flow at the same time.
- Bangladesh has a monsoon climate and the annual torrential rains which result often result in the rivers exceeding their capacity and flooding;
- In the spring, melting snow from the Himalayas further increases the flood risks as torrents of melt water enter the rivers at their source.
- Most of the country consists of a huge flood plain and delta.
- Two-thirds of the country is less than 5 meters above the sea level; and susceptible to river and rain water flooding and in low lying coastal areas, to tidal flooding during storm (MoWR, BCCSAP 2009)
- 10% of the land area is made up of Lakes and Rivers.
- Tropical storms bring heavy rains and coastal flooding.

Specific Human causes of flooding in Bangladesh:

- Increasing population pressure in the foothills of the Himalayas where the rain contributes to the source of the River Ganges and Brahmaputra has resulted in intense deforestation. It is believed that this reduction in interception has resulted in more water entering the rivers - indeed with 92% of the area drained by the rivers being in countries other than Bangladesh.
- Deforestation in the headwaters is also believed to be responsible for the increased soil erosion which has led to large amount of silt being washed into the rivers and subsequently being deposited on the river bed, reducing its channel capacity and increasing the likelihood of flooding.
- Increasing population pressure in Bangladesh itself has resulted in the sinking of many new wells resulting in the lowering of the water table and the subsequent subsidence of land making it even more prone to flooding
- Urbanization and human habitation of the flood plain has increased magnitude & frequency of floods.
- Global warming is blamed for sea level rise, increased snow melt & increased rainfall in the region.

- The building of dams in trans-boundary Rivers of upper riparian countries has increased the problem of sedimentation in Bangladesh.
- Poorly maintained embankments (levees) leak & collapse in times of high discharge.

Annex 3: The causes and impacts of one of the most severe Flood

Case of Flood 1998

The 1998 flooding of Bangladesh was one of the most destructive flooding events in modern world history - about two-thirds of Bangladesh was covered by the waters of the Brahmaputra, the Ganges and the Meghna rivers.

Effects

The floods covered over 68% of Bangladesh in water and some part of the capital Dhaka was submerged under two meters of water for more than three weeks. The 1998 flood lasted for 65 days from July 12 to September 14 1998. 31 million people were made homeless and the death toll reached over 1100. The flooding caused contamination of crops and animals and unclean water resulted in cholera and typhoid outbreaks in most of the rural areas. Few hospitals were functional because of damage from the flooding and those that were had too many patients, resulting in everyday injuries becoming fatal due to lack of treatment. 700,000 hectares of crops were destroyed, 400 factories were forced to close, and there was a 20% decrease in economic production. Communication within the country also became difficult. Most of the destruction occurred in the Ganges Delta. The floods did deposit fertile soil and silt, which meant better growing conditions for crops the next season.

Consequences

Immediately following the 1998 floods, a number of short-term relief measures were put in place to try and minimize loss of life. International aid programs provided food and the Government of Bangladesh introduced Vulnerable Group Feeding (VGF) programme for the poor people. Government of Bangladesh also distributed free seed to farmers to try and reduce the impact of food shortages (the government also gave 350,000 tons of cereal to feed people). Volunteers and aid workers worked to try and repair flood damage.

A number of measures were suggested to help prevent future flooding, such as upstream dam construction and major embankments around Dhaka, however, lack of money has meant that these suggestions have not been taken any further. Also, the United States of America donated SPARRSO, a weather station to monitor weather patterns, as well as predicting the next storm, flood or heavy rainfall.

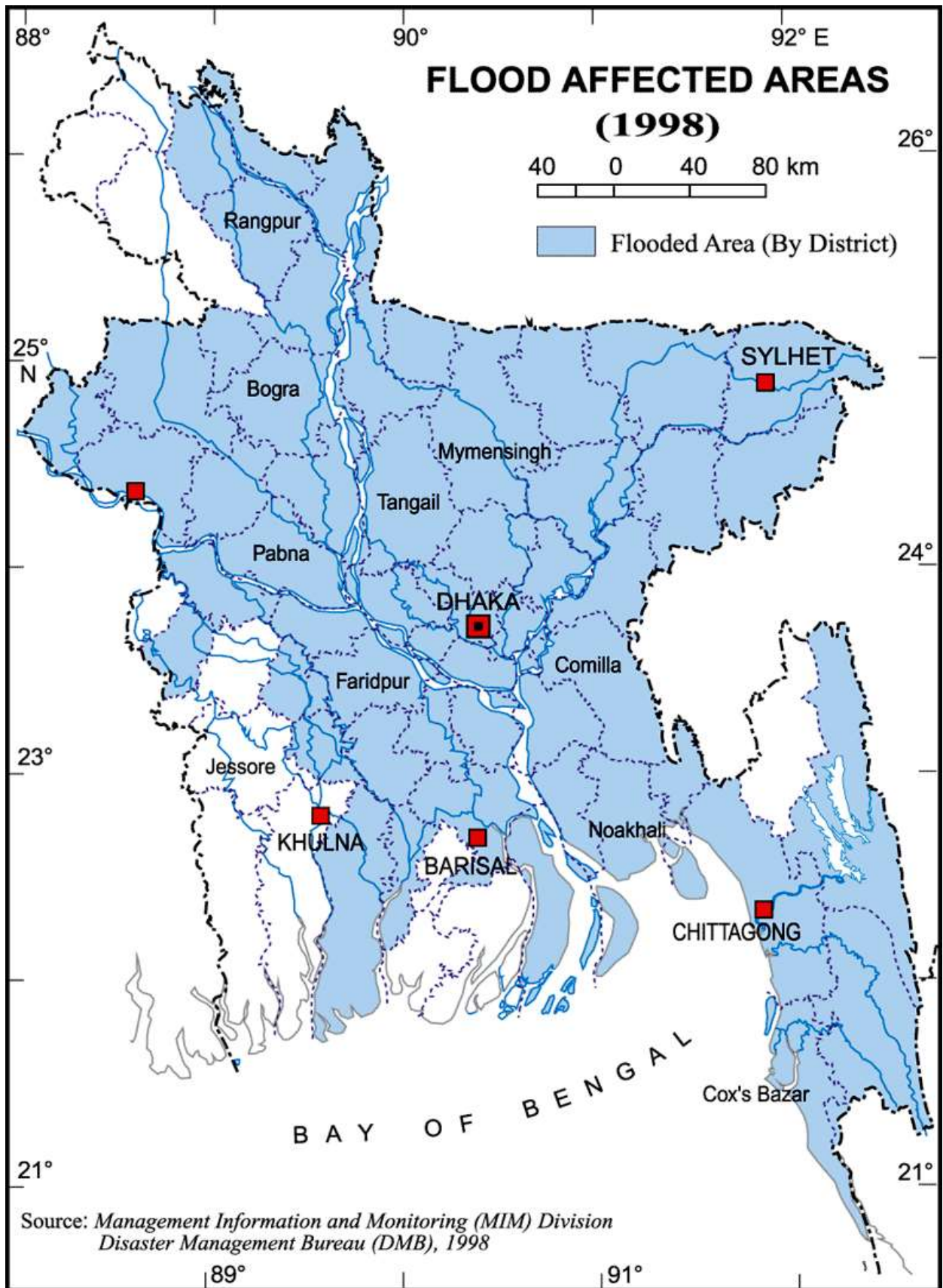


Figure 13: Severity and extent of flood in 1998

Case of Flood 2007

The 2007 floods came in two waves. The first wave commenced around the 24th July 2007 and initially affected Nilphamari, Lalmonirhat and Kurigram, Sherpur, Jamalpur, Sylhet, Sunamgonj districts. In following days Rangpur Gaibandha, Bogra, Sirajgonj were flooded, and subsequently the other districts were inundated up until about the 6th August. This represented about 39 districts. The second wave commenced on the 5th September and continued up until the 15th September 2007 when some new districts apart from the previous 39 were flooded. A total of 46 districts were affected to varying degrees during both flood waves. Refer to the attached map.

Effects

The flood inundated about 32000 sq. km. including the char areas of 6000 sq. km. affecting almost 16 million people in around 3 million households. Thousands of people also suffered from flood related health hazards. Eighty five thousand (85,000) houses were completely damaged, while almost one million suffered partial damages. 649 persons were reported to have died either as a direct impact of the flood or through flood related causes including bridge collapse or boat capsizing. A number of children drowned as a result of swimming in flood areas. A number in addition to this perished as a result of diseases caused by contaminated water and poor sanitation.

Consequences

The structures related to water management are considered in this section. This includes the levee, embankment, drainage channel, irrigation canal, sluice gate, regulator, bridge culvert and approach road to bridge. The water development board consolidated report on cumulative damages of the structures is BDT 5549.7 (USD 81.6 million). Some of the major damaged elements on 2007 are the Brahmaputra right embankment have damaged in some areas partially (Rangpur and Bogra districts), in some areas fully (Sirajganj and Gaibandha). Rangpur Town protection embankment, Sirajganj town protection embankment. Netrokona Kalmakanda embankment of 500 meter, East side of Gaokanda embankment, Lakhar char to Betua bazaar road cum embankment, and some other critical structures damaged by flood in 2007.

Office buildings, markets, schools, roads (paved roads, earth roads, carpeted roads, feeder roads), bridge and culverts, tube-wells, latrines, health centers, handlooms were damaged due to the disaster. According to Roads and Highways department, about 55% of roads were affected by the 2007 flood which is in length of 2,344 km. A total 52 bridges were damaged (1811 meter in length). The LGED reported a total of 14,294km roads (paved and unpaved) were damage in 46 districts. The flood washed away 849 bridge and culverts and 14 Union council buildings and 8 growth centers. A total of 70,367 tubewells were inundated and contaminated. According to directorate of Primary Education 8,668 primary schools were partially damaged and 205 primary schools need to be rebuilt. The education engineering department reported that a total 15 schools were fully damaged and 3,559 were partially damaged.

A total about 1.12 million ha of cropland were either partially or fully damaged in this flood which accounted the 42165.8 (million Taka (BD 22270.63 in 1st spell flood and 19895.25 in 2nd spell flood). These loses are from the private farms of the standing crops (Taman, seeding, broadcast aman, jute and vegetable). The death of livestock which estimates was BDT 5.8 million. Considering the losses accounted for milk, meat, egg, infrastructural damage of the total livestock sector is 608.55 million (Table 2). The fisheries sector losses are BDT 1,965 million which included the losses from fish fingerlings, fishes, shrimp, and

fisheries infrastructures. The forestry sector estimated the damage and losses is Taka 37.80 million which includes damage of trees, nursery and infrastructures.

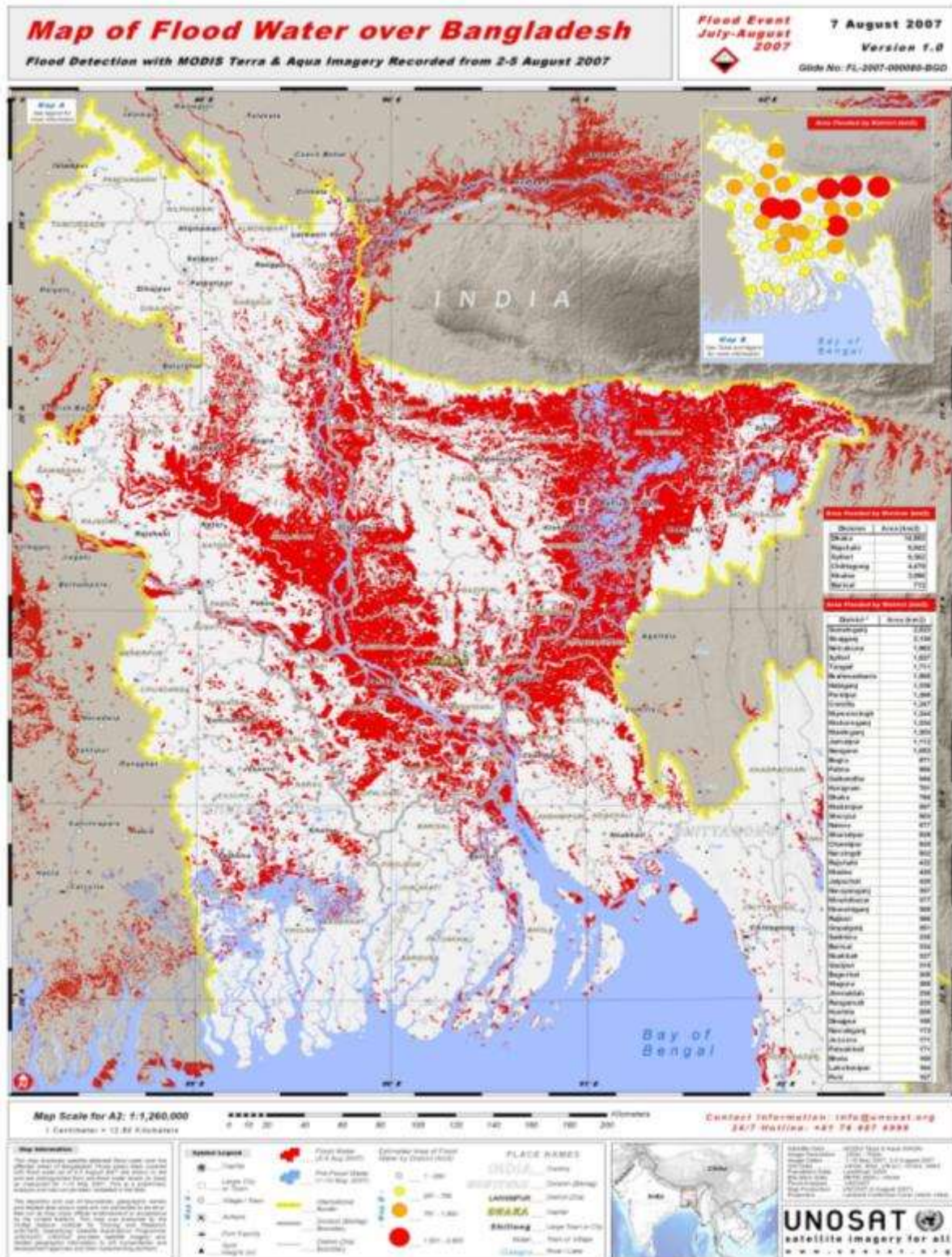


Figure 14: Flood Map 2007

Annex 4: Year-wise percentage of area inundated by Flood in Bangladesh

Table 9: Year-wise % of area inundated by floods in Bangladesh

Year	Flood Affected area		Year	Flood Affected area		Year	Flood Affected area	
	Square KM	% of area inundated		Square KM	% of area inundated		Square KM	% of area inundated
1954	36,800	25	1975	16,600	11	1995	32,000	22
1955	50,500	34	1976	28,300	19	1996	35,800	24
1956	35,400	24	1977	12,500	8	1998	1,00,250	68
1960	28,400	19	1978	10,800	7	1999	32,000	22
1961	28,800	20	1980	33,000	22	2000	35,700	24
1962	37,200	25	1982	3,140	2	2001	4,000	2.8
1963	43,100	29	1983	11,100	7.5	2002	15,000	10
1964	31,000	21	1984	28,200	19	2003	21,500	14
1965	28,400	19	1985	11,400	8	2004	55,000	38
1966	33,400	23	1986	6,600	4	2005	17,850	12
1967	25,700	17	1987	57,300	39	2006	16,175	11
1968	37,200	25	1988	89,970	61	2007	62,300	42.21
1969	41,400	28	1989	6,100	4	2008	33,655	22.80
1970	42,400	29	1990	3,500	2.4	2009	28,593	19
1971	36,300	25	1991	28,600	19	2010	26,530	18
1972	20,800	14	1992	2,000	1.4	2011	29,800	20
1973	29,800	20	1993	28,742	20	2012	17,700	12
1974	52,600	36	1994	419	0.2	2013	15,650	10.6

Source: FFWC, 2012

Annex 5: Total area, flooded area and District Damage Ranks, Bangladesh

Table 10: Portion of total area and flooded area (%) and districts damage ranks (DRR) for the administrative districts based on 1988 flood

ID	District name	Portion of total area (%)	Flooded area (%)	DDR	ID	District name	Portion of total area (%)	Flooded area (%)	DDR
1	Panchagar	0.93	8.72	1	33	Perojpur	1.00	35.01	4
2	Takurgaon	1.28	13.21	2	34	Jhalakhati	0.54	19.03	2
3	Nilphamari	1.20	16.96	2	35	Patuakhali	2.03	22.99	3
4	Lalmonirhat	0.87	16.81	2	36	Bagura	1.18	25.36	3
5	Kurigram	1.44	64.20	7	37	Bhola	1.60	16.80	2
6	Rangpur	1.57	17.60	2	38	Sherpur	0.90	54.90	6
7	Dinajpur	2.55	15.08	2	39	Jamalpur	1.40	87.52	9
8	Gaibandha	1.51	68.62	7	40	Mymensingh	2.85	49.41	5
9	Joypurhat	0.68	13.95	2	41	Netrokona	1.98	81.20	9
10	Naogaon	2.31	50.29	6	42	Kishoreganj	1.81	92.48	10
11	Bogra	2.12	53.55	6	43	Sunamganj	2.47	86.29	9
12	Nawabganj	1.16	74.80	8	44	Sylhet	2.13	75.04	8
13	Rajshahi	1.74	50.80	6	45	Moulvibazar	2.09	65.64	7
14	Natore	1.33	59.53	6	46	Habiganj	1.97	78.06	8
15	Serajganj	1.73	91.66	10	47	Tangail	2.30	72.56	8
16	Pabna	1.65	73.57	8	48	Manikganj	0.98	89.57	9
17	Kushtia	1.32	35.35	4	49	Gazipur	1.20	50.77	6
18	Meherpur	0.53	22.75	3	50	Norshingdi	0.73	78.25	8
19	Chuadanga	0.82	32.21	4	51	Dhaka	1.13	87.23	9
20	Jhenaido	1.35	12.87	2	52	Narayanganj	0.51	78.88	8
21	Magura	0.71	37.80	4	53	Munshiganj	0.71	71.06	8
22	Jessore	1.82	18.37	2	54	Bramanharua	1.30	92.72	10
23	Narail	0.70	66.67	7	55	Comilla	2.05	57.40	6
24	Satkhira	2.79	12.13	2	56	Chandpur	1.17	50.86	6
25	Khulna	2.98	19.84	2	57	Lakshmipur	1.05	17.83	2
26	Bagerhat	2.71	25.61	3	58	Noakhali	2.10	32.53	4
27	Rajbari	0.84	89.97	9	59	Feni	0.60	15.50	2
28	Faridpur	1.39	88.88	9	60	Khagrachari	1.99	1.22	1
29	Shariatpur	0.80	78.93	8	61	Rangamati	3.13	12.08	2
30	Madaripur	0.81	89.13	9	62	Chittagong	3.59	19.50	2
31	Gopalganj	1.09	92.88	10	63	Bandarban	3.18	4.95	1
32	Barisal	1.67	50.63	6	64	Cox's bazar	1.90	22.18	3
	Total						100.00		

Source: Hydrological Sciences Journal, June 2000(Development of Flood hazard maps of Bangladesh using NOAA-AVHRR images with GIS, Islam Monirul & Sado Kimittersu)

Annex 6: Flood Management in Bangladesh

Flood Management by Structural Measures

Structural option provided some benefits specially increase in agricultural production (BWDB, 2005 & BBS, 2002) at earlier period but some adverse effects were observed later on (Nishat et. al., 2000). Notably, the construction of high embankment along the both banks of the rivers in some cases resulted in rise in bed levels due to siltation causing obstruction to drainage. In the coastal areas, although the construction of polders prevented salinity intrusion, but resulted in restriction of the movement of the tidal prism, sedimentation of tidal rivers and obstruction to the gravity drainage. Another important impact on agriculture was found that the farmers in most cases opted for production of cereal crops, especially HYV rice enjoying a flood free situation rather than going for crop diversification. Structural measure caused many adverse effects on the aquatic lives especially on open water fisheries. National and regional highways and railways, to the extent feasible, have been raised above flood level. Raising feeder and rural roads will be determined in the context of disaster management plans.

A.i. River maintenance and erosion control: River maintenance through dredging is also going on in a limited case due to the high cost. Efforts are continued for erosion control on medium and small rivers.

A.ii. Flood control and drainage project: Flood Control, Drainage and/or Irrigation (FCD/I) projects are of two types, namely (i) full flood control facilities; and (ii) partial flood control. Till date, FCD/I projects provide **facilities in about 5.38 million ha which is about 59% of the country's net cultivated land (BWDB, 2000-01)**. Flood control and drainage structures have also been provided in major cities to make the cities flood free.

A.iii. Flood cum Cyclone Shelter:

School buildings are so constructed that they can be used as flood-cum cyclone shelter especially in the coastal zone with highest risk of flood and storm surge. These structures are not intended to change the flood regime, and therefore, considered as no-structural measures of flood management.

A.iv. Flood proofing:

Efforts have been made to provide vulnerable communities with mitigation by raising homesteads, schools and marketplaces in low-lying areas (rather than flood control) and in the char lands so that peasants can save their livestock and food stuff. Concept of flood zoning and flood insurance are not practiced in the country till date. Flood zoning will facilitate development in a co-coordinated way to avoid expensive investments in vulnerable areas. Proper land development rules need to be developed based on the flood-zoning map.

Other non-structural measures practiced are:

- Working with communities to improve disaster awareness.
- Develop disaster management plans.

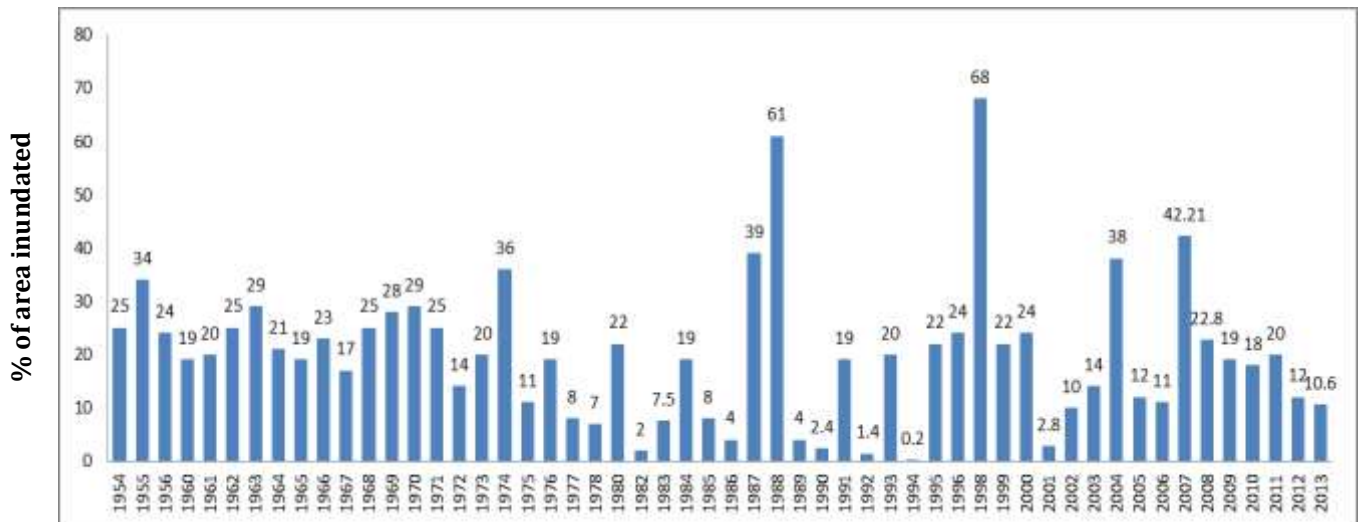


Figure 15: Graph showing year wise % of total inundation areas in Bangladesh

Non-structural Flood Management Measures

B.i. Indigenous Flood Proofing Techniques

- Raised Roads leading to selected schools and protected to become multi-purpose flood evacuation shelters.
- Raised Communal facilities to ensure safe evacuation.
- Built Drains to remove excess water in raised areas.
- Built Culverts to allow excess water to drain.
- Built Public Latrines and shower places on raised homesteads to improve sanitation facilities during flood season.
- Built Public tube wells on raised homesteads to reduce contamination of drinking water.
- Raised Traditional Homestead community clusters to demonstrate the effectiveness of indigenous mud raising techniques for flood proofing.
- Living With Floods

B.ii. Responses during floods

- Repair and reconstruct of Housing
- Food and drinking water storage and handling
- Nutrition management
- Maintenance of Health care facilities and hygiene
- Crop management and seed distribution
- Livestock and poultry management including livestock feed
- Communication (means of moving from one place to another)
- Temporarily relocation in flood shelters
- Taking shelter in temporary Flood Camps Management of day-to-day activities at flood shelters/camps

B.iii. Post-Flood Rehabilitation

- **Getting back to 'Normal Life'** by build back better of infrastructure, livelihood, communication etc.
- Restoration of health care, hygiene, and sanitation facilities
- Repair and Maintenance of dwellings, community infrastructure etc.
- Restoration of means of communication
- Management of early recovery and rehabilitation programmes
- Effective coordination among all stakeholders – affected communities, government, UN, development partners, NGOs, private sector and media.
- Meeting agricultural, livelihood, business, enterprise needs

Flood disaster management strategies:

- Specific shelter(s) could be assigned to specific agencies to carry out relief work;
- Shelter management committee could be formed for each shelter with the enthusiastic people from the local community;
- The shelter management should take care of the security of inmates;
- Government and private school and college and other education centers could be used as shelter during emergency situation.
- A National Disaster Management Alliance may be formed which will mobilise resources for and plan about relief and rehabilitation activities. The alliance could also operate a monitoring cell to oversee implementation;
- NGOs appeared to be working separately in the affected areas. NGOs and the government could link up to work more effectively together during flood, thus creating more efficient relief operations.
- Relief items should be given according to the family size and needs;
- Relief should contain a package of all essential items for a complete meal where applicable;
- Separate toilet and bathing facilities for men and women should be arranged;
- Specific problem related to women, adolescent girls and children should be addressed properly with special attention and initiatives should be taken to solve those problems during flood; and
- People should be made aware about the common disasters occurring in the country, including information about the causes and the impacts, as well as disaster preparedness and management.

Annex 7: Technical details of RIMES support to Bangladesh

- a) Longer-lead Flood Forecasting
- b) Enhanced the 1-10 day flood forecast technology for disaster preparedness in Bangladesh
- c) Piloted the application in preparedness planning and decision-making of experimental 1-10 day forecasts in pilot areas. Based on outcomes, the enhanced 1-10 day flood forecasting system has been operationalized by FFWC. Efforts to expand coverage of 1-10 day flood forecasting system from current 18 river stations to all 38 stations of FFWC
- d) Operationalizing 20-25 day and seasonal forecasting schemes Capacity building activities to enable intermediary users and communities to use forecast products
- e) Flash Flood Early Warning : Enhancing flash flood early warning system in Northeast Bangladesh for longer lead time Collaboration with the Bangladesh Meteorological Department (BMD)
- f) Weather/extreme weather events forecasting: Daily provision of weather simulation outputs for BMD weather forecasting Monitoring of typhoons and other extreme events and provision of simulation products up to a day
- g) Numerical Weather Prediction: Capacity building in the use of customized Weather Research Forecasting model increased lead time of weather forecasts from 24 to 72 hours. Model products are uploaded daily to the BMD website.
- h) Storm Surge Modelling: Enhanced capacity in generating high-resolution storm surge and wave forecasts at coasts.
- i) Concurrent Monitoring of Depressions and Cyclone Formation and Tracking: RIMES assists BMD in concurrent monitoring of depressions and cyclone formation in the Bay of Bengal using an advanced model to spot favourable conditions for cyclone formation, with a lead time of up to 7 days. The model is integrated at a greater resolution, currently at 9 km, which can be further improved to 3 km resolution.
- j) Monsoon Forum: A twice a year dialogue with national and local level forecast users.
- k) Pre-Impact Assessment Tool Development: Developing a RIMES Decision Support System for assessing potential hazard impact based on forecast information. Impact outlooks can guide preparation of response options/management actions for minimizing loss of lives, livelihood, and properties

Annex 8: Flood Forecasting Schemes in Bangladesh

Flood Forecasting in a deltaic region such as Bangladesh, is a difficult problem. A large amount of data is required in order to initialize the hydrological models. The Climate Forecast Applications in Bangladesh (CFAB) project is developing a series of forecasting schemes for precipitation and flood warning for the monsoon Asia region. These schemes cover short (1-10 days), medium (15-30 days) and long term (1-6 months) time periods. The schemes for the short and long-term forecasts depend on the output of global forecast models. Medium range forecasting arises from the development of a new physically based Bayesian statistical method. All three schemes have been used with some success in the forecasting of the discharges from the Ganges and Brahmaputra rivers into Bangladesh.

Coupled with detailed and existing forecast techniques used within Bangladesh, these discharge forecasts will prove extremely useful in agricultural planning, disaster mitigation and water resource management.

Three factors guided the development of the CFAB flood forecasting schemes:

- Hydrological data required to run models is difficult to obtain and much of it is sensitive and retained by different nations.
- State-of-the-art hydrological models require a substantial investment in technology and man power.
- Reliable and timely forecast are needed now.

Forecast Lead Time

- 3 –day deterministic flood forecast
- 5 –day deterministic(experimental) flood forecast
- Short range (1-10 days): This enables the current Bangladesh forecasts to be extended to 12 days.
- Medium range (20-25 days): Forecasts at these time scales enable significant agricultural adjustment and disaster mitigation programs to be enacted.
- Long range (1-6 months): These forecasts provide sufficient lead-time for long term planning to be enacted.

Warning Messages

The services of Gauge Reader's, Wireless operators and other support service providers are gratefully acknowledged. The FFWC is also grateful to the print and electronic news media and those who helped in disseminating the flood information during flood 2012. A number of NGOs have been working in different areas for dissemination of the FFWC flood warning message at grass root level (Union and Village), this enables flood preparedness at local level.

With support from the Bangladesh Meteorological Department (BMD), Interactive Voice Response (IVR) method is used; anyone can call 10941 from Teletalk and all other mobile network and hear a recorded Bangla Voice Message regarding days flood situation. As normal call charge applicable, the voice message is given within one minute duration.

Government level delegation of Flood Early Warning Dissemination:

- President's Office
- Prime Minister's Office
- Ministry of Water Resources
- Ministry of Disaster Management and Relief
- Department of Disaster Management
- Army Headquarters
- Public Information Department
- Government Departments
- News Agencies - Radio & TV
- NGOs & international relief organisations (MSF, Red Cross)
- Foreign embassies and consulates in Dhaka
- Field Wireless Stations
- And other places as directed by Department of Disaster Management

Major Functions of FFWC are as follows:

a. Data collection through

- Voice data (HF Wireless network, 67 stations)
- Mobile telephone (3 stations)
- Telemetry System (14 stations)
- Satellite Imagery (GMS, NOAA-12 & NOAA-14)
- On-line data from Bangladesh Meteorological Department, including satellite and rainfall radar data

b. Satellite Imagery:

- Reception of NOAA-12 and NOAA-14 images via direct acquisition facilities
- Monitoring of cloud & depression movements, precipitation estimation from cloud temperature analysis
- Cyclone monitoring

c. Real Time Data Management

- GIS based map display showing water level and rainfall status (Flood Watch)
- Data entry & processing
- Automatic data exchange to and from forecasting model
- Display of forecast water levels and discharges
- Automatic generation of flood forecast bulletins
- Generation of flood status at local administrative unit (Upazila) level
- Automatic statistics generation

d. Flood Forecast Model

The Flood Forecasting and Warning Centre, under the Directorate of Processing and Flood Forecasting Circle, Hydrology, BWDB carries out monitoring of 86 representative water level stations(out of which 73 is active) and 56 rainfall stations throughout the country. The principal outputs are the daily statistical bulletin

of floods, river situation, a descriptive flood bulletin, forecast for 24, 48 & 72 hours about 52 monitoring points, production of Thana Status Map, Satellite Imageries, special flood report along with different graphical and statistical presentation during the monsoon season.

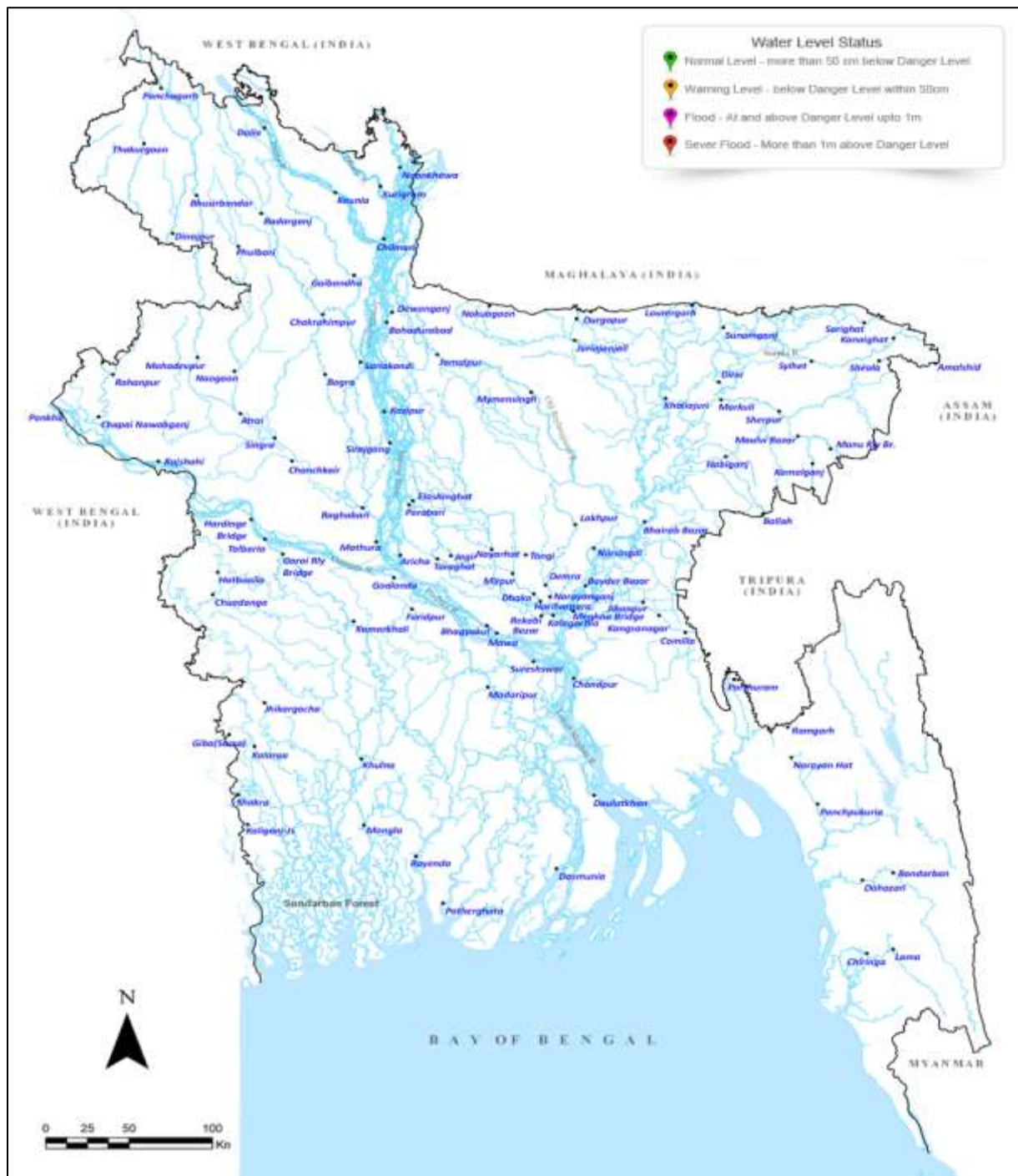


Figure 16: Distribution of Water level monitoring stations in Bangladesh

GIS Modelling and interpretations: One dimensional fully hydrodynamic model (MIKE 11 HD) incorporates all major rivers and floodplains. This is linked to a lumped conceptual rainfall-runoff model (MIKE 11 RR) which generates inflows from catchments within the country.

- Catchments Area = 82,000 sq. km.
- Total length of modelled rivers = 7270 km.
- No. of catchments =216

Flood maps generated from model results via GIS link to model (MIKE 11 GIS)

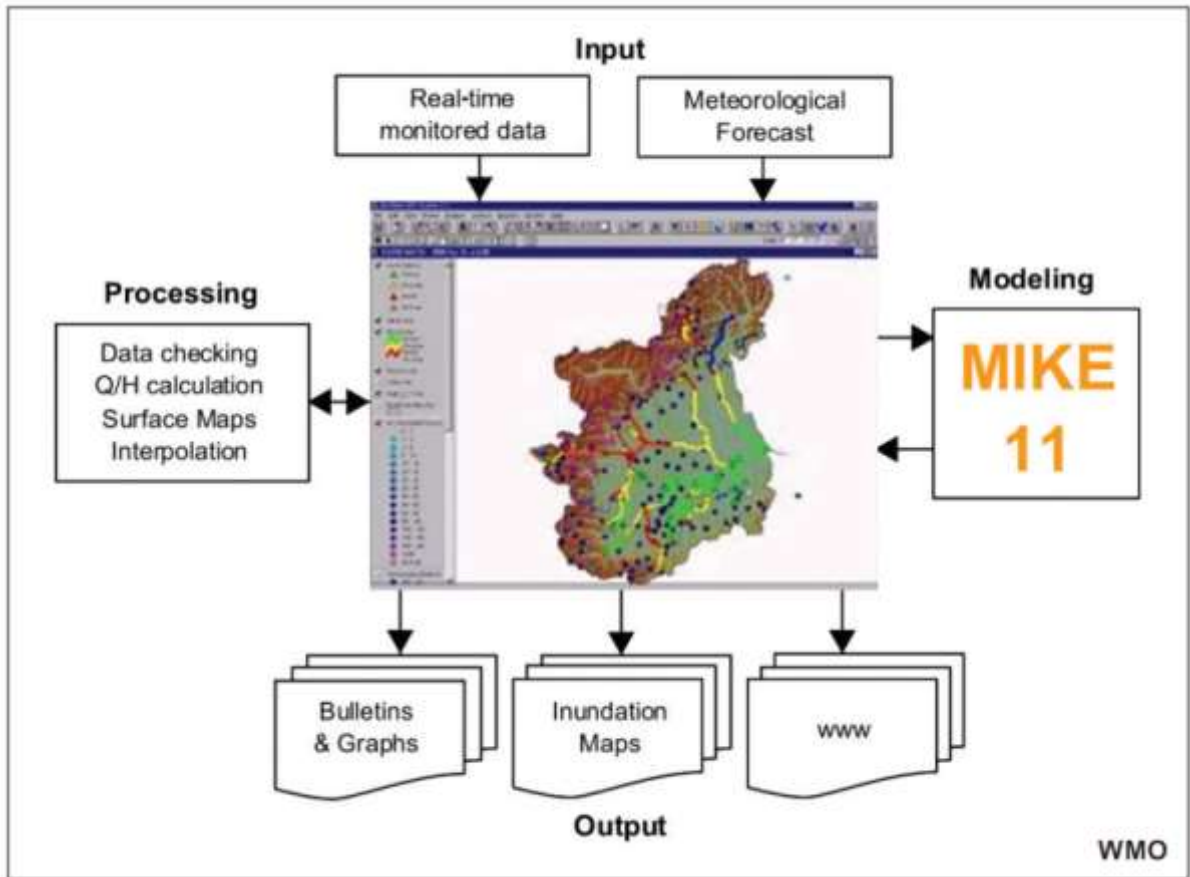


Figure 17: Flood Prediction Modelling

Outputs:

- Daily monsoon bulletin & river situation report
- River level forecasts for 24, 48 and 72 hours
- Current warning messages
- Special flood situation report
- Upazila inundation status map
- Flood forecast maps
- Monthly flood report
- Dry season bulletin (weekly)
- Annual Flood Report

Annex 9: Pre-positioned emergency relief items

Organization	Item	Item Details	Allocation	Unit	Stock Location
ACF	Cash	50000 Euro	5250000	BDT	Dhaka
	Food Items	Dry food - first 7 days	2000	Households	Dhaka
		Food aid package	2000	Packages	Dhaka
	Non-Food Items	Earth/Debris removal Tools	3	Sets	Dhaka
		Safety equipment	10	Sets	Dhaka
		Blanket (single layer)	2000	Pieces	Dhaka
		Family Kit	2000	Sets	Dhaka
	Clothes		2000	Pieces	Dhaka
	Emergency Shelter	Emergency shelter kit	2000	Sets	Dhaka
	Water and Sanitation	Water Treatment unit	10	Number	Dhaka
		Hygiene Kit	2000	Sets	Dhaka
		Hygiene promotion kit	4	Sets	Dhaka
		Water Purification Tablets	2000	Pieces	Dhaka
		Tube-well disinfection kit	3	Sets	Dhaka
		Tube-well repair tools	2	Sets	Dhaka
		Water Treatment Unit (Aquasure)	10	Number	Dhaka
		Motor Pump kit	2	Sets	Dhaka
		Emergency sanitation kit	2000	Sets	Dhaka
		Emergency latrine kit	400	Sets	Dhaka
Bathing corner		10	Number	Dhaka	
Emergency Health		Menstrual kit	4000	Sets	Dhaka
	Breastfeeding corners	10	Number	Dhaka	
ActionAid Bangladesh	Cash	Cash Grant	2,000,000	BDT	Dhaka
		Cash Grant	50,000	BDT	Rajshahi
		Cash Grant	50,000	BDT	Rajshahi
		Cash Grant	100,000	BDT	Rajshahi
		Cash Grant	100,000	BDT	Sylhet
		Cash Grant	100,000	BDT	Rangpur
		Cash Grant	100,000	BDT	Dhaka
		Cash Grant	100,000	BDT	Khulna
		Cash Grant	200,000	BDT	Rangpur
Care Bangladesh	Cash	Contingency Fund 150000USD	11572500	BDT	Dhaka
	Food Items	Wheat	280	Metric Tons	Cox's Bazar, Rangpur, Mymensingh & Sirajganj
		Vegetable .Oil	29	Metric Tons	
		Peas	14	Metric Tons	
	Non-Food Items	Mobile kitchens	3	Numbers	Dhaka
		Plastic Glass (size- regular)-1	20000	Pieces	Dhaka
		Plastic Bowl (4 Liter)-1	10000	Pieces	Dhaka
		Aluminum Cooking Pot (with Lid, capacity-2 kg rice)-1	8505	Pieces	Dhaka
		Aluminum Pitcher(15 Liter) - 1	9133	Pieces	Dhaka
	Emergency Shelter	Tarpaulin(Thermal proof, 4mX5m) -1	5249	Pieces	Dhaka
Nylon Rope (9 Meter)-1		5265	Number	Dhaka	

Organization	Item	Item Details	Allocation	Unit	Stock Location	
		Nylon Rope (20 Meter)-1	5265	Number	Dhaka	
		Mosquito net (family size) -1	10000	Pieces	Dhaka	
	Water and Sanitation	Truck-mounted water treatment plant (8000 L /hr capacity)	6	Number	Dhaka	
		water purifier powder (4 mg)	1134860	Packages	Dhaka	
Concern Worldwide	Cash	50000 Euro	5250000	BDT	Dhaka	
Gana Unnayan Kendra (GUK)	Cash	Cash for Emergency Response	500000	BDT	GUK Head Office	
	Non-Food Items	Ware Houses	3	Number	Gaibandha	
		Hand Mike	6	Number	Gaibandha	
		Life Jackets	50	Number	Gaibandha	
		Life Boya	45	Number	Gaibandha	
		Boat	21	Number	Gaibandha	
	Emergency Shelter	Makeshift Shelter	14	Number	Gaibandha	
		Polithine Sheet	262	Rolls		
	Water and Sanitation	Ring Salab (Seven Ring 1 Salab)	74	Sets	Gaibandha	
		GI Nipol - 1' X 1.5"	23	Number	Gaibandha	
		PVC Pipe- 1.5' X 15'	45	Number	Gaibandha	
		Tubwel Filter	15	Number	Gaibandha	
		Water Pot	400	Number	Gaibandha	
		Tubwel head	15	Number	Gaibandha	
		Jerecan	300	Number	Gaibandha	
		Desluding Machine	3	Number	Gaibandha	
		Lifebuoy Soap	1000	Pieces	Gaibandha	
		Water Tank T-11k- 11000 litre	1	Sets	Gaibandha	
		Platform raising	52	Number	Gaibandha	
		Emergency Health	First Aid Box	8	Number	Gaibandha
	Paramedics		5	Number	Gaibandha	
	Medical camp		12	Number	Gaibandha	
	Satellite clinic		48	Number	Gaibandha	
	Char Pusti Karmi (CPK)		32	Staff	Gaibandha	
	Char Sasthyo Karmi (CSK)		37	Staff	Gaibandha	
	IFRC/BDRCS	Non-Food Items	Saree	5707	Pieces	Dhaka
			Lungi	3887	Pieces	Dhaka
Emergency Shelter		Tarpaulin	7191	Pieces	Dhaka	
		Shelter Toolkits	2013	Pieces	Dhaka	
Water and Sanitation		Jerry Can	10554	Pieces	Dhaka	
	Hygiene Kits	1970	Pieces	Dhaka		
Muslim Aid UK	Cash	Cash Grant (20000 Pounds)	2500000	BDT	Kurigram, Rangpur, Rajbari, Manikgonj, Sirajgong, Gaibandha, Lalmonirhat, Jamalpur, Netrokona,	
	Food Items	Cash Grant (20000 Pounds)	2500000	BDT		
	Non-Food Items	Cash Grant (20000 Pounds)	2500000	BDT		
	Emergency Shelter	Cash Grant (20000 Pounds)	2500000	BDT		
	Water and Sanitation	Cash Grant (20000 Pounds)	2500000	BDT		
	Education	Cash Grant (20000 Pounds)	2500000	BDT		

Organization	Item	Item Details	Allocation	Unit	Stock Location
	Emergency Health	Cash Grant (20000 Pounds)	2500000	BDT	Sylhet and Shunamgonj.
Save the Children	Non-Food Items	NFI Packages	14155	Households	Barisal
		Kitchen Kits	500	Households	Barisal
	Water and Sanitation	Water Treatment Plants	5	Numbers	Barisal
		Low Lift Pump	5	Numbers	Barisal
		WASH Kits	500	Packages	Barisal
	Education	Children Recreation Kits	60	Packages	Barisal
Emergency Health	Fiber/Speed Boat with Engine	4	Numbers	Barisal	
Shushilan	Cash	Cash Grant	500000	BDT	Khulna
	Food Items	Chira Milases	0.35	Metric Tons	Satkihira & Khulna
	Non-Food Items	Soap	100	Pieces	Satkihira & Khulna
		Candle	100	Pieces	Satkihira & Khulna
	Emergency Shelter	Bamboo	170	Pieces	Satkhira
Water and Sanitation	Water Purifying Tablets	150	Pieces	Khulna	
Solidarities International	Cash	Cash Grant 15000 Euro	1575000	BDT	Dhaka
Terre des hommes Foundation	Non-Food Items	Fire Box (Match, Two Star)	5004	Dozen	Barguna
		Candle	2500	Dozen	Barguna
		Polywoven Bag (28"x32")	500	Numbers	Kurigram
		Generator (4KVA)	1	Numbers	Kurigram
		Generator (5KVA)	1	Numbers	Kurigram
	Emergency Shelter	Plastic sheet (17'x14'-4")	1628	Numbers	Kurigram
		Plastic sheet (17'x14'-4")	129	Numbers	Barguna
		Nilon rope (15' long)	500	Numbers	Barguna
	Water and Sanitation	Plastic jerycan (30L)	489	Numbers	Kurigram
		Plastic jerycan (12L)	1320	Numbers	Kurigram
		Plastic jerycan (12L)	1226	Numbers	Barguna
		Bathing soap (75gm, Lux)	9279	Numbers	Barguna
		Washing soap (130gm, Wheel)	1004	Numbers	Barguna
		Water tank	39	Numbers	Barguna
		PVC flexible water type (1" dia)	800	Numbers	Barguna
		Electric water pump (0.5HP)	1	Numbers	Barguna
		Electric water pump (1.0HP)	1	Numbers	Barguna
		Electric water pump (1.5HP)	1	Numbers	Barguna
		Water purifying tablet (Halotab)	17600	Numbers	Barguna
		Plastic buckets with lid (20L)	2000	Sets	Kurigram
Plastic buckets with lid (20L)		500	Sets	Barguna	
Plastic mug (2L)		500	Pieces	Barguna	
Plastic mug (2L)		500	Pieces	Kurigram	
Plastic toilet Slab+Pan	200	Sets	Kurigram		

Organization	Item	Item Details	Allocation	Unit	Stock Location
		Plastic Bibcock/fucet with nut/bolt fittings for hand washing station (1/2" dia)	2000	Sets	Kurigram
		Water treatment unit (mobile unit); 5000L/hr	2	Numbers	Kurigram
		Water treatment unit (mobile unit); 5000L/hr	1	Numbers	Barguna
	Emergency Health	Essential Medicine	2000	People	Kurigram
UNICEF	Education	Education Materials	18025	Children	Khulna
WHO	Emergency Health	Medical Team	All Upazila Health Complexes and District Hospitals		
		Emergency Medicines			
IFRC-SRC	Water and Sanitation	Cash Grant	7,581,400	BDT	Gaibandha
Christian Aid	Cash	50,000 GBP	6,568,877	BDT	Head Quarter
Christian Aid - CCBD	Non-Food Items	Blankets	5000	Pieces	Dhaka
		Shari	500	Pieces	Dhaka
		lungi	500	Pieces	Dhaka
		Children Cloathes	3000	Pieces	Dhaka
	Emergency Shelter	CI Sheet	200	Pieces	Dhaka
		Plastic Sheet	200	Pieces	Dhaka
Water and Sanitation	Water Purifying Plants	3	Number	Dhaka	
Christian Aid - SDS	Cash	Cash Grant	1,000,000	BDT	

Annex 10: List of Flood Shelters in Bangladesh

SL	Division	District	Upazila	Union Name	Name of Flood Shelters
1	Dhaka Division	Faridpur District	Faridpur Sadar	Ishan Gopalpur	Sadipur High School
2	Dhaka Division	Faridpur District	Faridpur Sadar	Aliabad	Chandpur Madandia Govt. Primary Flood Shelter
3	Dhaka Division	Faridpur District	Faridpur Sadar	North Channel	Kabirpur Junior High School Flood
4	Dhaka Division	Faridpur District	Bhanga	Chandra	Shonamoyee High School
5	Dhaka Division	Faridpur District	Sadarpur		Khalpar Barshimul Flood Shelter
6	Dhaka Division	Faridpur District	Saltha(New)	Ramkanthapur	Salta Dergee College
7	Dhaka Division	Faridpur District	Nagarkanda	Shonapur	Gogardia High School annexed Flood Shelter
8	Dhaka Division	Faridpur District	Charbhadrasan	Charshalpur	Charshalpur Flood Shelter
9	Dhaka Division	Faridpur District	Charbhadrasan	Gazirtek	Charnatakhola High School
10	Dhaka Division	Gopalganj District	Kotwalipara	kandi	Bhennabari High School Flood
11	Dhaka Division	Gopalganj District	Muksudpur	Jalilpar	95 no jalilpar Govt. Primary School
12	Dhaka Division	Jalalpur District	Bakshiganj	Tupkarchar	Tupkarchar Kathaltoli Flood
13	Dhaka Division	Jalalpur District	Islampur	Islampur	West Gangapara Islamia Dakhil Madrasha annexed
14	Dhaka Division	Jalalpur District	Madarganj	Jorakhali	Koladaha Mirjagolam Mostafa FS
15	Dhaka Division	Madaripur District	Shibchar	Bandar Khola	Asim Bepari kandi Flood Shelter
16	Dhaka Division	Manikganj District	Daulatpur	Banchamara	Shubuddhi Pachuria Madrasha Flood Shelter
17	Dhaka Division	Manikganj District	Manikganj Sadar	Bhararia	Kharashpur Labonnyo Prova High School
18	Dhaka Division	Manikganj District	Harirampur	Balra	Bahualatoli Flood Shelter
19	Dhaka Division	Kishoreganj District	Itna(New)	Raituti	Raji Flood Shelter
20	Dhaka Division	Munshiganj District	Lohajang	Gaodia	Dulugaon Govt. Primary School
21	Dhaka Division	Munshiganj District	Serajdikhan	Baluchar	Kalinagar Flood Shelter
22	Dhaka Division	Munshiganj District	Tongibari	Arialkhan	Natira Fazushah Junior High School
23	Dhaka Division	Netrokona District	Madan	Maghan	Maghan Rani Dinmoni High School

SL	Division	District	Upazila	Union Name	Name of Flood Shelters
24	Dhaka Division	Rajbari District	Goalandaghat	Debogram	Tena Pecha Flood Shelter
25	Dhaka Division	Narayanganj District	Narayanganj Sadar	Shantapura	Charkishoreganj Flood Shelter
26	Dhaka Division	Shariatpur District	Bhedarganj	Uttar Tarabunia	Uttar Tarabunia Flood Shelter
27	Dhaka Division	Shariatpur District	Damudya	Dhankathi	Moderhat Flood Shelter
28	Dhaka Division	Tangail District	Bhuapur	Nikrail	Polosia Rani Dinmoni High School
29	Dhaka Division	Tangail District	Gopalpur	Mehenagar	Shakharia Islamia Dakhil Madrasha
30	Dhaka Division	Tangail District	Mirzapur	Mohera	Sauyali Bhatkura M.K.A.B Girls School
31	Dhaka Division	Narsingdi District	Raiypura	Parahtali	Maddyo Nagar Flood Shelter
32	Chittagong Division	Brhamanbaria District	Banchharampur	Rupashdi	Dr. Rawshan AlamCollege annexed Flood Shelter
33	Chittagong Division	Chandpur District	Haim Char	Algi Uttai	Bajanti Ramani Mohan High School
34	Chittagong Division	Chandpur District	Shahrasti	Shuchipara(South)	Rage High School
35	Chittagong Division	Comilla District	Monohorganj	3 no Hasnabad	Manaharganj Bazar Anenxed Flood Shelter
36	Chittagong Division	Laxmipur District	Raipur	South Charbangshi	Charkasia Flood Shelter
37	Khulna Division	Bagerhat District	Chitalmari	Shantoshpur	Kalidas Boral Memorial High School
38	Khulna Division	Bagerhat District	Mollarhat	Kodhalia	Kochuria Bazar Flood Shelter
39	Khulna Division	Bagerhat District	Sarankhola	4 no Southkhalo	Sundarban islamia Dakhil Madrasha Flood Shelter
40	Khulna Division	Chuadanga District	Damurhuda	Karpash Danga	Karpash Danga Disaster Shelter
41	Khulna Division	Chuadanga District	Jiban Nagar	Shemanta	tentulia Disaster Shelter
42	Khulna Division	Jessore District	Keshabpur	Keshabpur	Balia Danga Disaster Shelter
43	Khulna Division	Jessore District	Sharsha	Putkhali	Shikri Disaster Shelter
44	Khulna Division	Jhenaidah District	Maheshpur	Tentulia	Padma Pukur Disaster Shelter
45	Khulna Division	Jhenaidah District	Maheshpur	Banshbaria	Bhairaba Disaster Shelter

SL	Division	District	Upazila	Union Name	Name of Flood Shelters
46	Khulna Division	Meherpur District	Meherpur Sadar	Buripota	Gobipur Disaster Shelter
47	Khulna Division	Narail District	Lohagara	Kotakhol	Makrail K.K S Institution Flood Shelter
48	Khulna Division	Satkhira District	Assasuni	Anulia	Nakhla DG Kapatakkha Dakhil Madrasha
49	Khulna Division	Satkhira District	Satkhira Sadar	14 no Fengri	G. Phulbari Dargaon Alim Madrasha Flood Shelter
50	Khulna Division	Satkhira District	Dabhata	Parulia	Parilua Disaster Shelter
51	Khulna Division	Satkhira District	Kaliganj	Thalna	Thalna Disaster Shelter
52	Khulna Division	Satkhira District	Shyamnagar	Gola	Gola Disaster Shelter
53	Rajshahi Division	Bogra District	Dhunat	Goshaibari	Bara Bila FFlood Shelter
54	Rajshahi Division	Bogra District	Sariakandi	Sariakandi	Sariakandi Degree College
55	Rajshahi Division	Bogra District	Sonatola	Tekani Chukaingarh	Moheshpara Abdul Mannan Girls High School
56	Rajshahi Division	Naogaon District	Atrai	Kalikapur	Atgram IslamiaDakhil Madrasha
57	Rajshahi Division	Natore District	Gurudaspur	Khubjipur	Burail High School & Vocational College Flood Shelter
58	Rajshahi Division	Pabna District	Bera	Natun Barengga	Natun Barengga High School Flood Shelter
59	Rajshahi Division	Sirajganj District	Sirajganj Sadar	Saidabad	Barashimul Panchasana Flood Shelter
60	Rajshahi Division	Sirajganj District	Chauhali	Khash Kaunia	Chowhali Women Fazil Madrasha Flood Shelter
61	Rajshahi Division	Sirajganj District	Kazipur	Nishchintapur	Udgari Degree College Flood Shekter
62	Rajshahi Division	Sirajganj District	Raiganj	Brakkhagacha	Shubarnogati High School annexed Flood Shekter
63	Rangpur Division	Gaibandha District	Gaibandha Sadar	Moloshachar	Kachhir Flood Shelter
64	Rangpur Division	Gaibandha District	Fulchhari	2 no Uria	Burail High School & Vocational College Flood Shelter
65	Rangpur Division	Gaibandha District	Sundarganj	Belka	Belka Zuhurul haque Junior High School
66	Rangpur Division	Kurigram District	Chilmari	Sholmari	Koyerpar Bir Bikram High School Flood Shelter
67	Rangpur Division	Kurigram District	Nageshwari	Jaukuthi	Narayanpur Flood Shelter
68	Rangpur Division	Kurigram District	Raumari	Sholmari	Shoulamari S R High School
69	Rangpur Division	Kurigram District	Ulipur	Begumganj	Khudirkuthi Abdul Hamid High School Annexed
70	Rangpur	Kurigram	Ulipur	Hatia	Hatia Bhabash Flood

SL	Division	District	Upazila	Union Name	Name of Flood Shelters
	Division	District			
71	Rangpur Division	Lalmonirhat District	Lalmonirhat Sadar	Rajpur	Rajpur Flood Shelter
72	Rangpur Division	Lalmonirhat District	Lalmonirhat Sadar	Mollahat	Kharua Flood Shelter
73	Rangpur Division	Lalmonirhat District	Lalmonirhat Sadar	Barabari	DiddhyaBaggish Flood Shelter
74	Rangpur Division	Lalmonirhat District	Lalmonirhat Sadar	Khuniagach	Kamaldar Para Non-Govt. Primary School annexed
75	Rangpur Division	Lalmonirhat District	Hatibandha	Shingimari	Shingimari Hatibandha Adarsha High School Flood Shelter
76	Rangpur Division	Lalmonirhat District	Kaliganj	Tush Bhandar	Bairathi Hazir Hat Flood Shelter
77	Rangpur Division	Nilphamari District	Nilphamari Sadar	Dolpar	Dolpar Flood Shelter
78	Sylhet Division	Habiganj District	Ajmiriganj	4 no Kakaildeo	Momchand Bhuiyan Adarsha Dakhil Madarasha Flood Shelter
79	Sylhet Division	Habiganj District	Baniachong	1 no Baniachong	Datta para Flood Shelter
80	Sylhet Division	Habiganj District	Kamalganj	Potonushar	Potonushar Rameshwarpur School-cum- Flood Shelter
81	Sylhet Division	Habiganj District	Rajnagar	Kamarchak	Adampur Flood Shelter
82	Sylhet Division	Sunamganj District	Dowarabazar	Mannangaon	Indanpur Flood Shelter
83	Sylhet Division	Sunamganj District	Tahirpur	Shrrepur Dakshin	Moyazzempur Flood Shelter
84	Sylhet Division	Sylhet District	Kanaighat	1 no East Laxmiprashad	Mesa Flood Shelter
85	Barisal Division	Barisal District	Agailjhara	Bakal	Agailjhara BPH Academy Flood Shelter
86	Barisal Division	Barisal District	Mehendiganj	Bhashanchar	Uttar Bhashanchar Asakia Dakhil Madrasha annexed Flood Shelter
87	Barisal Division	Barisal District	Muladi	1 Bhatmara	Bhatmara Union Junior High School (east side)Flood Shelter
88	Barisal Division	Barguna District	Amtali	Amtali	Amtali Bandar Hossainia Fazil Madrasha
89	Barisal Division	Barguna District	Barguna Sadar	Badarkhali	Kuramkhali Flood Shelter
90	Barisal Division	Barguna District	Patharghata	Patharghata	Koralia Flood Shelter
91	Barisal Division	Bhola District	Manpura	2 no Hazirhat	Char FoyezuddinFlood Shelter
92	Barisal Division	Bhola District	Tazumuddin	Manglachara	Didar Majhee Govt. Primary School annexed
93	Barisal Division	Jhalokathi District	Kathalia	Shoulajalia	Dakshin Kaikhai Govt. Primay School
94	Barisal Division	Jhalokathi District	Nalchiti	Ranapasha	Palestine Technical and Business Management College

SL	Division	District	Upazila	Union Name	Name of Flood Shelters
95	Barisal Division	Patuakhali District	Bauphal	Nazairpur	ASM Firoz Junior High School-cum-Flood Shelter
96	Barisal Division	Patuakhali District	Dashmina	Ranagopaldi	Charborhat Flood Shelter
97	Barisal Division	Patuakhali District	Kalapara	Latachapali	Kuakata Hospital Annexed Flood Shelter
98	Barisal Division	Pirojpur District	Matbaria	Tushkhali	Soto Masua Flood Shelter
99	Barisal Division	Pirojpur District	Nesarabad	10 no Sharengkathi	Uttar Korpa Flood Shelter

Annex 11: List of Water level monitoring stations in Bangladesh

Table 11: Water level monitoring stations in Bangladesh

Sl	River Name	Water level monitoring Stations	Recorded Maximum (m)	Danger Level (m)	Peak of the year (m)		Days above Danger level(m)	
					1998	1988	1998	1988
Brahmaputra Basin								
1.	Dharla	Kurigram	27.66	26.50	27.22	27.25	30	16
2.	Teesta	Dalia	52.97	52.25	52.20	52.89	-	8
3.	Teesta	Kaunia	30.52	30.00	29.91	30.43		38
4.	Jamuneswari	Badarganj	n/a	n/a	n/a	n/a	n/a	n/a
5.	Ghagot	Gaibandha	n/a	n/a	n/a	n/a	n/a	n/a
6.	Karatoa	Chak Rahimpur	n/a	n/a	n/a	n/a	n/a	n/a
7.	Karatoa	Bogra	n/a	n/a	n/a	n/a	n/a	n/a
8.	Brahmaputra	Noonkhawa	28.10	27.25	27.35	n/a	n/a	n/a
9.	Brahmaputra	Chilmari	25.06	24.00	24.77	25.04	22	15
10.	Jamun/a	Bahadurabad	20.62	19.50	20.37	20.62	66	27
11.	Jamun/a	Serajgonj	15.12	13.75	14.76	15.12	48	44
12.	Jamun/a	Aricha	10.76	9.14	10.76	10.58	68	31
13.	Old Brahmaputra	Jamalpur	18.00	17.00	10.76	10.58	68	31
14.	Old Brahmaputra	Mymensingh	14.02	12.50	13.04	13.69	33	10
15.	Buriganga	Dhaka	7.58	6.00	7.24	7.58	57	23
16.	Balu	Demra	n/a	n/a	n/a	n/a	n/a	n/a
17.	Lakhya	N/arayangonj	6.71	5.50	6.93	6.71	71	36
18.	Turag	Mirpur	8.35	5.94	7.97	n/a	70	n/a
19.	Tongi Khal	Tongi	7.84	6.08	7.54	n/a	66	n/a
20.	Kaliganga	Taraghat	10.39	8.38	10.21	10.39	66	65
21.	Dhaleswari	Jagir	n/a	n/a	n/a	n/a	n/a	n/a
22.	Dhaleswari	Rekabi Bazar	n/a	n/a	n/a	n/a	n/a	n/a
23.	Banshi	N/ayarhat	n/a	n/a	n/a	n/a	n/a	n/a
Ganges Basin								
24.	Karatoa	Panchagarh	n/a	n/a	n/a	n/a	n/a	n/a
25.	Pun/arbhaba	Din/ajpur	34.40	33.50	34.09	34.25	3	4
26.	Ich-Jamun/a	Phulbari	n/a	n/a	n/a	n/a	n/a	n/a
27.	Tangon	Thakurgaon	n/a	n/a	n/a	n/a	n/a	n/a
28.	Upper Atrai	Bhusirbandar	n/a	n/a	n/a	n/a	n/a	n/a
29.	Mohan/anda	Rohanpur	n/a	n/a	n/a	n/a	n/a	n/a
30.	Mohan/anda	Chapai-N/awabganj	n/a	n/a	n/a	n/a	n/a	n/a
31.	Little Jamun/a	N/aogaon	n/a	n/a	n/a	n/a	n/a	n/a
32.	Atrai	Mohadebpur	n/a	n/a	n/a	n/a	n/a	n/a
33.	Ganges	Pankha	22.97	21.50	24.14	n/a	66	n/a
34.	Ganges	Rajshahi	20.00	18.50	19.68	19.00	28	24
35.	Ganges	Hardinge Bridge	15.04	14.25	15.19	14.87	27	23
36.	Padma	Goalondo	10.01	8.50	10.21	9.83	68	41
37.	Padma	Bhagyakul	7.58	6.00	7.50	7.43	72	47
38.	Gorai	Gorai Rail Bridge	13.65	12.75	13.45	13.65	25	25
39.	Gorai	Kamarkhali	n/a	n/a	n/a	n/a	n/a	n/a
40.	Ichamati	Sakra	n/a	n/a	n/a	n/a	n/a	n/a
41.	Mathabhanga	Chuadanga	n/a	n/a	n/a	n/a	n/a	n/a
42.	Mathabhanga	Hatboalia	n/a	n/a	n/a	n/a	n/a	n/a
43.	Kobadak	Jhikorgacha	n/a	n/a	n/a	n/a	n/a	n/a

Sl	River N/ame	Water level monitoring Stations	Recorded Maximum (m)	Danger Level (m)	Peak of the year (m)		Days above Danger level(m)	
					1998	1988	1998	1988
44.	Kumar	Faridpur	n/a	n/a	n/a	n/a	n/a	n/a
45.	Arialkhan	Madaripur	n/a	n/a	n/a	n/a	n/a	n/a
46.	Surma	Kan/aighat	15.26	13.20	15.00	15.10	73	75
47.	Surma	Sylhet	11.95	11.25	11.72	11.95	14	21
48.	Surma	Sun/amgonj	9.46	8.25	8.90	9.03	56	62
49.	Kushiyara	Amalshid	18.28	15.85	17.60	17.50	54	65
50.	Kushiyara	Sheola	n/a	n/a	n/a	n/a	n/a	n/a
51.	Kushiyara	Sherpur	n/a	n/a	n/a	n/a	n/a	n/a
52.	Sarigowain	Sarighat	n/a	n/a	n/a	n/a	n/a	n/a
53.	Manu	Manu Raily	20.42	17.07	18.63	18.95	6	66
54.	Manu	Moulvi Bazar	15.50	11.75	11.68	13.01		25
55.	Khowai	Ballah	n/a	n/a	n/a	n/a	n/a	n/a
56.	Khowai	Habigonj	12.00	9.50	11.44	11.00	8	14
57.	Dhalai	Kamalgonj	n/a	n/a	n/a	n/a	n/a	n/a
58.	Bhugai	N/akuagaon	n/a	n/a	n/a	n/a	n/a	n/a
59.	Jadukata	Lorergarh	n/a	n/a	n/a	n/a	n/a	n/a
60.	Someswari	Durgapur	15.58	13.00	13.92	14.31	7	30
61.	Kangsha	Jariajanjail	n/a	n/a	n/a	n/a	n/a	n/a
62.	Meghn/a	Bhairab Bazar	7.66	6.25	7.33	7.66	68	68
63.	Gumti	Comilla	13.56	10.38	12.79	11.80	17	17
64.	Gumti	Debiddar	n/a	n/a	n/a	n/a	n/a	n/a
65.	Meghn/a	Chandpur	n/a	n/a	n/a	n/a	n/a	n/a
South Eastern Hill Basin								
66.	Muhuri	Parshuram	15.03	13.00	14.60	12.42	9	48
67.	Halda	N/arayan Hat	18.05	15.25	16.57	n/a	21	n/a
68.	Halda	Panchpukuria	11.55	7.00	10.44	10.05	4	6
69.	Sangu	Bandarban	20.38	15.25	15.25	16.80	1	3
70.	Sangu	Dohazari	9.05	5.75	7.42	n/a	2	n/a
71.	Matamuhuri	Lama	15.45	12.25	13.05	12.18	2	-
72.	Matamuhuri	Chiringa	6.83	5.75	6.85	n/a	5	n/a
73.	Feni	Ramgarh	21.41	17.37	15.58	17.50	1	n/a

Source: FFWC

Annex 12: List of Storage Depot for preposition in Bangladesh

Table 12: List of Central Storage Depot (all over Bangladesh)

SL	Name of CSD	District	Upazila	Storage Capacity(Metric Tones)	Type of food grains stored	Mode of accessibility with CSD (By Road/Rail/Waterway)
1.	Dhaka	Dhaka	Dhaka	8500	Rice, Wheat& Paddy	Road//Waterway
2.	Tejgaon	Dhaka	Dhaka	35000	Rice, Wheat& Paddy	Road/Rail
3.	N.Gonj	Narayanganj	Bandar	20630	Rice, Wheat& Paddy	Road/Waterway
4.	Mymensingh	Mymensing	Mymensing	27560	Rice, Wheat& Paddy	Road/Rail
5.	Dewanhat	Chittangong	Chittangong	40000	Rice, Wheat& Paddy	Road/Rail
6.	Hali Shahore	Chittangong	Chittangong	46000	Rice, Wheat& Paddy	Road/Rail
7.	Chandpur	Chandpur	Chandpur	13500	Rice, Wheat& Paddy	Road/Rail /Waterway
8.	Shantahar	Bogra	Adamdighi	44350	Rice, Wheat& Paddy	Road/Rail
9.	Muladuli	Pabna	Iswardi	42060	Rice, Wheat& Paddy	Road/Rail
10.	Dinajpur	Dinajpur	Dinajpur	20500	Rice, Wheat& Paddy	Road/Rail
11.	Barisal	Barisal	Barisal	27750	Rice, Wheat& Paddy	Road/Waterway
12.	Khulna	Khulna	Khulna	72400	Rice, Wheat& Paddy	Road/Rail/Waterway
13.	Maheswar Pasha	Khulna	Khulna	58827	Rice, Wheat& Paddy	Road/Rail/Waterway

Table 13: List of Central Storage Silos (all over Bangladesh)

SL	Name of Silos	District	Upazila	Storage Capacity (Metric Tones)	Type of food grains stored	Mode of accessibility with Silos (By Road/Rail/Water way)
1.	Chittangong	Chittangong	Chittangong	100000	Wheat	Road/Rail/Waterway
2.	Ashugonj	B.Baria	Ashuganj	50000	Wheat	Road/Rail/Waterway
3.	Narayangong	Narayanganj	Siddhirgonj	50000	Wheat	Road/Rail/Waterway
4.	Santahar	Bogra	Adamdighi	25000	Wheat	Road/Rail
5.	Khulna	Khulna	Khulna	800	Wheat	Road/Rail/Waterway

Annex 13: List of Community Radio stations in Bangladesh

Table 14: List of Community Radio

SL	Community Radio Station Name	Location
1.	Krishi(Agriculture), setup by Khamarbari Dhaka	Amtali Upazila, Barguna
2.	Radio Chilmari ,setup by RDRS	Chilmari, Kurigram
3.	Lokbetar, setup by Masline Media Center	Barguna Sadar, Barguna
4.	Nalta Radio, setup by Nalta Hospital and Community Health Foundation	Kaliganj, Satkhira
5.	Radio Mukti, setup by LDRS	Sherpur, Bogra
6.	Radio Palli kotha	Moulvibazar Sadar Upazila, Moulvibazar
7.	Radio Sagorgiri, setup by Young Power in Social Action (YPSA)	Sitakundu, Chittagong
8.	Radio Barind, setup by Human Rights Development Association	Naogaon Sadar Upazila, Naogaon
9.	Radio Mohananda, set up Proyash Manobik Unnyan Society	Chapai Nawarganj Sadar Upazila, Chapai Nawabganj
10.	Radio Padma, setup by CCD	Rajshahi Sadar Upazila, Rajshahi
11.	Radio Jhinuk, setup by Srizony Bangladesh	Jhenaidah Sadar Upazila, Jhenaidah
12.	Radio Bikrompur setup by EC Bangladesh	Munshiganj Sadar Upazila, Munshiganj
13.	Radio Sundarban setup by Broadcasting Asia in Bangladesh	Koira Upazila, Khulna
14.	Radio Naf, setup by Alliance for Cooperation and Legal Aid Bangladesh	Teknaf Upazila, Cox's Bazar
15.	Radio Meghna (Proposed)	Char Fassion, Bhola
16.	Radio Sagardwip (Proposed)	Hatia, Noakhali

Source: BNNRC , Bangladesh NGOs Network for Radio & Communication

Annex 14: Location Map of Rescue Boats in Bangladesh

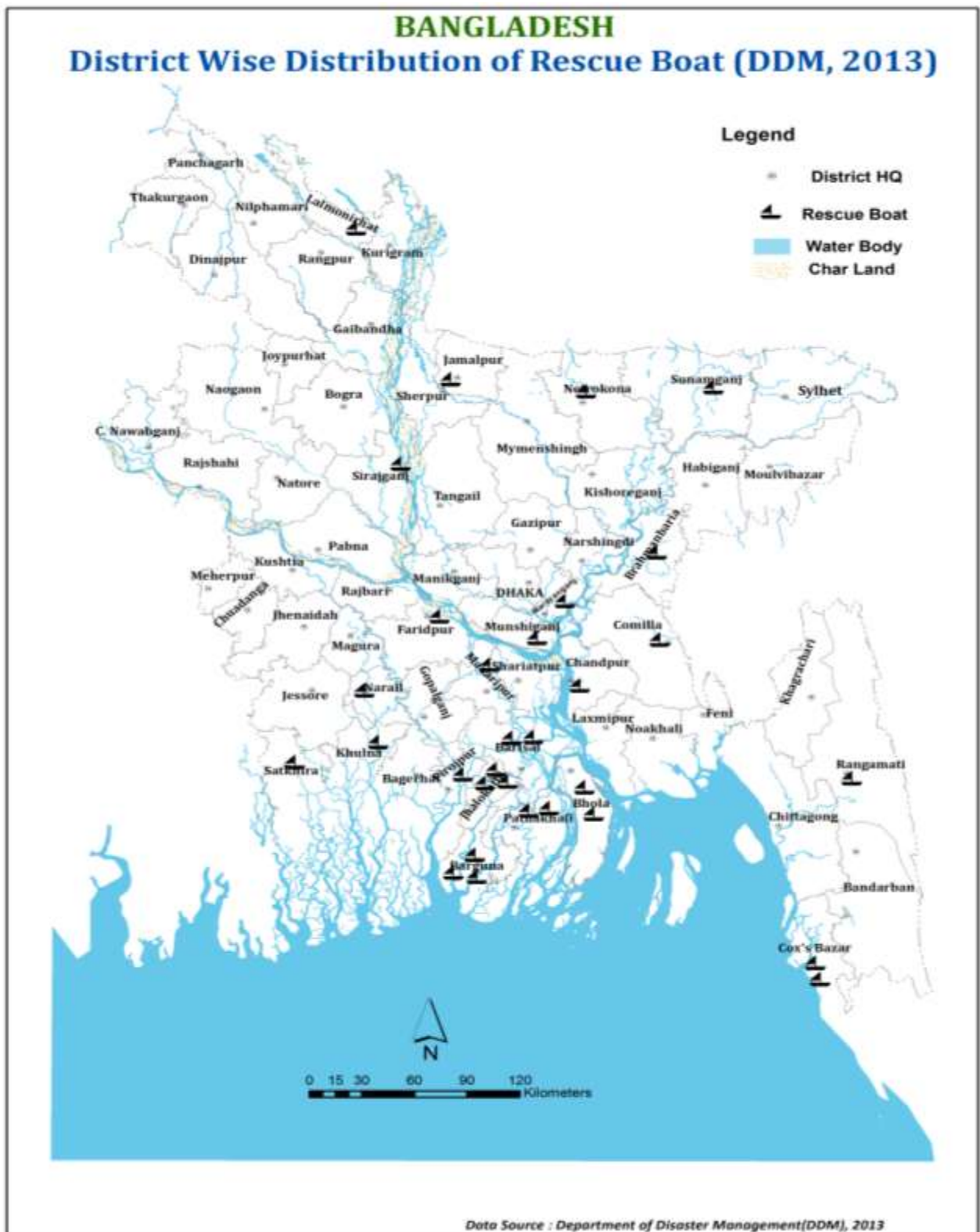


Figure 18: Map showing Flood rescue boat at district level.

Annex 15: District wise distribution of flood shelters

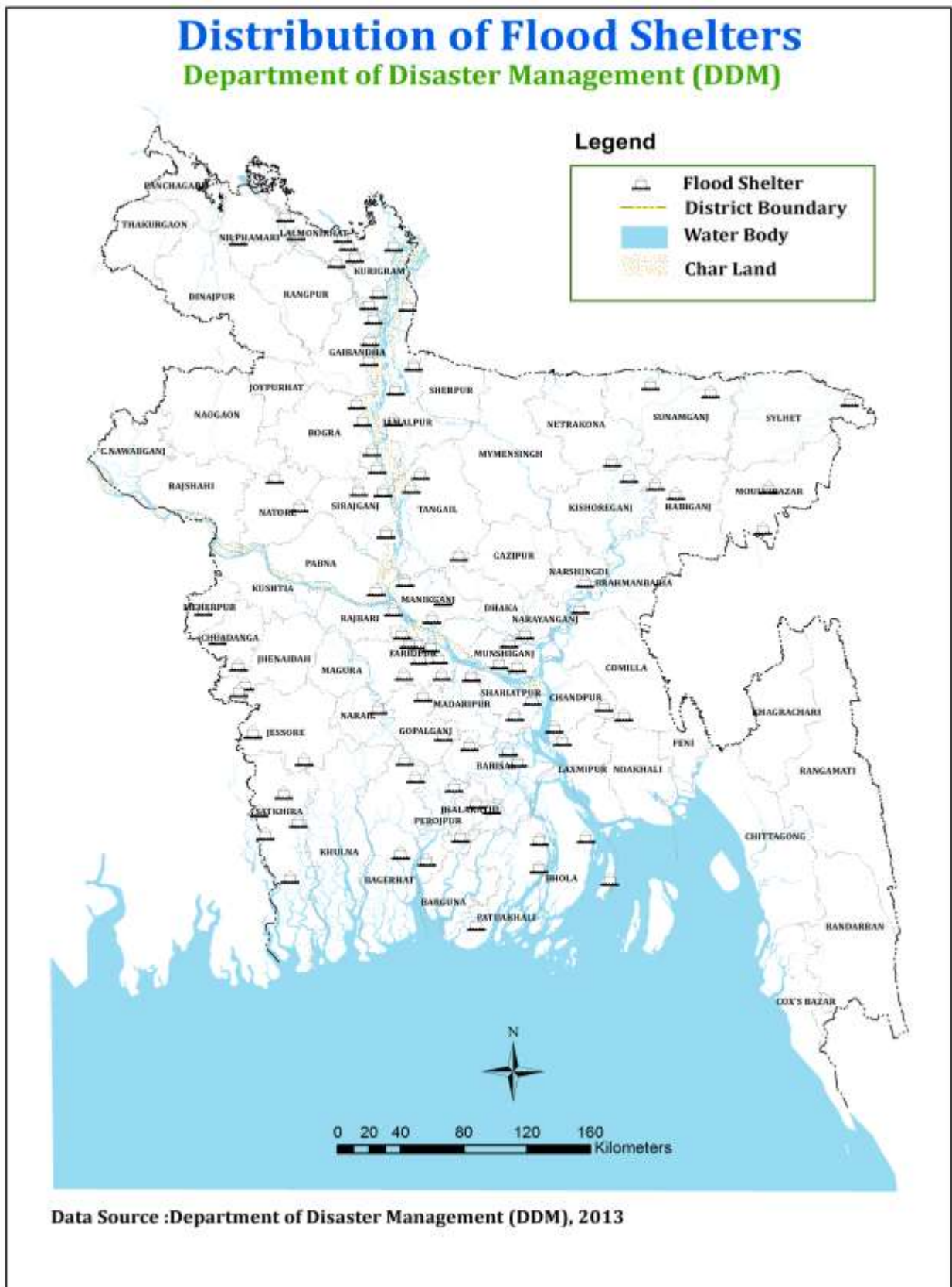


Figure 19: Map showing Flood Shelters at district level

Annex 16: Location of CSDs and silos of DoF

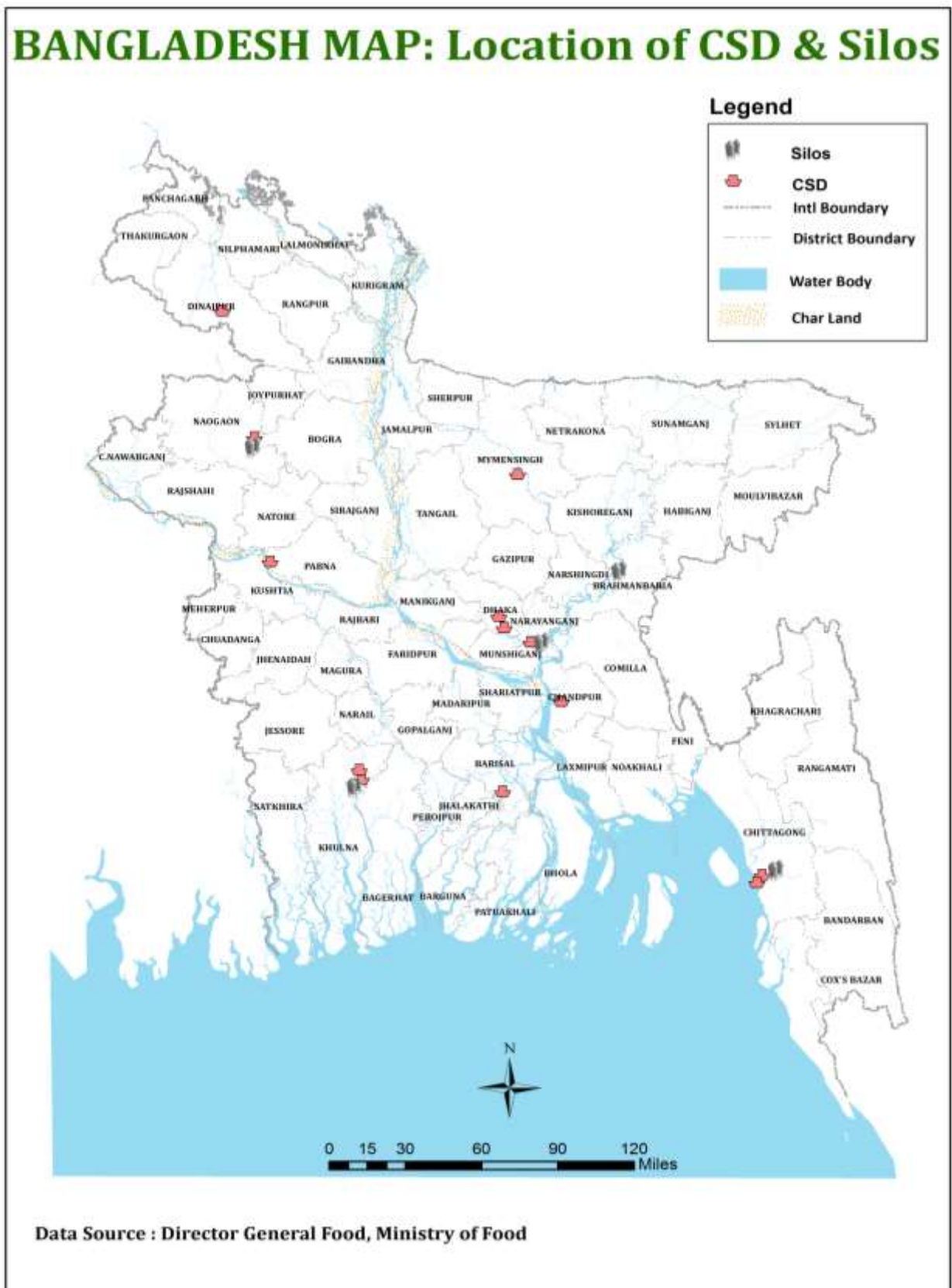


Figure 20 : Map showing location of CSD & Silo under Department of Food

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