MEGHALAYA STATE DISASTER MANAGEMENT PLAN

2016

Volume 1

MEGHALAYA STATE DISASTER MANAGEMENT AUTHORITY

GOVERNMENT OF MEGHALAYA

Dr. Mukul Sangma
Chief Minister
MEGHALAYA

Office : 0364-2224282
PABX : 2200
FAX : 0364-2227913
(R) 2522752

MESSAGE

I take this opportunity to congratulate the State Disaster Management Authority (SDMA) for preparing a comprehensive State Disaster Management Plan which integrates all the four phases of disaster management namely, prevention, response, mitigation and rehabilitation.

This plan will provide direction and guidance to different stakeholders in dealing with crisis situation. It will also enhance their capacity and facilitate positive action in all the phases of disaster management. This plan will help in the conduct of capacity building activities for both urban and rural communities and their participation in exercises and activities relating to prevention and preparedness for tackling multi-hazard vulnerabilities.

This plan has also taken into account the challenge of climate change and related issues faced by society today and touch on local coping mechanism.

I am sure that implementation of the plan in the State will lead to making Meghalaya more resilient to disasters.

(Dr Mukul Sangma)

Prof. R. C. Laloo M.Sc, Ph.D.

सत्यमेव जयते

Deputy Chief Minister
Food Civil Supplies & Consumer Affair,
Revenue & Elections etc.
Meghalaya, Shillong - 793001

MESSAGE

It is with a great joy to know that the Meghalaya State Disaster Management Plan is finally prepared.

The Plan will give a vast scope to the different stakeholders to tackle a wide range of disasters, both natural and man-made.

In this age of global warming and climate change, the plan will be a guiding light on how to take on the challenges that will prevail upon the State.

I, thus, dedicate this State Disaster Management Plan to the people of Meghalaya.

(Prof. R.C. Laloo)

Office : Room No. 413, Yojana Bhavan Meghalaya Sectt., Shillong
Tel. No.: 03642224576, PABX: 2644, Mobile : 9862088281
e-mail : rclaloo4@yahoo.com

K. S. Kropha IAS
Chief Secretary
Government of Meghalaya

सत्यमेव जयते

Rilang Building
Meghalaya Secretariat, Shillong - 793001
Tel.: +91-364-2224801, Fax: 0364-2225978
Email : cso-meg@nic.in

MESSAGE

The Disaster Management Act, 2005, stipulates that every State will prepare its own disaster management plan, which will provide a framework to deal more effectively, promptly and systematically with disaster situations.

The State of Meghalaya, which lies in the seismically active Zone V, is also prone to floods, fires, landsides, cyclonic storms and lightning strikes, besides earthquakes.

The Meghalaya State Disaster Management Plan has been prepared keeping in mind all aspects of disaster management such as disaster preparedness, post-disaster response, restoration and rehabilitation, long term mitigation etc.

I am sure that this plan will be a helpful resource for the State Government and its various stakeholders in minimizing the effects of various natural and man-made disasters in the State.

(K.S. Kropha)

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Abbreviations

AIR	All India Radio
BDO	Block Development Officer
BIS	Bureau of Indian Standards
CBRN	Chemical, Biological, Radiological and Nuclear
CBO	Community Based organisation
CBDM	Community Based Disaster Management
CEO	Chief Executive Officer
CSIR-NERIST	Council for Scientific and Industrial Research-North-East Regional Institute of Science and Technology
CSO	Central Seismological Observatory
CSOs	Civil Society Organisation
CTI	Central Training Institute
CWC	Central Water Commission
DC	Deputy Commissioner
DCMG	District Crisis Management Group
DEOC	District Emergency Operation Center
DDMA	District Disaster Management Authority
DIET	District Institute of Education & Training
DIC	Deputy Incident Commander
DIPR	Directorate of Information and Public Relation
DM&HO	District Medical and Health Officer
DMIS	Disaster Management Information System
DM	Disaster Management
DTO	District Transport Officer
FIR	First Information Report
FM	Frequency Module
GIS	Geographical Information System
GSI	Geological Survey of India
GoI	Government of India
GSHAP	Global Seismic Hazard Assessment Program
HRVA	Hazard Risk & Vulnerability Assessment
IAP	Incident Action Plan
I&MO	Information & Media Officer
IC	Incident Commander
ICS	Incident Command System
IEC	Information Education and Communication
IDRN	India Disaster Resource Network
IMR	Infant Mortality Rate
IMD	India Meteorological Department
IRS	Incidence Response System
IRT	Incident Response Team

IT	Information Technology
LHZ	Landslides Hazard Zone
LO	Liaison Officer
LPG	Liquid Petroleum Gas
LS	Logistics Section
MATI	Meghalaya Administrative Training Institute
MHA	Ministry of Home Affairs
MUDA	Meghalaya Urban Development Authority
NCMC	National Crisis Management Committee
NCC	National Cadet Corps
NDMA	National Disaster Management Authority
NDMP	National Disaster Management Plan
NDRF	National Disaster Response Force
NEC	National Executive Council
NESAC	North Eastern Space Application Centre
NEOP	National Emergency Operation Center
NGOs	Non Government Organisations
NIT	National Institute of Technology
NO	Nodal Officer
NIC	National Informatics Centre
NSS	National Service Schemes
NYK	Nehru Yuva Kendra
OS	Operations Section
PRIs	Panchayati Raj Institutions
PS	Planning Section
PWD	Public Work Department
RO	Responsible Officer
SAR	Search and Rescue
SCERT	State Council of Education Research and Training
SCMG	State Crisis Management Group
SDMP	State Disaster Management Plan
SDMA	State Disaster Management Authority
SDRF	State Disaster Response Force
SEC	State Executive Committee
SEOC	State Emergency Operation Centre
SIRD	State Institute of Rural Development
SO	Safety Officer
SOP	Standard Operation Procedure
SP	Superintendent of Police
SWAN	State Wide Area Network
TNA	Training Needs Assessment
ToT	Training of trainers
TV	Television
VHF	Very High Frequency

EXECUTIVE SUMMMARY

The Disaster Management Act, 2005 section 23 mandates the states to prepare the State Disaster Management Plan (SDMP) for their state. Meghalaya had prepared a SDMP in 2006. Since then many changes have taken place in the field of disaster management in the State, such as establishment of Disaster Management Authorities at the State (SDMA)and the District levels (DDMA), setting up of the State Executive Committee (SEC), State Disaster Response Force (SDRF), State Disaster Response Fund (SDRF) , the Disaster Management Centre at the Meghalaya Administrative Training Institute (MATI) and the notification of the Central Training Institute (CTI) of Civil Defence and Home Guards at Mawdiangdiang as the Nodal Training Institute for imparting training on Search and Rescue in the State. Hence, there is a need to prepare the SDMP afresh. The Meghalaya SDMA has prepared the SDMP,2016 incorporating all the changes in the field of disaster management and also the suggestions offered by National Disaster Management Authority (NDMA).The SDMP ,2016 is prepared in accordance with the Guidelines issued by the NDMA in 2007 for preparation of SDMP.

The SDMP of Meghalaya is broadly divided into 3 Volumes. Volume 1 gives an insight into the State Profile and other preparatory measures which have to be undertaken by the State. While Volume 2 is a Response Plan focusing on the response to various hazards with particular reference to the prevalent hazards in the State of Meghalaya such as earthquakes, cyclones, floods and landslides. Volume 3 gives the important contact numbers relating to disaster management, available equipments with their locations, Emergency Support Functions (ESF) and roles of different departments, list of materials for emergencies, list of hospitals and available communication system.

Let us have a glimpse of the contents dealt by each Volume of SDMP.

Volume 1

Chapter 1: Provides an overview of the State Profile, Vision, theme and Objectives of SDMP

Chapter 2: Gives an insight into the Vulnerability Assessment and Risk Analysis

Chapter 3: Discusses Preventive Measures to be taken by the State to mitigate various hazards like earthquakes, floods, landslides cyclones, industrial hazards and management of Chemical, Biological, Radiological and Nuclear hazards.

Chapter 4: Deals with Mainstreaming of Disaster Management Concerns into Development Plans/Programmes/Projects by different Government departments.

Chapter 5: Looks at the Preparedness Measures by different stakeholders like Community Based Organizations, Information Education Communication, Techno-Legal Regime, Medical Preparedness, Mock Exercises, Knowledge Management, State Disaster Response Force, Fire and Emergency Service, Civil Defense and Home Guards, Armed Forces/NDRF

Chapter 6: Covers the partnership with other stakeholders like National Disaster Management Authority (NDMA), National Institute of Disaster Management (NIDM), National Disaster Response Force (NDRF), State Disaster Response Force (SDRF),Armed Forces, Meghalaya Administrative Training Institute (MATI) and so on

Chapter 7: Deals with the Financial Arrangements both of the Central and State Governments.

Chapter 8: Discusses the Review and updation of SDMP

Chapter 9: Provides for the Coordination and Implementation

Chapter 10: Deals with the Governmental and Non Governmental Organization Coordination

Chapter 11: Discusses the Knowledge Management

Chapter 12: Presents the Climate Change, Impacts and Adaptive Responses in Meghalaya

Chapter 13: Deals with the Indigenous Knowledge and coping Strategies in Disaster Risk Management

Chapter 14: Discusses the Livestock Management during Emergencies and Disasters

Chapter 15: Deals with Equal Opportunity and Full Participation of People with Disabilities, Legal Framework and Awareness and Training

Volume 2

Chapter 1: Provides for Response, Response Management Arrangements and Response Activities

Chapter 2: Discusses the Incident Response System (IRS) and Roles and Responsibilities of Incident Response Team (IRT)

Chapter 3 to 6: Focuses on Hazard Specific Response prevalent in the State like earthquake, cyclones, floods and landslides

Volume 3

Deals with the important contact numbers relating to disaster management, available equipments with their locations, Emergency Support Functions and roles of different departments, list of materials for emergencies, list of hospitals and available communication system.

Background

India is vulnerable, in varying degrees, to a large number of natural as well as man-made disasters. As stated in the National Policy on Disaster Management, 2009, in India, 58.6 per cent of the landmass is prone to earthquakes of moderate to very high intensity; over 40 million hectares (12 per cent of the land) is prone to floods and river erosion; of the 7,516 kms long coastline, close to 5,700 kms is prone to cyclones and tsunami; 68 per cent of the cultivable area is vulnerable to drought and hilly areas are at risk from landslides and avalanches. Vulnerability to manmade disasters and emergencies of CBRN (Chemical, Biological, Radiological and Nuclear) origin is also on the rise. Heightened vulnerabilities to disaster risks can be related to expanding population, environmental degradation, unplanned urbanization, industrialization, etc. within high-risk zones.

India's vulnerability to a variety of natural and man-made disasters hinders the country's growth. The management of response in disasters requires the existing administrative set up, its various institutions and civil society as well as to carrying out a large number of tasks.

The activities involved in response management would depend on the nature and type of disaster. It has been observed that in times of disaster, apart from lack of resources, lack of coordination among various agencies and absence of role clarity amongst various stakeholders pose serious challenges. If the response is planned and the stakeholders are trained, there will be no scope for ad-hoc measures and the response will be smooth and effective.

The State of Meghalaya is a multi-hazard state and is prone to disasters like earthquake, floods, cyclonic storms, etc. The State witnessed a major earthquake in 1897 and a number of subsequent earthquakes of varying intensities thereafter, as whole of Meghalaya state falls under Zone V of the seismicity map of India. Flash Floods, fire, landslides, cyclonic storm and coal mine collapse and flooding are recurrent phenomena in the recent years which led to loss of many lives and extensive damage to properties in the state. It is therefore obvious that the state is in need of a Disaster Management (DM) Plan to direct all aspects of DM (including disaster preparedness, post-disaster response, short and medium-term physical reconstruction, social rehabilitation and long-term disaster mitigation).

Following the enactment of 'The DM Act, 2005, by Government of India (GoI) the Government of Meghalaya formulated a set of DM Rules 2010 under the provisions of DM Act 2005. The state has also brought out a revised DM Policy in 2013.

The State Disaster Management Plan (SDMP) has preparedness and mitigation focus as its. It also emphasis on the protection of lives and properties of the people of Meghalaya from the threat of natural, technological and human-induced disasters. The State Plan is in line with the National Disaster Management Plan (NDMP) of the National Disaster Management Authority (NDMA). It Establishes a base on which further plans, procedures, guidelines, logistical arrangement, District-level DM plans, Block-level DM Plans, village level DM Plans and local urban bodies level DM plans can be prepared.

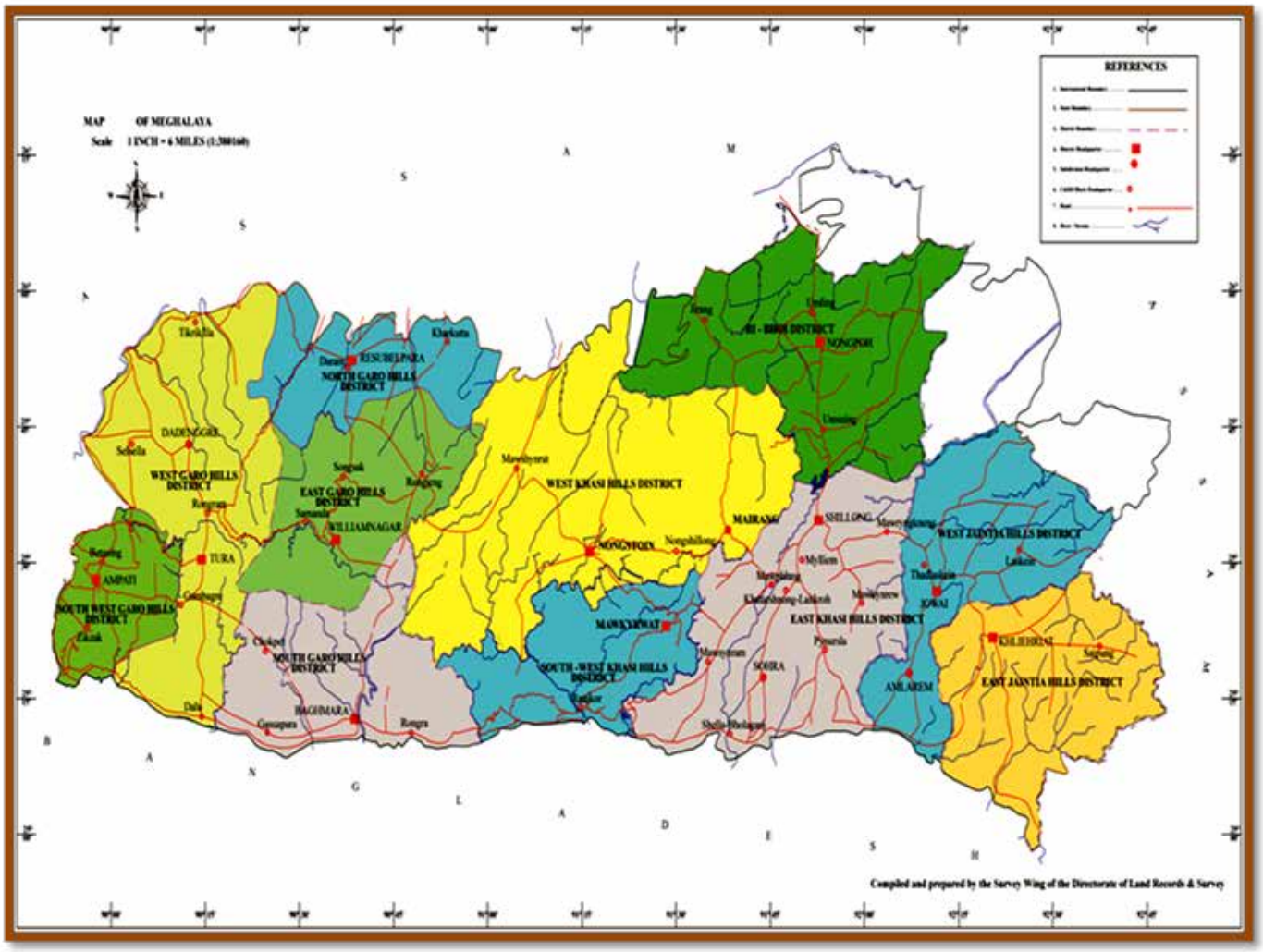
This plan lays down certain objectives and suggests strategies leading to the achievement of goals in a set time frame. The ultimate goal for the Government of Meghalaya with respect to various hazards is to have prepared communities in such a way that when the hazards strike, there is minimum loss of lives and properties. The plan rests on the conviction that well defined strategies, goals and end targets with identified players, roles and responsibilities are the precursors for effective management of disasters.

Part 1: General

Chapter 1: Introduction

1.1 State Profile

Date of Formation of Meghalaya State	21st January 1972
Total no. of districts	11
Total no. of blocks	39
Total no. of villages	6839



Map 1: Administrative map of Meghalaya

1.2 Geography

State is located on the North Eastern part of India

Area	**22429 sq. km**
Latitude	24°57’ and 26°10’ North latitudes
Longitude	89°46’ and 92°53’ East longitudes

Climate and Rainfall	The Climatic condition of Meghalaya is determined by the altitude of the land surface. The areas in the North and South lying in lower altitude have warm climate, where as those areas situated at higher altitude have cooler climate. During the summer, the South West monsoon coming from the Bay of Bengal causes heavy rainfall in these areas. Sohra and Mawsynram, which are situated on the southern slopes of East Khasi Hills, receive the highest amount of annual rainfall. The temperature variation at lower altitudes is between 33° and 22°C while at higher altitudes it is between 24° and 12°C.
Geology	The plateau comprises rocks of Achaean basement complex in the central and northern parts comprising gneiss, quartzite and schist. The rocks of Gondwana in the western part of Garo Hills contain pebble beds, sandstone and shale. The volcanic eruption 200 million years ago in Jurassic time is spread over E–W trending narrow belt in southern part of Khasi Hills and is termed as Sylhet Traps which includes basalt and rhyolites. Main rock types belong to Khasi, Jaintia and Garo group which include conglomerate, sandstone shale, silt with coal seams and limestone.
Connected Country	Bangladesh in the southern and Western Side
Connected / State	Assam in the Northern and Eastern side
Major Rivers	The rivers originating from the Meghalaya plateau are all rain-fed and most of the rivers either flow towards the north or south of the State. Rivers that flow towards the south drain into Barak Valley and those that flows towards the north ultimately join the Brahmaputra in Assam. The drainage system of Meghalaya is greatly determined and moderated by the presence of natural landscape and physiographic relief of the State. The Plateau proper forms the main watershed. The rivers of Jaintia Hills flow towards the north-west except river Lubha which flows south-west and joins river Surma in Bangladesh. River Kopili which is the most important river of Jaintia Hills rises from the upland east of Passi (near Jowai). It flows towards the north-east and then flowing towards the north-west in Karbi- Anglong finally joins the Brahmaputra. River Lubha (Lukha) rises from the foot of Marangksih and Ikorsingh peak and flows south-west. The rivers of Garo Hills falling under the northern group are rivers Damring or Krishnai, Dudhnai, Rongra, Jinari, Bhugi, Kalu and Ganol. The south flowing rivers are bigger and larger than the north-flowing ones. River Simsang is the biggest of all rivers in Garo Hills. It flows through the valley of Tura range in the north-west and Chitmang in the south-east and flows southwards just west of Williamnagar. Others flowing southward are the rivers Nitai and Bhugai. All the three take their source from the Nokrek region. River Krishnai is known to the Garos as Damring just as riverKalu on which there is Pelga Falls at Dalmagre is known tothem as Ganol. River Ganol is navigable for a distance of about 15 km. only during the rainy season. River Simsang follows a very winding course. In the Central Upland of Ri Khasi, river Umtrew rises from the foot of the Sohpetbneng Peak and flows towards the North. This Central upland acts as a water parting for a number of rivers such as the Umiam Umkhen, Umtrew, Khri, Digaru, and they all merge in the river Kapili before falling into the Brahmaputra. The rivers that flow towards the South are river Umngot, Kynshi, Umiew, Mawphlang, Umngi and Umrilang. River Umngot (also known as Piyan Gang) has its source over the Central upland and flows southwards into Bangladesh through the Dawki Bridge.

1.3 Demography (Cencus 2011)

Population	29,64,007
Male population	14,92,668
Female population	14,71,339
Sex Ratio	986/1000 male
Population Density	132/sq km

Rural Population	23,68,971
Urban Population	5,95,036
Decadal Growth Rate	27.82 %
Birth Rate	24.5%(2010)
Death Rate	8.4%(Rural), 5.6%(Urban)(2010)
Infant Mortality Rate(IMR)	58 % (Rural), 37% (Urban)(2010)

1.4 Socio – Economic (2011-12)

Per capita Gross State Domestic Product at Current Price: Rs. 60,232/-

Per capita Gross State Domestic Product at Constant Price: Rs. 42,497/-

Gross State Domestic Product at Current Price: Rs.11, 21,491/-

Gross State Domestic Product at Constant Price: Rs.15, 89,515/-

1.5(A) Population by Religion

Religion	Population			
	1971	1981	1991	2001
1	2	3	4	5
Hindus	1,87,140	2,40,831	2,60,306	3,07,822
Muslims	26,347	41,434	61,462	99,169
Christians	4,75,267	7,02,854	11,46,092	16,28,986
Sikhs	1,262	1,674	2,612	3,110
Buddhist	1,878	2,739	2,934	4,703
Jains	268	542	445	772
Other Religion	3,18,168	3,44,215	2,98,466	2,67,245
1. Jaintia				79
2. Khasi				1,20,245
3. Niam Shnong				6,041
4. Niamtre				77,376
5. Pnar				214
6. Shnong				1,398
7. Others				61,892
Religion not stated	1,369	1,530	3,461	7,015
T O T A L	**10,11,699**	**13,35,819**	**17,74,778**	**23,18,822**

Source: Department of Economic and Statistic, Government of Meghalaya

1.5(B) Population by Language

Language	Population			
	1971	1981	1991	2001
1	2	3	4	5
Khasi	457064	629640	87192	1091087
Garo	328613	399069	547690	728424
Assamese	23410	23356	34118	36576
Bengali	93967	119571	144261	185692
Gorkhalee/ Nepali	44445	61259	49186	52155
Hindi	17220	29728	38930	50055
Koch	13520	16150	18698	20834
Rabha	10841	13888	20455	22395
Other Language	22619	43158	42248	131604
Grand Total	**1011699**	**1335819**	**1774778**	**2318822**

1.6 Meghalaya Education Profile Percentage of Literacy by Sex

District	2011(P)		
	Persons	Male	Female
1	2	3	4
Jaintia Hills	63.26	59.75	66.71
East Khasi Hills	84.70	85.26	84.15
West Khasi Hills	79.30	80.29	78.30
Ri-Bhoi	77.22	78.52	75.85
East Garo Hills	75.51	79.56	71.32
West Garo Hills	68.38	73.31	63.34
South Garo Hills	72.39	76.77	67.72
Grand Total	**75.48**	**77.17**	**73.78**

Source: Census of India 2011 (Provisional)

Number of Educational Institutions by type of Institutions in Meghalaya

Sl.No	Institution	Total Number
1	Primary & Upper Primary	6612
2	Secondary School Class VIII to X	783
3	Higher Secondary School Class XI to XII	112
4	Diet / NTS	6
5	Polytechnic	3
6	Colleges	63
7	Private University	8
	Central University	1

Source: http://megeducation.gov.in

1.7 Health & Family Welfare Number of Medical Institutions

Districts	Year-2008-2009					
	Hospitals	Dispensable	Community Health Centre	Primary Health Centre	Sub-Centre	Available Beds
1	2	3	4	5	6	7
East Khasi Hills	4	4	6	24	63	1666
West Khasi Hills	1	-	5	17	64	430
Ri-Bhoi	1	2	3	8	27	229
Jaintia Hills	1	1	5	17	75	311
West Garo Hills	1	1	2	17	69	565
East Garo Hills	1	3	6	18	81	365
South Garo Hills	-	1	2	7	22	130
Total	**9**	**12**	**29**	**108**	**401**	**3696**

Number of Medical Personnel

Districts	Year-2008-2009						
	Doctors	Nurses	Pharmacist	A.N.M	Health Visitors	Lab Technicians	Vaccinators
1	2	3	4	5	6	7	8
East Khasi Hills	266	450	59	146	17	40	26
West Khasi Hills	61	103	32	109	9	23	7
Ri-Bhoi	44	51	14	44	4	15	4
Jaintia Hills	93	99	32	52	22	23	14
West Garo Hills	143	120	34	131	13	26	25
East Garo Hills	52	53	24	147	9	21	14
South Garo Hills	25	17	11	129	6	8	-
Meghalaya	**684**	**893**	**206**	**758**	**80**	**156**	**90**

Source: www.meghealth.gov.in

1.8 Police and Emergency Fire Services

Districts	Year 2016			
	Police Stations	Police Outposts / Check Posts	Beat Houses	Fire Stations
1	2	3	4	5
East Khasi Hills	13	9	4	17
South West Khasi Hills	2	3		1
West Khasi Hills	4	5		3

Ri-Bhoi	4	11		3
West Jaintia Hills	4	4	1	4
East Jaintia Hills	2		4	1
West Garo Hills	6	12	3	7
South West Garo Hills	2	4		2
North Garo Hills	2	4		1
East Garo Hills	4	6		2
South Garo Hills	5	7		2
Total	**48**	**65**	**12**	**43**

Source: http://megpolice.gov.in

1.9 Agriculture

Agriculture provides direct and indirect employment to around 66% of the total work force of the state and contributes 33% of the Net State Domestic Product. 339217 (Ha) Area is under cultivation and 70 Percent are engaged in Agriculture.

1.10 Forests

Notified Forests under the Control of State Forest Department

Sl No.	Class of Forests	Area (in Sq. Km.)
1	Reserved Forests	713.12
2	Protected Forests	12.39
3	National Parks (including proposed)	267.48
4	Wild life Sanctuaries	34.20
Total		**1,027.19**

Extent of Forests (sq km)

Dense Forest	**5,681.00**
Open Forest	**9,903.00**
Scrub	**259.00**
Non Forest	**6,586.00**
Total	**22,429.00**

Source: http://www.megforest.gov.in/megfor_extent_forest.htm

1.11 Veterinary and Animal Husbandry:

Livestock Population 2012 Census

Sl No	Species		Total Population (Numbers)
1	Cattle	Crossbred	26458
		Indigenous	879295
2	Buffalo	Indigenous	24894
3	Goat	Indigenous	472325
4	Pig	Exotic/ Crossbred	137984
		Indigenous	431317
5	Sheep	Exotic/ Crossbred	805
		Indigenous	20186
6	Poultry	Fowl	3541716
		Duck	22845
		Others	498

Source: http://www.megahvt.gov.in/livestockcensus.html

1.12 Electricity

Dams in Meghalaya

Sl. No.	Dam Name	River	District	Purpose
1	Khandong Dam	Kopili	Jaintia Hills	Hydroelectric
2	Kyrdemkulai (Umiam st-III) Dam	Umtru	West Khasi Hills	Hydroelectric, Irrigation, Water Storage
3	Mawphlang Dam		East Khasi Hills	
4	Myntdu-Leshka Dam	Myntdu		Hydroelectric
5	Nongkhyllem Dam	Umtru	Ri Bhoi	Hydroelectric
6	Umiam Dam	Umiam	Ri Bhoi	Hydroelectric
7	Umtru Dam	Umtru	Ri Bhoi	Hydroelectric, Irrigation, Water Storage

Source: http://india-wris.nrsc.gov.in/wrpinfo/index.php?title=Dams_in_Meghalaya

The existing Power Stations of the Meghalaya Power Generation Corporation Limited (MePGCL):

Sl. No	Station	Type	No of Units/ Capacity	COD	Capacity (MW)
1	Umiam Stage-I	Storage/ Pondage	4*9 MW	FY 1966	36
2	Umiam Stage-II		2*10 MW	FY 1971	20
3	Umiam Stage-III		2*30 MW	Unit 1: FY 1979 Unit 2: FY 1979	60
4	Umiam Stage-IV		2*30 MW	FY 1993	60

5	Umtru Power Station	Run of River (ROR)	4*2.8 MW	Unit 1-3: FY 1958 Unit 4: FY 1969	11.2
6	Sonapani HEP		1.5 MW	FY 2010	1.5
7	Leshka HEP		3*42 MW	Unit 1& 2:FY 2013 Unit 3: FY 2014	126
					314.7

Source: http://meecl.nic.in/network.htm

The status of consumption of MeECL

No.	Items	Unit	2013-14
1	Installed Generation capacity	Mega Watt	314.70
2	Energy Generation	Million Kilo Watt Hour	861.79
3	Connected load within the State	Mega Watt	630.043
4	Energy consumption within the State	Million Kilo Watt Hour	1072.53
5	Number of consumer within the State	Number	350306
6	Number of Grid Sub-Station	Number	13
7	Number of Electrified Villages	Number	5462
8	Per capita consumption	Kilowatt hour	398

Source: http://meecl.nic.in/network.htm

1.13 Transportation

Number of Registered Vehicles in Meghalaya

Year 2010-2011										
Trucks	**Buses**	**Cars**	**Jeeps**	**Tractors**	**Trailers**	**Two Wheeler**	**Three Wheelers**	**Taxis**	**Other**	**Total**
23029	4071	43901	15541	665	2765	62791	8525	14326	6123	181737

Source: Commissioner of Transport

Road Length Maintained By the Public Work Development

Year	Surfaced (Kms)	Un-Surfaced(Kms)	Total (Kms)	Road Density per 100 Sq Km
2009-2010	5581	2987	8568	38.20

Road Mileage by Class of Roads (in Kms)

National Highway	State Highway	Major District Roads	Other District Road	Village Road	Urban Road	Total
793	1134	1219	3439	1789	1947	8568

1.14 Vision.

"To build safer and disaster resilient communities in the state through a creation and sustenance of culture of preparedness, mitigation and response to natural calamities."

1.15 Theme

The plan comprises risk and vulnerability assessment of disasters in the State. It emphasises the preventive and preparedness measures that would be necessary for disaster risk reduction in the state. It highlights the importance of mainstreaming DM concerns into developmental plans and programmes of the State with proper coordination and implementation arrangements for the same. It also encompasses the financial arrangements and timely review and updation of the plan for effective disaster management in the state.

1.16 Objectives

- Highlight the vulnerability of the state with respect to potential natural hazards
- Provide an overview of the various structural and non-structural preventive measures that would help in the disaster risk reduction in the state
- Provide hazard specific mitigation plans
- Highlight a pathway for mainstreaming DM concerns into developmental plans and programmes in the state
- Emphasise on the partnerships with stakeholders for various DM related activities
- Provide an outline of the various response activities that would be necessary in the event of a disaster along with disaster specific action plans
- Emphasise the Psycho-Social Care and Mental Health Support that could be provided in the event of a disaster
- Provide an outline for effective livestock management for ensuring the upkeep and continuity of livelihood avenues for the rural population in the event of a disaster
- To Review and update the SDMP periodically

Chapter 2: Vulnerability Assessment and Risk Analysis

2.1 Introduction:

A comprehensive understanding of the pattern of various hazards is crucial in order to focus and prioritize the scarce resources for ensuring sustainable development in areas and populations at risk. Similarly, identification of various disasters and the assessment of the consequent effects of such disasters are essential to adopt preventive, preparedness, response and recovery measures to minimize losses during disasters and to ensure quick recovery. For a multi-hazard prone State like Meghalaya, it is essential to ensure that vulnerability and risk reduction aspects are taken into account for all developmental plans and programmes.

While hazards are inevitable, and the elimination of all risks is impossible, there are many technical measures, traditional practices and public experience that can reduce the extent or severity of economic and social disasters. Hazards and emergency requirements are a part of living with nature, but human behaviour can be changed

This statement was made by participants *at a forum organized in July 1999 by the United Nations' (UN) International Decade for Natural Disaster Reduction (IDNDR)*

Vulnerability Analysis

Vulnerability can be defined as:

The characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of natural or man-made hazards. ''

Vulnerability and capacity assessment is a basic process used to identify the strengths and weaknesses of households, communities, institutions and states.

The vulnerability of an area is determined by the capacity of its social, physical, environmental and economic structures to withstand and respond to hazards. Vulnerability analysis has both the engineering aspect & the socio-economic dimension. An analysis of the vulnerability in a given geographical location, an understanding of the socio-economic factors and the capability of the community to cope with disasters, will immensely help the development and disaster managers to plan for risk reduction against future hazards.

Risk assessment is a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of possible vulnerability that together could potentially harm people, property, services, livelihoods and the environment on which they depend. It includes review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes known as a risk analysis process (UNISDR, 2011).

Risk in general is characterized by hazard intensity, exposure of elements and the scale of damage that happen under the influence/action of the hazard. The risks faced are not static and there is a continuous need to study, undertake research and update the profile of the risk within the State as well as the surrounding region.

A detail risk assessment will help in identifying risk reduction measures, prioritize response functions, update preparedness plan and inform strategic and policy decision making at all levels of administration (Local/District/State/National). A detailed Multi- Hazard Risk & Vulnerability Assessment (HRVA) study can direct strategic investment plan for risk reduction.

The State of Meghalaya is prone to natural hazards such as earthquakes, floods, landslides and cyclones, which affect a large number of the population who are residing in the vulnerable areas of the state.

Chronological reviews of the past major disasters show possibilities of such similar events occurring in future. Since the detailed HRVA is in the process of implementation under the guidance of SDMA, after completion of the HRVA it will throw light on the critical issues as identified by experts in their reports.

2.2 Potential Hazard Threat to the State

Hazards both natural and manmade are of immediate concern to the State of Meghalaya. The fragile ecology and geology of the State coupled with large variations in Physio-climatic conditions render it vulnerable to vagaries of nature in one way or the other.

Name of the District	Earth quake	Land slide	Cyclonic wind	Flood	Coal Mining	Population (2011)		Indus-tries	Cement Indus-tries
						District	HQ		
East Khasi Hills, Shillong	VH	H	VH	VH	L	2306069	143007	L	L
West Garo Hills, Tura	VH	M	VH	VH	H	518390	74858	L	L
West Jaintia Hills, Jowai	VH	M	VH	VH	VH	295692	28430	L	L
Ri Bhoi District, Nongpoh	VH	L	VH	M	L	192795	17055	VH	M
South Garo Hill, Baghmara	VH	L	VH	VH	VH	100980	13131	L	L
East Garo Hills, Williamnagar	VH	L	VH	VH	H	132257	24597	L	L
West Khasi Hills, Nongstoin	VH	L	VH	L	H	294115	14252	L	L
East Jaintia Hills, Khliehriat	VH	L	M	L	VH	122436	2191	H	VH
South West Garo Hills, Ampati	VH	L	L	L	L	172495		L	L
North Garo Hills, Resubelpara	VH	L	VH	L	L	118325	9725	L	M
South West Khasi Hills, Mawkyrwat	VH	L	VH	L	M	110152	16666	L	L

Table: 1 List of districts in order of priority based on hazards vulnerability profile.

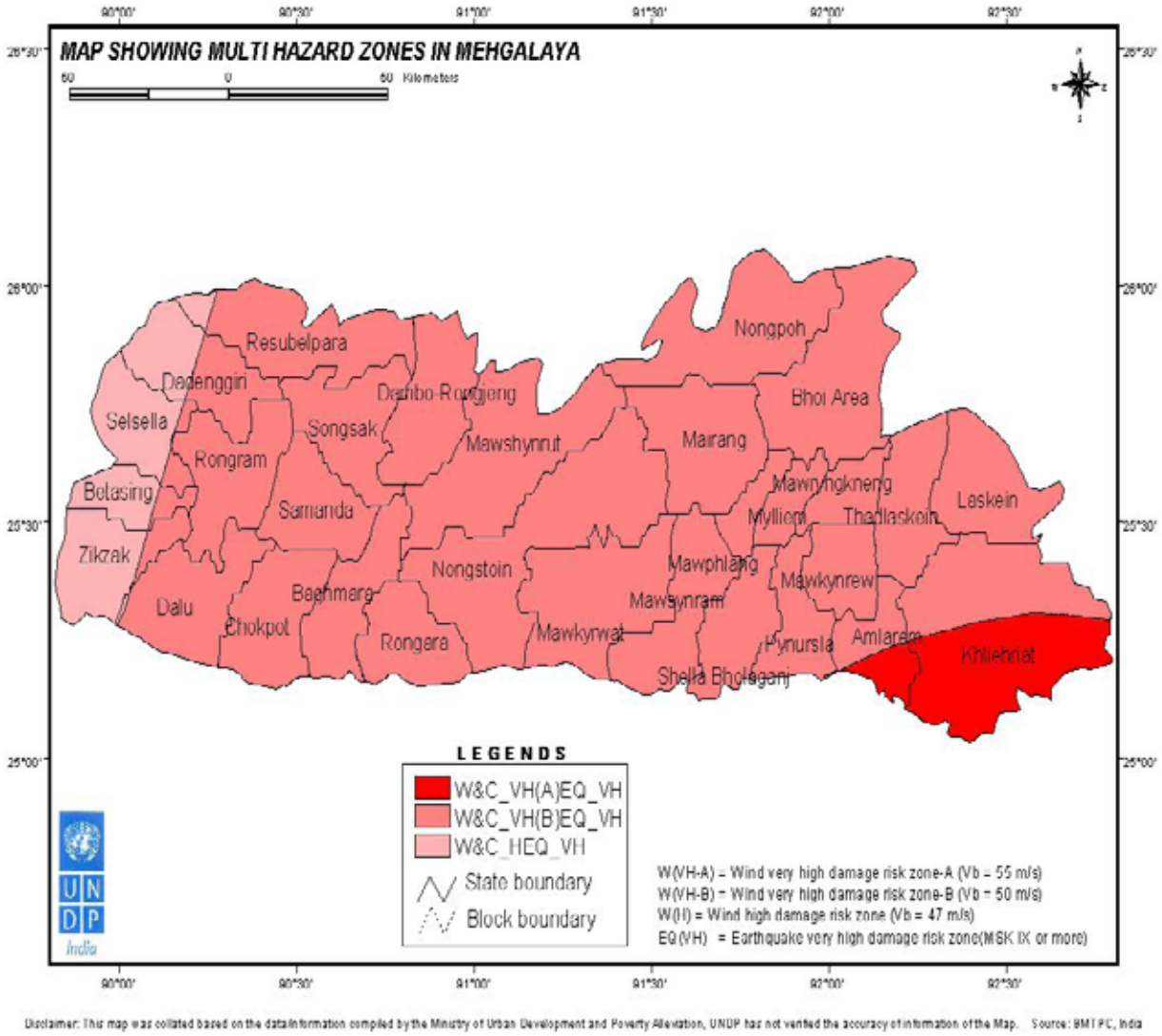
* List of districts in accordance with the hazard vulnerability is prepared on the basis of data available with the Department of Revenue and Disaster Management, Govt. of Meghalaya for the last ten years.

**Data on industries and cement factories are collected from the Dept. of Commerce and Industries, Government of Meghalaya

Due to topographical, meteorological and geological variability across the state the incident of cloud bursts, flash floods, landslides, drought like situation, cyclonic wind and other natural calamities affect the State frequently. According to the disaster prone map of the country, Meghalaya is a multi-hazard State, having hazards such as earthquakes, flash floods, landslides, cyclonic wind etc.

2.3 Vulnerability of Meghalaya to Natural Hazards

As the State lies in the seismically active zone, special emphasis should be given to reduce the impacts of earthquake. Moreover, it is also affected by hazards such as floods, flash floods, epidemics, fire, hailstorm, lightening, road accidents, etc.



Map 2: Multi Hazard Zones in Meghalaya

2.3.1 Vulnerability to Earthquakes

The State of Meghalaya has witnessed seismic events of '8.7 magnitude in 1897'. This region has been identified as a potential site of a future catastrophic earthquake. With the growth of population and infrastructure seismic vulnerability has increased and previous earthquakes have provided a glimpse of the devastating potential of seismic tremors

Largest Instrumented Earthquake in Meghalaya

7 April 1951 - Near Rongrengiri, Meghalaya, 6.8 (TS) 20:29:12.40 UTC, 25.80N, 90.40E

Significant Earthquakes in Meghalaya

The following list briefly outlines significant earthquakes in this region. General locations are provided for historical events for which "generalized" epicentral co-ordinates are available.

12 June 1897 - Near Rangjoli, Assam, Mw 8.0, 26.00N, 91.00E

Close to 1,500 people were killed and hundreds injured. Heavy damage occurred in most parts of Meghalaya and Assam. Damage occurred as far as Kolkata, Dhaka and eastern Bihar. Tremors were felt over a wide section of India.

9 September 1923 - West of Durgapur, Dhaka Division (Indo-Bangladesh Border), 7.1 (TS), 22:03:42 UTC, 25.25N, 91.00E

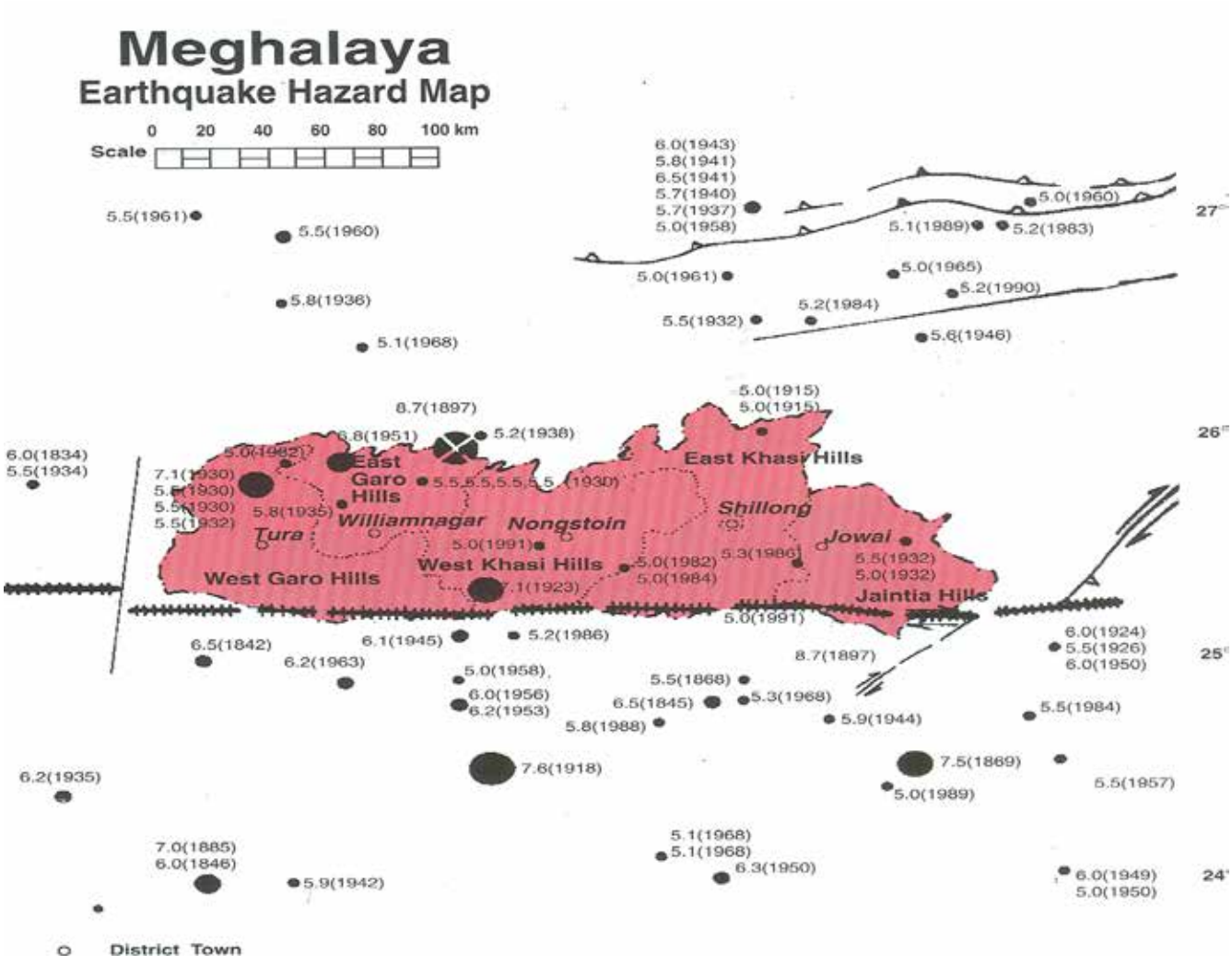
2 July 1930 - South of Dhubri, Assam (Meghalaya - Assam Border region), 7.1 (TS) 21:03:34.4 UTC, 25.80N, 90.20E

Heavy damage occurred in Dhubri. No fatalities were recorded for this earthquake, despite the fact that it occurred late at night.

27 March 1932 - North-west of Jowai, Meghalaya, 6.0 (TS), 08:48:45 UTC, 25.50E, 92.50N

19 May 1945 - Near Mohanganj, Dhaka Division (Indo-Bangladesh Border region) 6.0 (TS) 05:02:53 UTC, 25.10N, 90.90E

7 April 1951 - Near Rongrengiri, Meghalaya, 6.8 (TS), 20:29:12.40 UTC, 25.80N, 90.40E



Map 3: Map showing the earthquake hazard zone in Meghalaya

According to Global Seismic Hazard Assessment Program (GSHAP) data, the State of Meghalaya falls in a region of high to very high seismic hazard. As per the 2002 Bureau of Indian Standards (BIS) map, this State also falls in Zone V.

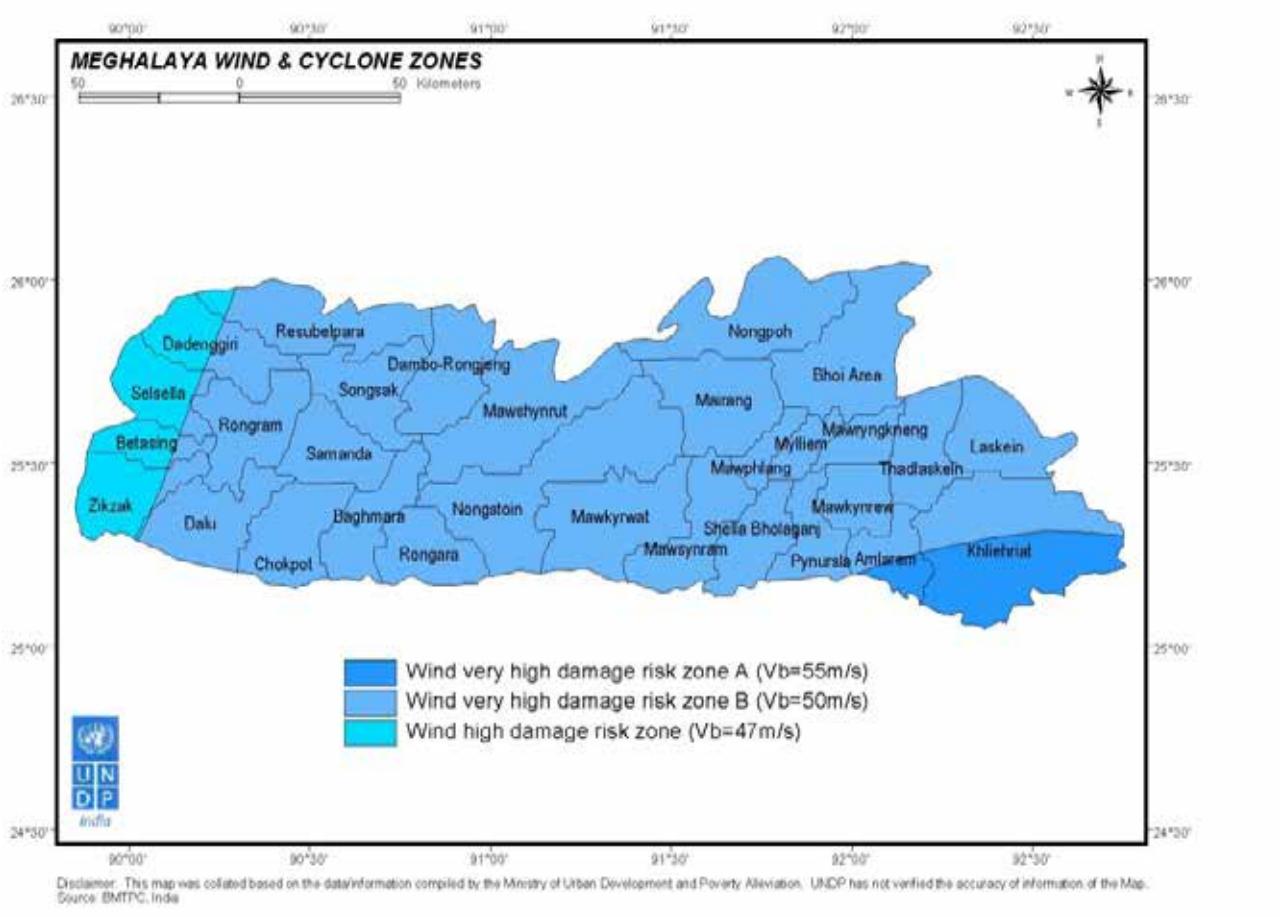
2.3.2 Vulnerability to Cyclones

Meghalaya is situated in the north eastern direction of Bangladesh which is highly prone to cyclone/ winds. Every year about 60% of the area is affected by cyclone in Bangladesh. The Districts of West Jaintia Hills and East Jaintia Hills may experience a wind speed of up to 55m/s. Occasional cyclones do occur in western Meghalaya their severity being more during monsoon season. The Districts close to Bangladesh like South West Garo Hills, South Garo Hills, South West Khasi Hills, West Khasi Hills, fall in very high cyclonic zone due to close proximity to Bay of Bengal (which is a cyclone basin). In this zone wind speed can reach up-to 50 m/s, which can cause large scale damages. The Bay of Bengal accounts for seven percent of the annual tropical cyclone activity worldwide; the recorded frequency of cyclones per year along the Bay of Bengal is four and inevitably one of the four transforms into a severe cyclone causing human and property losses

Illustration of Districts affected by cyclonic storm											
Years	**East Khasi Hills,**	**West Khasi Hills**	**Ri-Bhoi**	**West Jaintia Hills**	**East Jaintia Hills**	**East Garo Hills**	**West Garo Hills**	**North Garo Hills**	**South Garo Hills**	**South West Khasi Hills**	**South West Garo Hills**
	No. of persons died										
2005	----	3	2	---	---	3	----	---	---	---	---
2006	6	3	---	---	---	---	----	---	---	---	---
2007	1	4	---	---	---	---	---	---	---	---	---
2008	4	3	---	---	---	---	---	---	---	---	---
2009	---	1	---	---	---	---	---	---	---	---	---
2010	---	---	---	---	---	---	1	---	---	---	---
2011	---	---	---	---	---	---	---	---	---	---	---
2012	---	1	---	---	---	---	---	---	---	---	---
2013	----	4	---	---	8	---	---	---	---	---	---
2014	----	---	---	---	1	---	---	---	---	---	---
Total	**11**	**19**	**2**		**9**	**3**	**1**	**---**	**---**	**---**	**---**

Table No 2: Damage Caused by Cyclonic wind for Last 10 Years

Source: Records of Revenue and Disaster Management Dept of Govt. Of Meghalaya.



Map 4: Wind and Cyclone Zone in Meghalaya

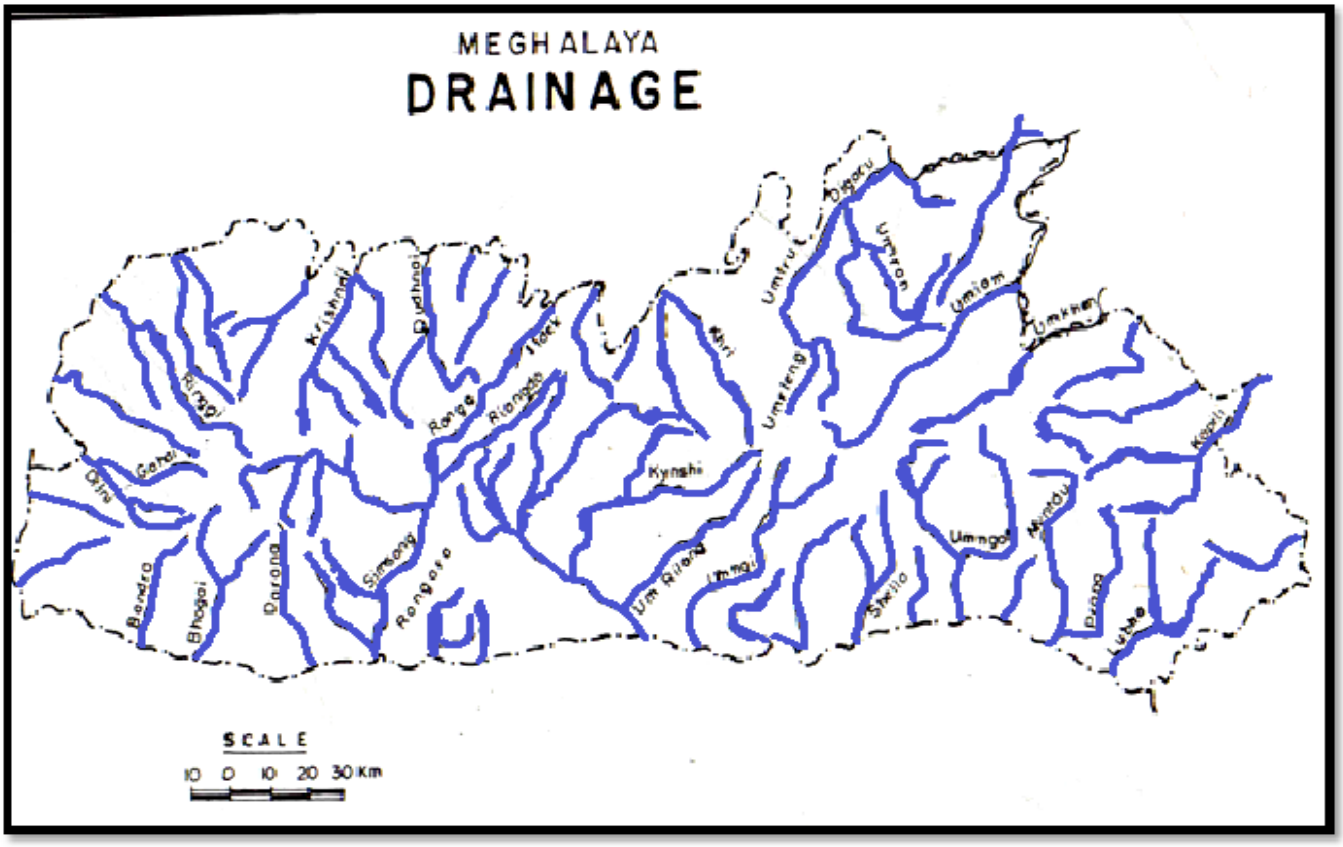
2.3.3 Vulnerability to Floods

The State with hilly terrain does not suffer from a major problem from floods, However, due to heavy rain, flash floods may be caused resulting in river bank erosion and some local damage. In Meghalaya, floods occur in river valleys, when flow exceeds the capacity of the river channel, particularly at bends or meanders.

The plain areas of Meghalaya adjoining Assam are affected by flood due to the back flow of water from the River Brahmaputra during the flood season between June and October. The tributaries like Krishnai, Jinari, Jingjiram, Rongai, Dudhnoi, Ringgi, Gohai, Dilni etc cause flood in the plain areas of the State.

Illustration of Districts affected by flood											
Years	**East Khasi Hills,**	**West Khasi Hills**	**Ri-Bhoi**	**West Jaintia Hills**	**East Jaintia Hills**	**East Garo Hills**	**West Garo Hills**	**North Garo Hills**	**South Garo Hills**	**South West Khasi Hills**	**South West Garo Hills**
	No. of persons died										
2005	---	---	---	---	---	---	----	---	---	---	---
2006	---	---	---	---	---	---	---	---	---	---	---
2007		---	---	---	---	1	---	---	---	---	---
2008	---	---	---	2	---	---	---	---	---	---	---
2009	---		---	15	---	---	---	---	---	---	---
2010	---	---	---	---	---	---	---	---	---	---	---
2011	---	---	---	---	---	---	---	---	---	---	---
2012	---	---	---	1	---	---	---	---	---	---	---
2013	---	---	---	---	---	---	---	---	---	---	---
2014	---	---	---	3	---	4	11	---	---	---	---
Total	---	**---**	**---**	**21**	---	**5**	**11**	**---**	**---**	---	**---**

Table No 3: Damage Caused By Flood for the last 10 Years in the State



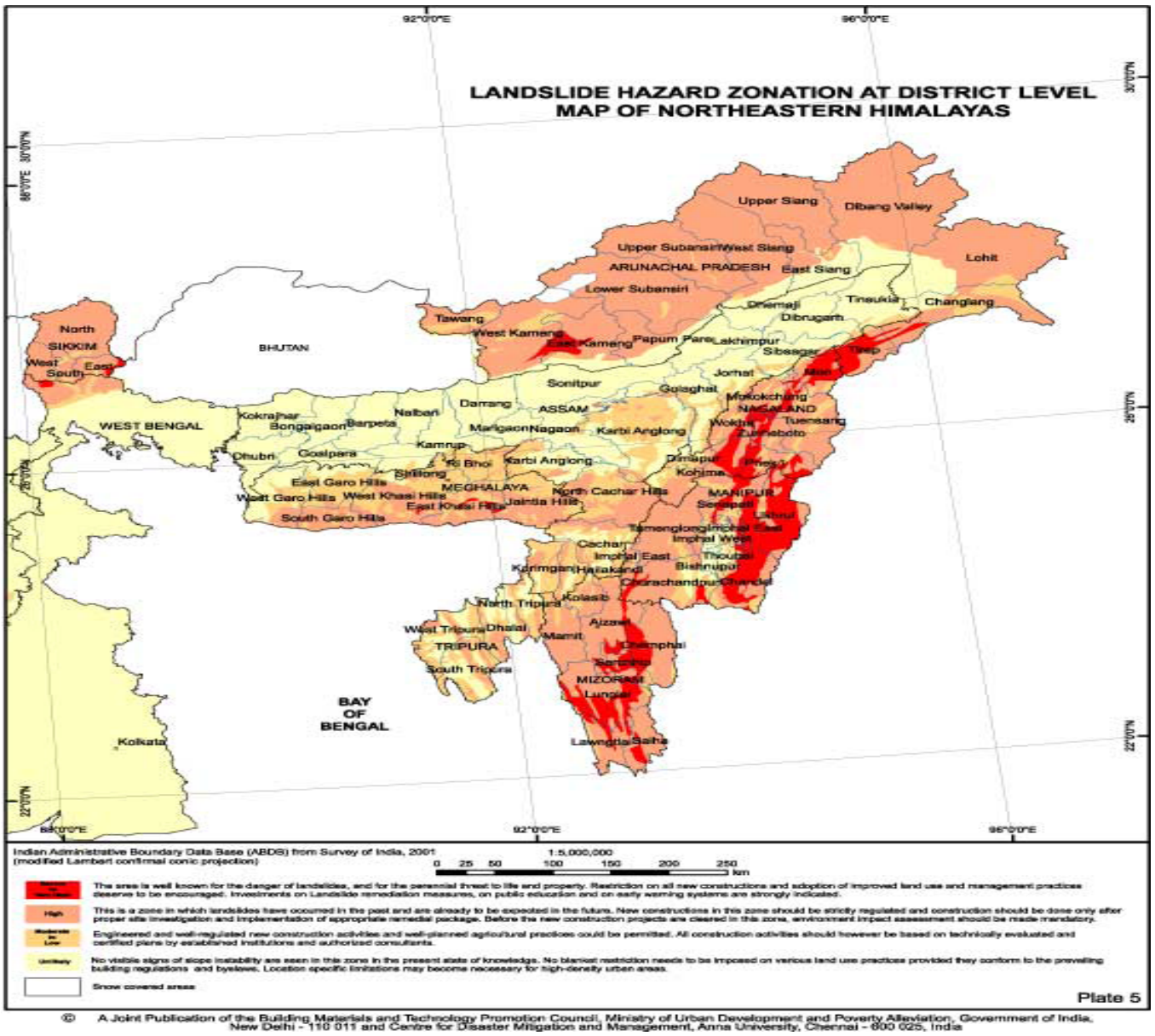
Map 5: Drainage pattern in Meghalaya

The Flood Prone Areas of Meghalaya

- Western part of Meghalaya like Tikrikilla, Phulbari, Rajabala, Garobadha, Hallidaygunj, Bhaitbari, Fersakandi, Magurmari, Silkata, Mahendraganj etc
- Plain areas near Bangladesh like Baghmara, Balat, Shella, Dawki etc
- Urban Flooding in localized areas of Shillong, Williamnagar, Tura etc
- Localised areas of West Khasi Hills, South West Khasi Hills, East Khasi Hills Jaintia Hills and in Ri-Bhoi Districts

2.3.4 Vulnerability to Landsides

Meghalaya being a hilly terrain is prone to landslides. Every year a number of landslides have been reported from various localities. These cause a lot of miseries to public, resulting in loss of lives and properties, disruption of communication network, besides causing economic burden on the society. Landslide is primarily attributed to high slope, immature geology, neo-tectonic activity, heavy rainfall, unplanned and improper land use practice in the State. Landslides generally occur during heavy rains, that is during the months of June to October in Meghalaya



Map No 6: Landslide prone areas of North east India

2.3.5 Landslide Prone Areas

Southern part of Meghalaya is more susceptible to Landslides than the Northern Part. National Highways like Bajengdoba-Tura-Dalu, Damra–Siju-Baghmara, Guwahati – Shillong- Tamabil, and Shillong- Jowai- Badarpur are prone to landslides.

Landslide occurred frequently at Sonapur on Shillong- Jowai- Badarpur Road, but now the problem has been mitigated by constructing a tunnel for the vehicular traffic. Urban areas of Shillong and Tura, Jowai are also prone to landslides due to the faulty Construction of Houses and rapid Urbanization.

Illustration of Districts affected by Landslide											
Years	East Khasi Hills,	West Khasi Hills	Ri-Bhoi	West Jaintia Hills	East Jaintia Hills	East Garo Hills	West Garo Hills	North Garo Hills	South Garo Hills	South West Khasi Hills	South West Garo Hills
	No. of persons died										
2005	---	---	---	---	---	---	----	---	---	---	---
2006	---	---	---	---	---	---	---	---	---	---	---
2007	4	---	---	---	---		---	---	---	---	---
2008	---	---	---		---	---	---	---	---	---	---
2009	---		---		---	---	---	---	---	---	---
2010	---	---	---	3	---	---	---	---	---	---	---
2011	---	---	---	---	---	---	---	---	---	---	---
2012	---	2	3		---	---	---	---	---	---	---
2013	---	---	---	---	---	---	---	---	---	---	---
2014	9	3	---	3	---			27	---	---	---
Total	13	**5**	**3**	**6**	---			**27**	**---**	---	**---**

Table 4: Number of persons died due to Landslides in the State

Source: Revenue and Disaster Management, Govt of Meghalaya.

2.3.6 Vulnerability to Fires

Urban areas in Meghalaya are vulnerable to fire accidents due to various reasons, most of which have been attributed to accidents caused by erroneous human activities leading to outbreak of fire. Most of the urban areas have high density of population and narrow lanes making those localities highly vulnerable to fire incident.

42% of the geographic area of the state is covered by forests and these forests are very vulnerable to forest fires during the dry seasons from February to April. Every year a large stretch of these forests are destroyed either by forest fires or by the Shifting or Jhum cultivation that is practiced in the State in which large areas of forests are burnt down for the cultivation purpose. Such type of slash-and-burn or burn-and-plant method of shifting cultivation destroys not only the forest cover but also cause adverse effect on the people living close to the forest by polluting the environment. Financial institutions, NGOs and government agencies have some measure of success in enlightening the farmers on the ill effects of Jhum agriculture and so new innovations have been incorporated with traditional methods for higher yield

Some of the major fires in the State are as follows:

- Cathedral, Fire Shillong, in 1930
- PWD –Secy & C.E.'s Building, Fire Shillong, 1976
- Assembly Building, Fire in 2001
- Governor's House Secretariat, Fire 2002

2005	---	---	---	---	---	---	----	---	---	---	---
2006	---	1	---	---	---	---	---	---	---	---	---
2007	---	---	---	---	---		---	---	---	---	---
2008	---	---	---	---	---	---	---	---	---	---	---
2009	1	---	---	---	---	---	---	---	---	---	---
2010	---	---	---	---	---	---	---	---	---	---	---
2011	---	3	---	---	---	---	---	---	---	---	---
2012	1	---	---	1	---	---	---	---	---	---	---
2013	---	---	6	---	---	---	---	---	---	---	---
2014	---	---	---	---	1	---	---	---	---	---	---
Total	**2**	**4**	**6**	**2**	**1**	**---**	**---**	**---**	**---**	**---**	**---**

Table 5: Number of persons died due to fire incident in the state

2.3.7 Lightning and Hailstorms

Lightning occurs during the monsoon months and can strike at any place. Hailstorm generally occurs in the pre and post monsoon months. Some loss of crops lives and properties due to lightning and hailstorms are reported in the state.

2.3.8 Mining and non-mining related vulnerability of the State

Coal and limestone are important minerals found in the State of Meghalaya. The total Coal and Limestone reserve in the State are 68 and 500 million tonnes respectively. NSS data for 2011-12 shows the percentage of workers engaged in coal mining in Meghalaya is about 1.5 percent out of total of 10 lakhs workers. In 2012-13, revenue from this sector in the form of mineral concession fees, rents and royalties was to the tune of Rs. 357 crores which constituted about 27% of the state's own revenue receipts. Most of the Coal mining in the State are done un-scientifically i, e. through rat hole mining. Coal mine accidents such as collapse of the mine walls or mine flooding cause several deaths annually. Government of Meghalaya has framed Meghalaya Minerals and Mining Policy of 2012 to regulate the mining activity in the state.

Accidents In Coal Mines And Construction Sites In Meghalaya (2010 - 2015)				
Year	**No. of Accidents**	**No. of persons died**	**No. of persons injured**	**Total No. of persons died & injured**
2008-2012	Data are not available			
2013	21	35	19	54
2014	12	13	1	14
TOTAL	**33**	**48**	**20**	**68**

Table No 6: Accidents in Coal Mines and Construction Sites in Meghalaya

Source: Office of the Labour Commissioner, Government of Meghalaya, Shillong

2.3.9 Vulnerability of dams

Meghalaya has multipurpose dams catering to the irrigation, Hydro power and drinking water. Most of the dams are young and have not experienced any recorded catastrophic breaches, and as Meghalaya is prone to heavy rainfall and as it lies in high seismic zone, they are more vulnerable. Frequent inspections and detailed report about the structural maintenance and safety have to be done by concerned authorities and experts at regular intervals. Remedial measures suggested by the experts should be put into action for the safety and maintence of the dams to mitigate the risks.

Major Hydro power station	Umiam Hydel Project, Umtrew Hydel Project, Myntdu-Leshka-I Hydel Project and the Sunapani Micro Hydel (SESU) Project.
Proposed Hydrel Project	Kynshi (450MW), Umngi −1 (54MW), Umiam-Umtru -V (36MW), Ganol (25MW), Mawphu (120MW), Nongkolait (120MW), Nongnaw (50MW), Rangmaw (65MW), Umngot (260MW), Umduna (57MW), Myntdu-Leshka-II (60MW), Selim (170MW) and Mawblei (140MW).
Proposed Thermal Project	Nangalbibra (750 MW of power)
Total generation of electricity	314.7 MW
Total consumption	610 MW

2.3.10 Vulnerability to road accidents

Economic growth and increase in per capita income of the State has resulted in phenomenal growth in the number of motor vehicles in the State. Road transport is the principal mode of transportation of the people of the State. As a result the annual death toll in road accidents in the State is increasing exponentially. The topography of the State of Meghalaya is also a contributing factor for rise in road accidents in the State.

Year	Total No. of Accident	Total No. of Fatal Injuries	Total No. of Injuries
2011	599	147	345
2012	483	161	257
2013	525	124	266

Table No 7: No of persons injured due to road accidents in the state

Source: Asstt. Inspector General of Police (E), Meghalaya Shillong.

- The following are the main factors contributing to road accidents in the State:
- Lack of Maintenance of vehicles to make them road worthy.
- Poor visibility due to Fog or Smog
- Poor or untrained driving
- Over speeding and overtaking at blind curves in narrow roads
- Non-use of horns
- Use of Mobiles and Headphones while driving
- Driving under the influence of liquor and non-adhering to traffic rules.

Apart from the observance of the Traffic Week, No tolerance week, Safety Week annually, there must be regular and sustained campaigns to prevent and reduce the road accidents.

2.3.11 Industrial Hazards

The state has industrial pockets concentrated in Ri-Bhoi, East Jaintia Hills Districts which render these areas vulnerable to industrial hazards. During 2010-2011 the state had 6069 small, medium and large units operating in the state.

Industrial hazards can be categorized into four types - fire, explosion, toxic release and environmental damage. This is because industries employ many different processes of production involving a wide range of raw materials, intermediates, waste products and final products.

Fire: This is the most frequent type of hazard. The effect of fire on people usually takes the form of skin burns and is usually dependant on the duration of exposure and the intensity of the heat. It produces lots of toxic fumes like Acrolein, Carbon monoxide and Cyanides which are very harmful for living organisms. Physical structures can also be damaged either by the intensity of the high temperature or combustion. It may also have an effect on essential services like power and instrumentation which can cause an escalation of the incident.

Explosion: Explosions in industries kill people but the indirect effects of collapsing buildings, flying glass and debris cause more loss of lives and severe injuries. Gas explosions and dust explosions are the main types of explosions. Gas explosions occur when a flammable gas mixes with air and is exposed to an ignition source. Dust explosions occur when flammable solids especially metals in the form of fine powders are intensively mixed with air and ignited.

Toxic/Chemical release: Sudden releases of toxic vapours have the potential to cause death and severe injuries several miles from the release point. Water and air are the main carriers of toxic vapours. Their release into public sewage systems, rivers, canals and other water courses, either directly or through contaminated water used in fire fighting can result in serious threat to public. The number of casualties depends on the weather conditions, population density in the path of the cloud and the effectiveness of the emergency arrangements.

Environmental Damage: The hazards of fire, explosion and toxic releases not only has the potential for causing injury, loss of life and damage to property but may pose a severe threat to the environment. Release of other substances, not directly toxic to humans can also cause major pollution problems. It is becoming increasingly recognized that damage to natural resources such as plant and animal life can have serious long term consequences.

Vulnerabilities Factor

Location of Communities: Communities are located too close to the Industrial estate. If there is an explosion or chemical release those communities will be severely affected causing loss of life and structural damage.

Inadequate developmental planning. Industries in the Industrial estates are located in such a way that it is easy for one failure to cause a domino effect

Lack of knowledge: The people of the state and primarily the people living close to the industrial estate are unaware of the potential hazards they face on a daily basis. Although they have been warned may times, these people continue to ignore the risk because a disaster of catastrophic scale has never occurred at the estate and companies boast of the low probability of such an incident.

Lack of mitigation measures: No specialized medical facility exists to deal with industrial cases.

Lack of evacuation expertise: The emergency response system is inadequate to handle industrial emergencies as there is a lack of specialized medical personnel as well as triage equipment and facilities.

Transportation risks: Many chemicals including flammable hydrocarbons are transported by the roadway alongside other vehicles and pedestrians. This poses a risk of explosion, fire, blast fragments and other harmful injury to bystanders in the event of an accident.

List of hazardous Industries in Meghalaya as furnished by the Meghalaya Pollution Control Board

Sl.No	Name of Unit	Location	Employment
	M/s Shree Sai Rolling Mills (India) Ltd	Rangsakona, Byrnihat	61
	M/s Umadutt Industries Ltd	Amjok, Byrnihat	21
	M/s Dyna Roof Pvt Ltd.	10th Mile, Mawsmai	16
	M/s A.A. Nutrtions	Mawsmai	25
	M/s K.K. Beverages Pvt Ltd	9th Mile, Baridua	16
	M/s Anabond Limited	9th Mile, Baridua	48
	M/s Jai Kamakhya Alloys Pvt Ltd	Umtru Road, Byrnihat	22
	M/s Meghalaya Bitchem Pvt Ltd	9th Mile, Killing Road, Baridua	20
	M/s Shree Sai Prakash Alloys Pvt Ltd	Rangsakona, Byrnihat	73
	M/s Shree Sai Smelters (India) Ltd	Rangsakona, Byrnihat	70
	M/s Shillong Ispat & Rolling Mills	13th Mile, Tamulkuchi,Byrnihat	37
	M/s Jai Plastech Pvt Ltd.	Rajabagan, Byrnihat	37
	M/s Shivani Ispat & & Rolling Mills Pvt Ltd	13th Mile, Tamulkuchi, Byrnihat	41
	M/s Satyam Alloys	13th Mile, Tamulkuchi, Byrnihat	19
	M/s Pawan Castings (Meghalaya) Pvt Ltd	Harlibagan, Byrnihat	36
	M/s Shree Mahabir Foods Ltd	Umper, Byrnihat	11
	M/s Milestone Beverages Pvt Ltd	13th Mile, Tamulkuchi, Byrnihat	45
	M/s Umadutt Industries	13th Mile,	18
	M/s Meghalaya Cast & Alloys Pvt Ltd	Harlibagan, Byrnihat	28
	M/s Pioneer Carbide Pvt Ltd	Upper Balian, Byrnihat	26
	M/s N.R. Roller Flour Mill	Them Marwet, Khanapara	19
	M/s Hindustan Coca Cola Beverages	15th Mile, Byrnihat	335
	M/s Marak Plastics Pvt Ltd	15th Mile, Byrnihat	41
	M/s Megha Plast Pvt Ltd	15th Mile, Byrnihat	25
	M/s Omni Agate System Pvt Ltd	9th Mile, Byrnihat	26

	M/s Timpack Pvt Ltd	15th Mile, Byrnihat	55
	M/s York Print Pvt Ltd	9th Mile, Amerigog	75
	M/s Surya Alloy Industries Pvt Ltd	13th Mile, Tamulkuchi, Byrnihat	73
	M/s Meghalaya Feed Products Pvt Ltd	9th Mile, Baridua	31
	M/s RNB Caribide & Ferro Alloy Pvt Ltd	Umiam Industrial Area	16
	M/s S.M. Polypack Industries	Umiam Industrial Area	31
	M/s Greystone Ispat Ltd	EPIP, Byrnihat	46
	M/s Kamakshi Ispat Ltd	EPIP, Byrnihat	22
	M/s Maithan Alloys Ltd	EPIP, Byrnihat	54
	M/s Commercial Iron & Steel Co. Pvt Ltd	EPIP, Byrnihat	31
	M/s Nezone Industries Pvt Ltd	EPIP, Byrnihat	31
	M/s F.W. Ferro Tech Pvt Ltd	EPIP, Byrnihat	31
	M/s Nalari Ferro Alloy Pvt Ltd	EPIP, Byrnihat	19
	M/s Trikuta Ferro Alloys Pvt Ltd	EPIP, Byrnihat	18
	M/s Khasi Alloys Pvt Ltd	EPIP, Byrnihat	15
	M/s Brahm India Pvt Ltd	EPIP, Byrnihat	19
	M/s Meghalaya Steels Ltd	EPIP, Byrnihat	42
	M/s Greystone Smelters Ltd	EPIP, Byrnihat	20
	M/s Shyam Century Ferrous	EPIP, Byrnihat	133
	M/s Kakarania Innovative Systems Pvt Ltd	EPIP, Byrnihat	18
	M/s Byrnihat Ispat Pvt Ltd	EPIP, Byrnihat	30
	M/s Meghalaya Meneral Products	EPIP, Byrnihat	21
	M/s H.M. Cement Ltd	Upper Balian, Byrnihat	68
	M/s Bimla Ispat Pvt Ltd	13th Mile, Tamulkuchi, Byrnihat	32
	M/s SRM Plasto Pvt Ltd	Amjok, Umtru Power House Road,Byrnihat	40
	M/s SRM Plasto Pvt Ltd	Umiam Industrial Area, Umiam	16
	M/s CMJ Breweries Pvt Ltd	Extended EPIP, Byrnihat	100
	M/s Sriram Wire Products (Meghalaya)	13th Mile, Tamulkuchi, Byrnihat	24
	Megha Food Products	9th Mile Baridua, Baridua	8
	M/s RNB Cements Ltd	Umiam Industrial Area, Umiam	36
	M/s Nezone Pipes & Structures	Extended EPIP, Byrnihat	18
	M/s NTL Steels	EPIP, Byrnihat	12
	M/s Pioneer Carbide Pvt Ltd	Upper Balian, Byrnihat	26
	M/s N.R. Roller Flour Mill	Them Marwet, Khanapara	19
	M/s Hindustan Coca Cola Beverages	15th Mile, Byrnihat	335
	M/s Marak Plastics Pvt Ltd	15th Mile, Byrnihat	41
	M/s Megha Plast Pvt Ltd	15th Mile, Byrnihat	25
	M/s Omni Agate System Pvt Ltd	9th Mile, Byrnihat	26
	M/s Timpack Pvt Ltd	15th Mile, Byrnihat	55
	M/s York Print Pvt Ltd	9th Mile, Amerigog	75
	M/s Surya Alloy Industries Pvt Ltd	13th Mile, Tamulkuchi, Byrnihat	73
	M/s Meghalaya Feed Products Pvt Ltd	9th Mile, Baridua	31
	M/s RNB Caribide & Ferro Alloy Pvt Ltd	Umiam Industrial Area	16
	M/s S.M. Polypack Industries	Umiam Industrial Area	31

	M/s Greystone Ispat Ltd	EPIP, Byrnihat	46
	M/s Kamakshi Ispat Ltd	EPIP, Byrnihat	22
	M/s Maithan Alloys Ltd	EPIP, Byrnihat	54
	M/s Commercial Iron & Steel Co. Pvt Ltd	EPIP, Byrnihat	31
	M/s Nezone Industries Pvt Ltd	EPIP, Byrnihat	31
	M/s F.W. Ferro Tech Pvt Ltd	EPIP, Byrnihat	31
	M/s Nalari Ferro Alloy Pvt Ltd	EPIP, Byrnihat	19
	M/s Trikuta Ferro Alloys Pvt Ltd	EPIP, Byrnihat	18
	M/s Khasi Alloys Pvt Ltd	EPIP, Byrnihat	15
	M/s Brahm India Pvt Ltd	EPIP, Byrnihat	19
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	M/s RNB Cements Ltd	Umiam Industrial Area, Umiam	36
	M/s Nezone Pipes & Structures	Extended EPIP, Byrnihat	18
	M/s NTL Steels	EPIP, Byrnihat	12

Table 8: Major hazardous Industries In Ri-Bhoi District Industrial Belt

Sl.No	Name of Unit	Location	Employment
	M/s Meghalaya Cement Ltd	Thangsai	132
	M/s Jaintia Coke Pvt Ltd	Nongsning	31
	M/s JUD Cement Ltd.	Wahiajer, Narpuh Elaka	123
	M/s Jaintia Cement Pvt Ltd	Umpleng, Latyrke, Sutna	87
	M/s Abhi Coke Pvt Ltd	Lad Rymbai	19
	M/s Megha Technical Engineers Pvt Ltd	Lumshnong	59
	M/s Cement Manufacturing Company Pvt Ltd	Lumshnong	174
	M/s Hills Cement Company Ltd	Mynkre	103
	M/s Meghalaya Minerals & Mines Ltd	Lumshnong	**20**
	M/s Adhunik Cement Ltd	Umsoo- Mutang, Thangskai	165
	M/s Green Vallied Industries Limited	Nongsning Village	100
	M/s Amrit Cement Industries Limited	Umlaper	98
	M/s Star Cement Meghalaya Ltd	Lumshnong	147

Table 9: Major hazardous Industries in East Jaintia Hills District

RI - BHOI DISTRICT		
1	M/S h.m. Cement Ltd. (Integrated cement plant)	Upper Balian, Burnihat, Ri – Bhoi District. PIN – 793101
2	M/s RNB Cements (P) Ltd. (Integrated cement plant)	Umiam Industrial Area, Umiam, Ri – Bhoi District. PIN – 793101
NORTH GARO HILLS DISTRICT		
3	M/s Virgo Cements Ltd.	Damas village, North Garo Hills District
4	M/s Billennium Cements Ltd. (Clinker Grinding Plant)	Damas village, North Garo Hills District
EAST KHASI HILLS DISTRICT		
5	M/s Mawmluh Cherra Cements Ltd. (Integrated cement plant)	Mawmluh village, East Khasi Hills District.

Table 10: Cement Factories in R-Bhoi, North Garo Hills and East Khasi Hills District

Source: Director of Commerce and Industries, Meghalaya, Shillong

2.3.12 Managing Chemical, Biological, Radiological and Nuclear Emergencies (CBRN) –

Chemical transport includes both hazardous and non-hazardous cargo and transportation of Hazchem by road is a major concern. Hazchem carrier when involved in an accident could lead to:

- Fire
- Explosion
- Release of toxic vapours
- Release of corrosive chemicals

Such an accident has the potential to cause disaster – Fatalities, injuries and damage to environment and property. In India it is seen that 20% of the chemical accidents occur during transportation and 50% of LPG Accidents also happen during transportation. Some of the issues pertaining to the occurrence of chemical disaster are lack of awareness amongst enforcement agencies regarding provisions relating to hazardous chemical transportation, lack of enforcement of available legislative tools, lack of proper driver training and awareness, lack of proper sensitization of first responders – Police, Fire and Medical, lack of sensitization of general population and absence of Hazardous Chemical Transport Accident reporting and investigation system

Legislations related to Chemical Emergency Management are as follows:

- Environment Protection Act, 1986
- Factories Act, 1948 as amended in 1987
- Manufacture, Storage and Import of Hazardous Chemicals rules, 1989 as amended in 1994 and 2000
- Public Liability Insurance Act, 1991 and Rules
- Chemical Accidents (Emergency Planning, Preparedness and Response Rules) 1996
- Central Motor Vehicles Rules, 1989 as amended in1993

- Hazardous Wastes (Management and Handling) Rules, 1989 as amended in 2000 and 2003
- The Explosives Act, 1884
- The Explosive Rules, 2008
- The Static and Mobile Pressure Vessels (Unfired) Rules,1981 as amended in 1993, 2000 & 2002
- The Gas Cylinders Rules, 2004
- The Petroleum Act, 1934 & The Petroleum Rules, 2002

Legislations for safety of the Factories are as follows:

- Factories Act 1948
- Manufacture Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989
- Chemical Accidents (Emergency Planning, Preparedness and Response)
- Rules, 1996
- Disaster Management Act, 2005

As regards the transportation of petroleum and other Hazchem products, the urban population of Shillong, Jowai, Khliehriat are very vulnerable as National Highway 44 passes through Shillong, Jowai and Khliehriat and vehicles carrying essential commodities as well as petroleum, LPG and other Hazchem product to the states of Mizoram, Tripura and three districts of Assam namely Cachar, Hailakhandi, and Karimganj apart from Jaintia Hills Districts of Meghalaya passing through this route The pressure on the road transportation is immense on this stretch of the National Highway and any Hazchem disaster will have a catastrophic impact on it. This particular highway serves as the lifeline for all afore mentioned States and Districts as there is no alternative road communication to the rest of the country. This highway serves a total population of 87.66 lakhs by feeding the population of Assam (36.12 lakhs), Meghalaya (3.92 lakhs), Mizoram (10.91 lakhs), Tripura (36.71 lakhs) according to 2011 provisional census.

2.3. 13 Air Crash

Public air traffic in the State is limited to two sectors mainly along Shillong – Guwahati and Tura, Shillong-Kolkatta Pawan Hans Helicopter service was introduced in Meghalaya in March 1988, but it was suspended and again it was reintroduced in 1999, now services are available from Shillong to Tura and Guwahati. Defence also operate their own Helicopter services for their uses regularly. The only major air crash in Kyrdem Kulai, Ri-Bhoi district involving civilian tragedy was in September 2004, in which 10 people (including a Cabinet Minister and two MLAs from Meghalaya) were killed.

2.3.14 Types of Materials Used For Roofs and Walls in Meghalaya and Their Level of Risks

Distribution of Houses according to the types of materials used for roofs and walls and their levels of damage risk prepared according to data of 2011 census

Materials used for roofs	Percentage
Grass/thatch/bamboo/wood/mud	16.4
Stone	1.8
Metal/G.I/Asbestos	67.3
Concrete	4.7
Tiles handmade and burnt bricks	0.7

Types of Materials Used For Walls

Materials used	Percentage
Grass/thatch/bamboo	38.9
Mud/unburnt brick	6.3
Wood	18.5
Stone not packed with mortar/ Stone packed with mortar	5.7
Burnt brick Concrete	14.7

CATEGORY OF VULNERABILITY

- **Category A (Clay and stone walls)**
- **Category B (brick walls)**

These two categories of houses are vulnerable to receive severe damage including collapse in earthquakes

Category C (concrete and wood frame houses)

Behave much better and only a few collapse in earthquakes

Category D (thatch/metal sheet huts)

They account for majority of houses and they suffer very little damage in earthquakes and do not pose threat to life as the category A and B housing

2.4 Vulnerability of critical infrastructure to natural hazards

A. Potential effects of natural hazards on water supply system

Type of hazard	Infrastructure Type	Impact	Consequences
HIGH WINDS	Houses; Reservoirs ; Over head cables;	Damage to houses /damage to crops Damage to cables	Homelessness, economical loss, Endanger dams/ reservoir Power and telecom failure
HEAVY RAINS	Storm water Drains; Pumping stations	Blocking of drainage system Landslides Flooding	Damage to drainage system, crops and houses, Blockage of roads
EARTHQUAKE	Reservoirs, Ground water Transmission mains, aqueducts, Drainage Distribution system	Structural failure of buildings, road, bridges, Liquefaction, Damaged /Pipe fracture	Loss of water supply system, Fracture of roads, supply failure, Loss of operation, reduced output, close down, Loss of storage of Water tanks due to Burst, leakage in the water Tanks

B. Potential effects of natural hazards on electricity generation and distribution

Type of hazard	Infrastructure affected	Impact	Consequences
High winds	Transmission towers and power lines Power generating stations, cooling towers and sub-stations Distribution lines (overhead)	Collapsed towers and power lines Damage and partial collapse Collapsed lines	Loss of power supply Disrupted power supply
Heavy rain	Reservoirs Generating stations, other facilities	Damage to the generating system Flooded	Possible Progressive failure Loss of supply
Earthquake	Damage to infrastructures Generating stations, Sub-stations, other facilities Distribution lines	Damage from ground failure and motions Damage from Ground failure and motion, e.g. isolators, equipment support frames Collapse of lines and pole mounted transformers	Loss of supply Local loss of supply

C. Potential effects of natural hazards on communication systems

Type of hazard	Infrastructure affected	Impact	Consequences
High winds	Radio and TV towers Overhead cables, Serving of cables	Disorientation Collapse of poles Loss of service	Disruption to or loss of Transmission capability Loss of transmission, high fault rate
Earthquake	Radio and TV towers Overhead cables Underground cables Telephone exchanges	Damage/collapse Collapse of Poles, swerving of cables Damage to cables and broken ducts Dislocation of printed circuit boards, collapse of building	Complete loss of transmission High fault rate, Loss of service Complete loss of service Long term loss of services
Heavy rain	Radio and TV towers, Underground cables Telephone Exchanges	Interference with signal path Flooded	Temporary loss of service High fault rate Complete loss of service

Chapter 3: Preventive Measures

Prevention means the identification of hazards, which will become threats to life and property, and initiating measures to reduce potential loss of life and property.

> ***Preventive activities***
>
> Eliminate or reduce the exposure to and/or reduce the impact of a hazard on communities at risk. Activities, such as the building of dams and levees, land use planning and improved building codes, are focused on reducing the likelihood and/or consequences of the hazards

Whereas Mitigation means lessening or limitation of the adverse impacts of hazards and related disasters (UNISDR 2007). The adverse impacts of hazards often cannot be prevented fully, but their scale or severity can be substantially lessened by undertaking various strategies and actions in course of time. Prevention and mitigation are part of the pre-disaster planning under which variety of activities are undertaken.

> ***Measures of mitigation:***
>
> - Policies for land use planning and building standards
> - Financial assistance for resilient infrastructure
> - Managing warning systems
> - Community education and engagement
> - Public awareness
> - Hazard specific programs

Mitigation is an integral component of sustainable development, which helps the communities to become more resilient from the impacts of disasters.

In the world where there is increasing threat of hazards, mitigation remains the most effective strategy to reduce the risks of these hazards. The State of Meghalaya has to decide its own mitigation strategy according to its own risks, resources and capabilities. In order to implement the mitigation measures effective support of all stakeholders such as the government machinery, research institutions, non-governmental agencies and the community are required.

The Mitigation strategy is broadly classified into structural and non structural mitigation measures.

Structural mitigation measures refer to capital investment on physical constructions or other development works, which include engineering measures and construction of hazard resistant and protective structures and other protective infrastructure.

Non-structural measures refer to awareness and education, policies, techno-legal systems and practices, training, capacity development etc.

> ***Objectives of the mitigation strategy:***
>
> - To substantially increase public awareness of disaster risk management for making the communities safer to live in and work.
> - Promoting institutional mechanisms
> - Incentives and resources for mitigation
> - Mainstreaming, land use planning, and regulations for DM
> - Planning/building resilience of the communities and systems including lifeline buildings

The table below illustrates the Specific Hazards, Nodal Departments and supporting agencies. The nodal departments are expected to carry out Hazard Risk Vulnerability Analysis in respect of the hazards and prepare short, medium and long term mitigation measures both structural and non-structural.

SL. No	Hazards Specific	Nodal Departments	Supporting Agencies
1	Earthquake	Revenue & DM Dept	IMD, Ministry of Earth Sciences/ Geological Survey of India, NDRF, SDRF and Armed Forces
2	Landslides	PWD	IMD, Ministry of Earth Sciences, NESAC, Forest
3	Floods/ Flash Floods/ Cloud Burst	Revenue and DM	IMD, CWC, NESAC, NDRF, SDRF
4	Fire	Home (Fire Department)	Revenue and Disaster Management
5	Forest Fire	Forest Department	Revenue and Disaster Management, Fire dept
6	Drought	Agriculture	IMD, Revenue and Disaster Management
7	Cyclonic Storms	Revenue and Disaster Management	IMD, Agriculture and Horticulture, Home, NESAC
8	Hailstorms	Revenue and Disaster Management	IMD, Home and Insurance , Agriculture
9	Road Accidents	Concerned District Administration	Transport, PWD, BRO, Home and Health
10	Civil Aviation Accidents	Transport	Civil Aviation, Home , Health
11	Boat Capsizing	District Administration	Home and Health
12	Stampede	District Administration	Admin, Health and Home
13	Terrorism	Home (P)	Admin, Health, Rev & DM
14	Industrial accident	Commerce & Industries Department	Labour & Employment, Home, Pollution Control Board
15	Chemical	Commerce & Industries Department	Industry and Department Labour, Home, NDRF
16	Biological	Health and Family Welfare	Home, Admin, NDRF
17	Mines Collapse/ Mishaps	Department of Mining and Geology	Pollution Control Board , Department of Health, Forest and Home
18	Dam/ Reservoir Burst	Power, MeECL	Forest

Table 11: Specific Hazards and Nodal Departments in Meghalaya

3.1 Early Warning and Dissemination Systems

Nodal Agencies for Early Warning:

Following are the Nodal agencies mandated for early warning of different natural hazards in the state of Meghalaya:

Specific Hazards and Departments in the State

Disaster	Central Agencies	Agencies at State level
Cyclonic wind	IMD	Rev & DM
Floods	CWC	Revenue and DM
Drought	M/o Agriculture	Agriculture Deptt

State agencies will coordinate with central agencies. These agencies are responsible for keeping track of developments in respect of specific hazards assigned to them and inform the designated authorities/agencies at National, State and District levels about the impending disasters. All state agencies would coordinate with Central agencies directly or through MHA/ NDMA. Early warning will be available in the website www.imd.gov.in

3.2 Categorization of hazards according to different levels:

3.2.1 Earthquake: With the help of first hand information or disaster communication system and remote sensing satellite information, the disasters can be categorized into any of the following four levels.

Intensity Of Earthquakes	
Seismic Zone	**Intensity on Modified Mercalli scale**
Zone II (Low intensity zone)	VI (or less)
Zone III (Moderate intensity zone)	VII
Zone IV (Severe intensity zone)	VIII
Zone V (Very severe intensity zone)	IX (and above)

Source: http://www.imd.gov.in/pages/services_seismo.php)

3.2.2 Cyclone: It has been categorised in accordance with the wind speed and intensity

- **Category 1:** Category 1 cyclone's strongest winds are GALES with typical gusts over open flat land of 90 - 125 km/h.
- **Category 2:** A Category 2 cyclone's strongest winds are DESTRUCTIVE winds with typical gusts over open flat land of 125 - 164 km/h.
- **Category 3:** A Category 3 cyclone's strongest winds are VERY DESTRUCTIVE winds with typical gusts over open flat land of 165 - 224 km/h.
- **Category 4:** A Category 4 cyclone's strongest winds are VERY DESTRUCTIVE winds with typical gusts over open flat land of 225 - 279 km/h.
- **Category 5:** A Category 5 cyclone's strongest winds are VERY DESTRUCTIVE winds with typical gusts over open flat land of more than 280 km/h.

3.2.3 Flood: Central Water Commission has developed a network of flood forecasting stations and issues Daily Flood Bulletins to all designated Authorities/Agencies of the Central Government and State Governments/ district Administration during the South East Monsoon season for all the major river basins in the following categories:

Level Forecast

Low Flood: The river is said to be in "LOW FLOOD" situation at any flood forecasting sites when the water level of the river touches or crosses the warning level, but remains below the danger level of the forecasting site.

Moderate Flood: If the water level of the river touches or crosses its danger level, but remains 0.50 m below the Highest Flood Level of the site (commonly known as “HFL”) then the flood situation is called the “MODERATE FLOOD” situation.

High Flood: If the water level of the river at the forecasting site is below the Highest Flood Level of the forecasting site but still within 0.50m then the flood situation is called “HIGH FLOOD” situation. In “High Flood Situations” a special “Orange Bulletin” is being issued by the Central Water Commission to the users agencies which contains the “special flood message” related to the high flood.

Unprecedented Flood: The flood situation is said to e “UNPRECEDENTED” when the water level of the river crosses the “HIGHEST FLOOD LEVEL” recorded at any forecasting site so far. In “Unprecedented Flood Situations” a special “Red Bulletin” is being issued by the Central Water Commission to the users agencies which contains the “special flood message” related to the unprecedented flood. **Source**: http://india-wris.nrsc.gov.in/

3.2.4 Landslide: Geological Survey of India issues alerts and warnings to all designated authorities and agencies of the Central Government and State Governments/ district Administration for landslides in the following categories.

Category IV: Landslides of small dimensions that occur away from habitations and do not affect either humans or their possessions.

Category III: Landslides which are fairly large and affect infrastructural installations like strategic and important highways and roads, rail routes and other civil installations like various appurtenant structures of hydroelectric and irrigation projects

Category II: The landslides that may occur on the fringes of inhabited areas and result in limited loss of life and property.

Category I: Landslides of large dimensions that is located over or in close vicinity of inhabited areas like urban settlements or fairly large rural settlements. Activity on these slides can result in loss of human lives, dwellings on large scale.

3.3. Hazard Specific Mitigation Plan

Attempt has been made to indicate the possible structural and non-structural intervention that can be to be taken by the nodal departments to mitigate the impact of disasters. This is not an exhaustive but illustrative list to assist the nodal department to initiate action. The nodal department may consider expanding or limiting various structural and non structural measures according to the need of the department

3.3.1 Earthquake

In most earthquake disasters, the casualties are caused mostly due to the collapse of buildings which are not earthquake-resistant. The loss of lives could be minimized by constructing earthquake resistant buildings and structures in earthquake-prone zones. In the event of an earthquake, the state would also coordinate with the Indian

Meteorological Department (IMD) which can quickly determine the earthquake source parameters on occurrence of earthquake and disseminate the information to all the concerned agencies responsible for relief and rehabilitation measures.

Following are some of the earthquake specific structural and Non-Structural mitigation measures which could be undertaken for important locations in the State.

Structural mitigation	Non-Structural mitigation
Undertake seismic micro zonation study and prepare seismic micro-zonation map which can be an important tool for planning developmental activities for various departments in the State	Conduct/ organize programmes in MATI such as Training of trainers (ToT) for technical institution such as National Institute of Technology (NIT), structural engineers, architects, and masons in earthquake resistant construction.
Observe appropriate BIS codes for earthquake resistant construction of infrastructures and buildings in the State.	Initiate demonstration projects to disseminate earthquake-resistant techniques.
Revise and adopt model building bye-laws and other safety codes for construction in urban areas, operation and enforcement of such bye-laws could be extended to rural areas by legislation	Organize Mass public awareness and sensitization campaigns on earthquake and other hazards risk reduction in the State.
Reconstruct/retrofit the unsafe old buildings/ structures as per technical assessment to make them earthquake resistant	Prepare DM plans at the State, District, Block, ULB and Village, Schools, hospitals levels and integrate disaster mitigation measures into the development plans and programme

3.3.2 Cyclone

Cyclones are characterized by destructive winds, storm surges and very heavy rainfall, each one having its own impact on humans and livestocks and their activities. The cyclone specific structural and Non-Structural mitigation activities are described below

Structural mitigation	Non- structural mitigation
Keep the roofs of the houses intact during strong winds by mean of strong cords and other means	Impart training to the stakeholders involved in Cyclone mitigation and management
Construct Cyclone shelters for people to enable them to take refuge during the cyclones.	Strengthen early warning system in the State, Coordinate with Meteorological Dept. to get localized cyclonic information and issue alert to the people for advance preparedness.
Construct wind breakers to minimize the effects of high winds on the houses	Use technology to identify evacuation routes in case of emergency
	Disseminate cyclone risks to general public residing in vulnerable areas and create awareness on Cyclone safety tips among the community.
	Prepare Maps, delineate and demarcate cyclone hazard areas and sensitive/vulnerable areas to high wind velocities and take advance precautionary measures and organize mass awareness campaigns.

3.3.3 Floods

Floods occur in some areas of the State. Encroachments into the flood plains, natural water bodies and dumping of garbage in the rivers over the years have aggravated the flood problem

in rural and urban areas. There is a need to take effective and sustained mitigation measures to prevent the adverse impacts of flood in the State by adopting various structural and non-structural measures, as described below:-

Structural mitigation	Non- structural mitigation
Development of catchment areas of the flood plain by afforestation, Land sloping, construction of small reservoirs/Check dams etc.	Community awareness and education for mitigating impact of flood.
Enactment and enforcement of laws regulating developmental activities in the flood plain as well as prevent encroachment of natural drainage system and wet lands.	Mapping of flood prone areas which can be used for pre-disaster decision making.
Strengthening and Up-gradation of existing Flood forecasting system and establishing infrastructure for flood warning and dissemination.	Formulation of flood preparedness plan comprising of emergency response planning and training, land use regulation, flood proofing, setting alternative plans and local social structure strengthening.
Built-in safeguards for new water and sewage systems and utility lines from flooding	Proper land use planning is done properly to avoid mudslides and landslides due to heavy rainfall.
Strengthening of Storm drains clearance before rainy season.	
De-silting of rivers in flood prone areas	
Construction of embankments	

3.3.4 Landslides

Landslides are the down-slope movements of masses of rock debris or earth due to shear failure. Landslides may occur suddenly or through a prolonged period of time, with or without any apparent provocation. Landslides and other mass movements are common where the terrain is young, particularly in active mountain belts.

Some of the structural & non structural measures that can be under taken to reduce the impact of landslides are:-

Structural mitigation	Non- structural mitigation
As landslides mostly occur due to heavy precipitation, identify all stream runoff and clear blocked areas before the rainy season, to avoid blockade.	Training of professionals like engineers and geologists for landslide mapping, investigation techniques, analysis, and observational practices.
Maintain and protect both sides of the river and stream to avoid erosion and improve the channels for free flow of water	Develop an inventory of the existing built environment in areas around existing landslides and in high hazard zones as per the landslides hazard Zone (LHZ) maps and along strategic road
	Monitoring of landslide prone areas either through an automated system or by preparation of hazard area maps and following up ground check on such vulnerable areas during monsoon or raining season.
	House site allotment should be considered only after careful consultation with Land Use Plan to avoid risk of landslides and land-sinking.
	Laws should be enforced to regulate or prevent construction in vulnerable areas and ensure that any type of construction or developmental activities in high hazard areas be cleared only after appropriate remedial measures are in place.

	Soil testing should be mandatory before permission is considered for any new construction.
	Organize public awareness campaigns on warning and protective measures to be undertaken, importance of insurance and structural mitigation measures.
	Conduct LHZ and prepare Landslide Incidences mapping. Paleoslide zones should be identified and mapped.

3.3.5 Industrial Hazards

Design and Pre-modification review: It involves proper layout, facilities and material selection. Research should be done to try to substitute extremely toxic chemicals with safer ones. Less chemicals should be stored as a reduction in inventory will cause less damage should an accident occurs.

Chemical Risk Assessment: Chemicals are assessed based on compatibility, flammability, toxicity, explosion hazards and storage.

Process Safety Management: HAZOP studies, reliability assessment of process equipment, incorporating safety trips and interlocks, scrubbing system, etc. should be done before effecting major process changes. Management should try to develop a culture of safety in industrial organizations

Safety Audits: Periodical assessment of safety procedures and practices, performance of safety systems and gadgets along with follow up measures should be carried out.

Emergency Planning: A comprehensive risk analysis indicating the impact of consequences and specific written down and practiced emergency procedures along with suitable facilities should be done. This can be done by communities as well as national or regional corporation authorities

Training: Proper training of employees and protective services should be done.

Special times and escorts for dangerous vehicles

Public Cooperation on the road: The public should cooperate with the police and allow tankers and heavy duty vehicles carrying dangerous materials to take the shortest possible route on time in order to avoid accidents.

Public awareness: Everyone should be aware of potential disasters and informed of protective and safety measures. MSDS sheets should be readily available to the public. Cautions must be taken to display on dangerous household items and car care products and so on.

Proper storage of hazardous materials: All chemicals and hazardous materials should be kept at proper storage temperature and in locked cupboards away from children and animals. Also, if reactive substances are stored, it should be stored is a watertight container.

Disaster Emergency response plan: Department of Transport, Commerce and Industries, Pollution Board, Traffic Police and the industrial Units should prepare Disaster Emergency Response plan and regularly update it.

Mock Drills: All the industrial units should carry out regular mock exercise in collaboration with the Administration along with the population residing in the periphery of the industrial units to be better equipped with skills to deal with any emergency situation.

Quick Response Team: All the industrial units should have their own quick response team and regularly train them so that they can handle the situation of industrial disaster till outside help arrives.

3.3.6 Managing Chemical, Biological, Radiological and Nuclear Emergencies (CBRN)

Pre-Emergency Planning

Hazard Identification

(1) The first step shall be to identify potential on-site and off-site hazards such as gas leaks, spills, fire, explosion, transportation accidents, pipeline ruptures, equipment failure, natural calamities, etc. and the types of damages caused by them. The hazard identification shall include: (a) information on toxicological, physical, and chemical properties of the substances being handled in the format of Material Safety Data Sheet (MSDS) (b) The identification of potential impact on downwind air quality or downstream water quality from an incidental release and possible danger to human, Floura & Fauna and animal health. (c) Hazards to the installation shall also include Natural perils such as floods, earthquakes, cyclones or landslides etc.,

- Mitigation measure:
- Roads, On-Road facilities, Signage
- Road improvement activity to be taken up on priority
- Identify accident prone zones
- Display appropriate signage
- Dedicated transport corridors
- Provide facilities such as crane/ambulance at specific intervals
- Plan city/town by-pass
- Provide adequate and safe parking options with rest areas for the drivers
- Decongestion of traffic intersections – flyovers, removal of encroachments
- Smart signals – divert traffic on alternate routes for decongestion and emergency response

Response centers - Health

- Using GIS techniques map the National and State highways
- Overlay the location of Major hospitals state-wide including DH, SDH, CHC and major private hospitals
- Establish Trauma-Center norms
- Identify gaps and evaluate cost to cover the gap
- Form a PPP model for up-gradation, operation & maintenance

Response centers - ERC

- On the available GIS map of National and State highways – locate the available ERCs
- Overlay the location of first responders - police stations, Fire stations and major industries
- Mark locations of DHQ
- Establish benchmarks based on number of chemical industries and broad extent of chemical cargo movement along the corridors in the vicinity
- Draw circles of 25/50 Km from potential response centers
- Identify blank areas and plan to establish ERCs/Upgrade existing facilities at the response centers

Response System

- Hazmat Van
- Advanced fire-fighting facilities
- Temporary area lighting facilities – flood lights (flame proof – POL Service)
- Spill containment/mop-up/coverage systems
- Use of appropriate PPEs
- Procurement of advanced PPEs

Administrative Solutions:

Department of Hazchem Transport Management under State Police and Dept. of Transport to be set up for imparting:

- Comprehensive training for staff issuing fitness certificates regarding design codes, their requirement for the inherent safety of the container and the vehicle, etc.
- Comprehensive training of the inspectors regarding the applicable legal requirements
- Training for the inspectors regarding the Hazardous chemicals so as to make them understand the consequences of non-compliance and the extent of possible damage in case of an accident involving hazardous chemical carrier.
- Specific training on handling and transport of non petroleum cargo
- Recording and analyzing transportation accident data

Modification / Harmonization of Rules

- List of Hazardous Chemicals in different rules to be harmonized
- Accident Database mechanism needs to be devised and implemented
- Responsibility for Loading Leaky/Defective Tankers to be clearly defined in CMV Rules
- Number, specification and type of Fire Extinguishers & PPEs to be clearly specified and different rules to be harmonized.

Sl. No.	Districts	No. of Petrol Pumps	Storage of LPG	Bottling Plant	Kerosene Depot
1.	North Garo Hills	7	1	Nil	1
2.	West Garo Hills	20	4	Nil	3
3	South West Garo Hills,	2	1	Nil	2
4	East Jaintia Hills	27	Nil	Nil	2
5.	West Jaintia Hills	13	3	Nil	4
6.	East Garo Hills	4	1	Nil	2
7.	South West Khasi Hills,	3	Nil	Nil	Nil
8.	Ri-Bhoi,	32	2	Nil	2
9.	East Khasi Hills	25	12	Nil	20
10.	West Khasi Hills	4	2	Nil	2
11.	South Garo Hills	3	1	Nil	1

Table 12: District wise Number of Petrol Pumps and Storage of LPG, Bottling Plant and Kerosene in the State.

Source: Food Civil Supplies and Consumer Affairs, Government of Meghalaya, Shillong

To manage an incident of CBRN contamination of water supply, a model SOP as given under will be followed.

Incident Reporting

Any breach of security or suspected event of accidental or intentional contamination will be communicated to the Executive Engineers or any other functionary of PHE

Department office through the quickest possible means. Subsequently, s/he will inform the same to the local police, law enforcement and intelligence agencies and request for physical quarantine of the contaminated site. The incident would also be reported to Secretary Department of Home, SEC, and SDMA with a request to remain at stand by.

Site Characterization

Water supply in charge along with law enforcement agencies would visit the site and make an onsite inspection for identification of physical evidences to confirm the incident. Police & Law enforcement agencies would collect and preserve physical evidences for further investigation and necessary action. Water facility in charge will also make an initial hazard assessment based on available evidences for determining potential need for specialized men, material, techniques or equipment. Based on the findings of initial site evaluation, both to and fro water supply should be stopped immediately.

Preliminary Screening

Specifically Trained personnel of PHE department would be deployed for sample collection and spot-testing. Sample would be collected from the nearest point. Sample collected would be divided into two, one for spot testing and another for laboratory testing. First set would be subjected to spot testing by prescribed methods. Once the incident and nature of contamination

is established the same would be communicated to district administration in precise and clear language for activating their crisis management plan. Following positive screening, second half of the sample would be immediately sent to pre identified reference laboratories in consultation with SDMA/NDMA.

Risk Communication

District administration in association with disaster management authority will make public pronouncement of contamination in clear and precise language along with requisite precautions to be taken. All care will be taken to avoid undue panic situation.

Alternate Supply

The concerned Executive Engineer in association with district administration would make alternate supply arrangements. In absence of alternate supply, water would be decontaminated through the technique of reverse osmosis and mobile water purification van developed by DRDO for which contact will be established with NDMA.

Decontamination

Supply lines and storage facilities would be decontaminated using appropriate and available technology such as Reverse Osmosis, Carbon Columns and other Water Purification System (WPS) suitable for purification of water contaminated by CBRN agents. State Pollution Board shall advise on this issue.

Restoration of supply

Following repair and decontamination of facility, a fresh water sample would be retested and certified for public consumption.

Chapter 4: Mainstreaming DM Concerns into Developmental Plans/ Programmes/ Projects

The word mainstream is obviously derived from the metaphor of a small, isolated flow of water being drawn into the mainstream of a river where it will expand to flow smoothly without loss or diversion. Therefore 'mainstreaming risk reduction' describes a process to fully incorporate disaster risk reduction into relief and development policy and practice. It means radically expanding and enhancing disaster risk reduction so that it becomes normal practice, fully institutionalised within an Organisation relief and development agenda.

Mainstreaming is a cross-cutting issue which requires public cooperation and consideration, scientific knowledge and know-how, conscientious risk sensitive development planning and practice, a people-centered early warning system and disaster response mechanisms at state and district levels.

Safeguarding human rights and integrating gender concerns are essential to achieving mainstreaming concepts at the local and state levels. Because disaster risks impact multi-sector development activities (such as education, health, environment, governance, employment and livelihoods) they influence development gains. An assessment of the extent to which these social domains consider natural or human-induced factors or risks (existing and prospective) in the conceptualization and implementation of programmes is crucial for successful execution of risk mitigation plan

The link between disaster and development has been appreciated by India only recently and it has been endorsed by Hyogo *Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters* which envisages "integrating risk reduction into development policies and plans at all levels of Government including poverty reduction strategies and multi-sectoral policies and plans".

4.1 Disaster and Development

Natural disaster risk is intimately connected to processes of human development Disaster impacts result in a serious social and economic setback to the development. On the other hand, the process of development, and the kind of development choices made by individuals, communities and nations can generate new disaster risks.

The intricate relationship between disaster and development is outlined in the following Table.

THREE DIMENSION OF DEVELOPMENT AND DISASTER LINKAGE		
Disaster limits development	**Economic Development**	**Social Development**
	Destruction of fixed assets. Loss of production capacity, market access or material inputs. Damage to transport, Communications or energy infrastructure. Erosion of Livelihoods, savings and physical capital.	Destruction of health or education infrastructure and personnel. Death, disablement or migration of key social actors leading to an erosion of social capital.
Development causes disaster risk	Unsustainable development practices that create wealth for some at the expense of unsafe working or living conditions for others or degrade the environment.	Development paths generate cultural norms that promote social isolation or political exclusion.
Development reduces disaster risk	Access to adequate drinking water, food, waste management and a secure dwelling increases people's resilience. Trade and technology can reduce poverty. Investing in financial mechanisms and social security can cushion against vulnerability.	Building community cohesion, recognizing excluded individuals or social groups (such as women), and providing opportunities for greater involvement in decision making, enhanced educational and health capacity increases resilience.

Source: Reducing Disaster Risk a Challenge for Development, UNDP

4.2 Legal Context

The Disaster Management Act was enacted on 23rd December, 2005. The Act provides for establishment of –

- NDMA (National Disaster Management Authority)
- SDMA (State Disaster Management Authority)
- DDMA (District Disaster Management Authority)

As per the Act, NDMA has been entrusted with responsibility to

- "*lay down guidelines to be followed by the different Ministries or Departments of the Government of India for the purpose of integrating the measures for prevention of disaster or the mitigation of its effects in their development plans and projects*."
- *"monitor the implementation of the guidelines laid down by the National Authority for integrating of measures for prevention of disasters and mitigation by the Ministries or Departments in their development plans and projects"*

The State Disaster Management Authority (SDMA) which has been created as an apex authority at the State level has been mandated under clause (d), Sub Section (2) of Section 18 of the Act to "lay down guidelines to be followed by the departments of the Government of the State for the purposes of integration of measures for prevention of disasters and mitigation in their development plans and projects and provide necessary technical assistance therefore" and to "review the development plans of the different departments of the State and ensure that prevention and mitigation measures are integrated therein {Section 18 (2) (g)}.

Similarly, the State Executive Committee (SEC) headed by the Chief Secretary is responsible to "monitor the implementation of the guidelines laid down by the State Authority for integrating of measures for prevention of disasters and mitigation by the departments in their development plans and projects {Section 22 (2) (e)}. The DDMAs have also been entrusted with the similar functions of laying down guidelines to be followed by various departments and also to review their development plans for DRR integration.

4.3 Mainstreaming DRR: Sectoral Approach

The nodal department in column I should develop time-line and modalities for mainstreaming DRR in developmental planning and risk reduction. The suggested Structural and Non-Structural measure are illustrative in nature and Departments may exercise their judgement in expanding it further depending on requirements.

Departments (I)	Non Structural (II)	Structural (III)
Infrastructure: Public Works, Dept, Community and Rural Development, Public Health Engineering, Irrigation, Soil Conservation	• To incorporate disaster risk impact assessments as part of the planning process before • the construction of new roads or bridges, check dams • To promote use of hazard risk information in land-use planning and zoning programmes. • Promoting watershed management in hilly terrains • Encouraging roof-top water harvesting • Promoting stream water harvesting • Training on use of disinfectants (halogen tabs, bleaching powder, etc) • Training of rural volunteers on repairing of tube wells/ and damaged drinking water sources. • Providing loans for setting up of water banks and rainwater harvesting initiative • Creating awareness on the waterborne diseases	• Making all weather resistant roads • Constructing of • roads/ culverts considering disaster resistant norms/features • Avoiding construction in vulnerable areas • Periodic verification/ repairs of roads/culverts/bridge • Constructing embankment to restrict waters from entering the agricultural land • Desilting of channels during agricultural off-season • Preventing Soil erosion • Clearing the water channels • Opening up alternate channels for releasing excess water • Constructing community water storages
Housing: Urban Affairs Housing Development, Community and Rural Development	• To promote the increased use of hazard-resilient designs (e.g. flood proofing, or seismic safety) in Urban and rural housing programmes in hazard-prone areas. • To promote utilisation of national building codes that have special provisions for enhanced design standards for buildings in hazard prone areas. • To promote compliance and enforcement of local building laws requiring prescribed standards under natural building codes in urban hazard-prone areas. • Supervising the conduct of fire safety mock drills among people • Creating awareness on safe construction • Training of rural masons/ helpers/ carpenters/ plumbers on construction of safe houses • Promoting low cost disaster resistant technology in rural housing	• Determining disaster-prone areas by use of advanced technology such as GIS, Remote Sensing and Mapping

Health	• Identify hospitals and health facilities that are located in hazard-prone areas, analyse their internal and external vulnerability during emergencies, and increase the hazard resilience of these hospitals. • To prepare and implement a Hospital Preparedness Plan for all such health facilities • Conducting community level first-aid training programmes • Conducting regular mock drill in hospitals. • Linking with the community first-aid teams and ASHA for refresher training and refilling of first-aid kit • Arranging for professional counseling and post-traumatic stress disorder	• Construction of the health centres and hospitals should be disaster resistant • Making provisions for emergency medicines and supplies • Retrofitting hospitals and health centers if necessary
Finance Department	• To incorporate provisions in micro-financing schemes to have flexible repayments schedules that can be activated in the event of recipients being affected by natural disasters. • To encourage the financial services sectors and local capital markets to develop schemes for financing disaster risk reduction measures.	
Agriculture and allied Department (Fishery, sericulture and weaving)	• Promoting Crop Insurance • Creating Community grain/seed banks • To promote effective programs of contingency crop planning to deal with year to year climate variations. • To promote effective programs of crop diversification including the use of hazard resistant crops, to deal with shifts in climate patterns. • To ensure sustainable livelihoods in areas of recurrent climate risks (i.e. arid and semi-arid zones, flood and cyclone prone areas) by promoting supplementary income generation from off-farm (e.g. animal husbandry) and non-farm activities (e.g. handicrafts). • To promote effective insurance and credit schemes to compensate for crop damage and losses to livelihoods due to natural hazards. • Generating awareness on use of fish nets, safe Fishing Zones, Warning System • Training Fishermen/ Farmers on net making, managing response time, pond safeguards, etc. • Prompting insurance of fisheries	• Regular pond cleaning and bleaching
Education	• To incorporate DRR modules into the school curriculum • Conducting periodic mock drills in schools on fire safety • Encouraging NCC/NSS volunteers to go for disaster management training	• To construct all new schools located in hazard-prone areas to higher standards of hazard resilience • Conduct rapid visual survey and retrofitting of the weak school structure • To add features in schools in hazard prone areas for use as emergency shelters such as facilities for water, sanitation and cooking.

Veterinary and Animal husbandry	• Promoting insurance of livestock • Creating awareness on livestock management in disasters • Promote Planning for fodder contingency	• Setting up veterinary centres which are disaster resistant
Home Guards and Civil Defence	• Providing for regular mock drills • Promote volunteerism among the youth and involve them in rescue operation. • Training volunteers from community on search and Rescue operations	• New equipments and technology should be available with HG&CD personnel for carrying out search and rescue operation

4.4 Mainstreaming DRR into ongoing Flagship Programmes

The nodal department will prepare structural and non-structural mitigation measure in respective of important schemes and projects. Similar measures may be contemplated by Deptt in respect of schemes which are not include herein

Name of the Scheme	Sector	State Department Responsible for Implementation of the Scheme	Proposed strategies
Indira Awas Yojana	Housing	Community and Rural Development	i. Inclusions of such measures like application of Hazard resistant design in construction of IAY houses, appropriate site of IAY housing as per guideline of IAY. ii. Development of model design for IAY houses which could be easily referred to by DRDAs at district level and used for community awareness depending on the geographical location. iii. Capacity Building of Rural masons on safe construction. iv. Capacity Building of local representative institution. v. Community Awareness. vi. Capacity Building Programmes for DRDA officials on Disaster Risk Reduction issues.
Mahatma Gandhi National Rural Employment Guarantee scheme	Livelihood security and Rural development	Community and Rural Development	i. Identify works that are available which can take into account the hazard profile and ensure continuous employment opportunities in the event of disasters. Works which reduce disaster risk are given priority in plans-such as local mitigation works etc. ii. Any other implementable suggestion within the ambit of the scheme.

Pradhan Mantri Gram Sadak Yojana	Infrastructure	PWD (Road)	i. The Master Plan for rural roads, the district rural road plan and identification of core network under the planning process of this scheme should, the overall guidelines of its preparation, explicitly address the disaster risk reduction concerns and accord priority to connect the vulnerable habitations. ii. The technical guidelines should explicitly provide for suitable protection and inclusion of disaster risk concerns explicitly – while provision of cross drainage, slope stabilization, protection works are already included, in multi-hazard and especially flood and landslide prone areas, fair weather roads need to be upgraded on a priority basis. iii. The maintenance guidelines are modified to ensure that in case of disasters these roads get provision for restoration to ensure all weather connectivity.
Sarva Siksha Abhiyaan	Education	Education	i. Development of a Policy of school safety. ii. Introducing school safety as a part of the guidelines of SSA iii. which is currently focusing on inclusive development. iv. Developing structurally safe designs for schools. v. Introducing School Safety in the Teacher's Training Curriculum. vi. Training of Rural Engineers appointed under SSA Scheme as well as the SSA State Coordinators. vii. Community Awareness/ SMS awareness.
National Rural Health Mission	Health and family welfare	Health	i. Ensure that the village Health Plan and the District health plan explicitly address the disaster risk reduction concerns in the vulnerable habitations and the vulnerable districts and the disaster management plan as per DM Act 2005 and links itself to the District and village Health plans. ii. Provide training to the ASHA workers on disaster health preparedness and response. iii. Strengthening of Health Surveillance System in rural areas. iv. Ensuring structural safety of the CHC/PHC and other health care service delivery centres in rural areas. v. Training of doctors and hospital staffs on mass casualty management and emergency medicine. vi. Community awareness on disaster management.

4.5 Psycho-Social Care and Mental Health Support (PSSMHS)

Disasters are devastating not only physically, but also emotionally and psychologically. In manmade disasters psychological morbidity is seen in almost 30-40% of the population within the first year.

Early Identification & Treatment

- Primary Care - Physicians can play a vital role
- Most survivors attending primary Health Care facility present with anxiety or depression complain of aches and pains
- Adequate recognition and early treatment can hasten recovery & decrease suffering

Four different phases of psychosocial consequences related to response, relief & reconstruction

- **Heroic phase** – People struggle to prevent loss of lives and minimise damage. People cooperate well in helping others***. It lasts for few days to a week.***
- **Honeymoon phase -** Massive relief efforts lift the spirits of survivors & hopes of quick recovery run high. Survivors clean up debris and anticipate considerable help in solving their problems. ***It Lasts for a few weeks into several month***
- **Disillusionment phase-** is characterized by strong feelings of disappointment, resentment and bitterness – especially if delays for compensation occur and promises of the government are not fulfilled. Community groups may weaken or disappear. ***It Lasts from several months to a year or more***
- **Reconstruction Phase Survivors-** realize that they will need to solve their problems of rebuilding their homes and business. They gradually assume such responsibility. ***It Lasts from one year to several years***

Psycho Social Support needs to be provided to the following persons

- **Primary Survivors**: Those directly exposed to the disaster.
- **Secondary Survivors**: Grieving close relatives of primary victims.
- **Third level Survivors**: Rescue & recovery personnel- medical, mental health professionals, etc.
- **Fourth level Survivors**: People in the community – reporters, government personnel.
- **Fifth Level Survivors**: Individuals experiencing disturbed states after seeing or hearing media reports.

Following measures will be taken:

i. Department of Social Welfare & Child Development will set up counselling centers

ii. Integrate with Disaster Management (DM) mental health plans and Health/Hospital DM Plans

iii. Integrate with all trainings in the area of Psychology, Social Work, Mental Health, Emergency Medical Response, Hospital Administration, Nursing and Paramedics

iv. Inclusion in the Community Based Disaster Management (CBDM) Plan and training of Panchayati Raj Institution (PRI) team members

v. Developing awareness material for the community

vi. Evolve a mechanism for community outreach education programmes on Psycho-Social Support and Mental Health Services (PSSMHS)

vii. Creation of a core group of master trainers at district level.

Chapter 5: Preparedness Measures

5.1 Resource Availability:

Indian Disaster Resource Network (IDRN), a web based information system is a platform for managing the inventory of equipments, skilled human resources and critical supplies for emergency response at the National Level. The IDRN network has the capabilities of generating multiple query options based on the specific equipment, skilled human resources and critical supplies with their location and contact details.

5.2 Community Based DM (CBDM):

Community should be closely associated with prevention, mitigation, preparedness, training, capacity building, response, relief, recovery i.e. short term and long term, rehabilitation and reconstruction.

In order to enhance communities' capacity to take action which will help themselves in the absence of necessary outside response for days the Meghalaya Disaster Management Plan envisages creating necessary community awareness about hazards, risks and skilful response.

Medical first aid, Search and Rescue, Road clearance and Fire fighting are the specific areas which community response preparedness has to address.

Local durbars and nokmas and village disaster management committees will be encouraged to keep essential items like rope, shovel, spade, bamboo etc needed after the disaster and also encourage to establish local early warning systems like ringing of bells in the church, temple or mikes in the mosque, beating drums etc as well as conducting regularly community level disaster response drills.

This will contribute in strengthening community's capacities; ensures livelihood security and sustainable development. CBDM emphasizes the importance of community as the primary stakeholder in risk reduction and development process.

5.3 Training, Capacity building and other proactive measures

Proactive measures such as strengthening community defence, training and enhancing capacities of non-governmental organization as stakeholders in DM will supplement SDMAs efforts in achieving risk reduction and well prepared civil society. There are several institutions such as Home Guards and Civil Defence, National Cadet Corps (NCC), National Social Service (NSS), Nehru Yuva Kendra (NYK), NGOs, etc that are active in the state.

In order to formulate adaptive, realistic and appropriate training or orientation programmes for all concerned stakeholders, following are the recommended Capability Building Measures that need to be adopted:

Sl. No	Type of Training	Nodal Department for conducting the training
1	Practical Training of Home Guards personnels, Police, Traffic, in various aspects of DM including search and rescue technique	Home Guard and Civil Defence
2	Training of civil society, Community Based organisations (CBOs) and corporate entities in various aspect of DM	MATI,
3	Training of Fire and Emergency Service personnels in various aspects of DM	Fire and Emergency Services
4	Training of State Disaster Response Force (SDRF) Teams in various aspects of DM	NDRF
5	Training of media in various aspects of DM with special focus on the role of Media in Disaster Management.	MATI, DIPR
6	Training of engineers, architects, structural engineers, builders and masons in various aspects of DM	NIT, Shillong Polytechnic
7	Training of educational and training institutions personnels in various aspects of DM	MATI
8	Training of medical Professional on handling mass causalities and trauma counselling	Health Deptt, EMRI, Army Medical Corps
9	Specialized Training in-Search & Rescue,	NDRF, Home Guard and Civil Defence
10	Analysis of training needs of various stake holders in the field of disaster management.	MATI
11	Ensuring minimum standards for DM training institutions, training programmes, community awareness courses.	MATI
12	Incorporation of DM as one of the main activities of youth organizations such as NCC, Boys Scouts, Girls Guides, NSS, Nehru Yuva Kendra and local activists, interested clubs and their involvement.	SDMA, Education Department and Sports and Youth Departments.
13	Strengthening of all State and District level EOCs using the state of the art technology.	SDMA, DDMA, Home Guard and Civil Defence
14	Regular updating, rehearsals, mock drills and simulations of various departmental plans	SDMA
15	Inventory of Lifeline buildings such as of schools, hospitals, and administrative buildings and assess their safety and take measures for improving safety.	MUDA, Urban Affairs, PWD (B)
16	Training on preparation of DDMP,BDMP and VDMP	SDMA, DDMA
17	Training of District Disaster Management Officials	SDMA, DDMA, MATI

5.4 Information Education and Communication

IEC campaign can be carried out through different means among the community for mass coverage and generating awareness on DM Advertisement in print as well as electronic media, hoarding, booklets, leaflets, banners, sand-table, demonstration, folk dancing and music, street play, exhibition, TV slot, radio slot, audio-visual and documentary, school campaign etc. can be

carried out in order to in order to make the dissemination campaign effective. Proper planning and development of IEC materials are required

5.5 Amateur Ham Radio system in Disaster Management

The use of amateur radios in times of crisis and disasters is well recorded and has wide acceptability. The use of ham radio has higher significance as wire lines, cell phones and other means of conventional communications may be inadequate or may be non-functional. Amateur radio not being dependent on terrestrial facilities can operate effectively during disaster. Although amateur radio operators are experienced, capacity building in improvising antennas and setting up the systems in a relatively short time will be required. Training of youths from local community on the techniques of handling amateur radio systems, maintenance and setting up location for operating amateur radio will prove beneficial as sustainable means of preparedness of the community.

5.6 Media preparedness in DM

The media plays a critical role in information and knowledge dissemination in all phases of disaster management. The versatile potentiality of both electronic and print media will be fully utilized at the state as well as at the district level. Role of media in post disasters or reporting and extent of damages is well recognized. Media – electronic as well as print media has a great potential in raising general awareness and preparedness. Print media – Khasi, Garo, and English as well as Hindi can carry special series on State's vulnerability to different disasters. It can also carry a summarized and succinct preparedness measures that community could follow. Electronic media especially Television (TV) and cable channels have greater impact. SDMA will engage electronic media in developing disaster-based feature films, documentaries, talks or programmes, which will cater to a large audience of the state.

5.7 Techno-legal regime

While the state has strong legislative tools, lack of coherent regulations make it difficult to achieve a state of adequate advance preparedness. Rapid urbanization without adequate infrastructure, mushrooming of high rise buildings, degradation of environment which are inadequate to cope with hazards such as floods, cyclone, landslides and earthquakes etc. increase the risks manifold. Building regulations/bye-laws provide the mandatory techno-legal framework for regulating building safety in terms of planning, design that can withstand hazards like flood, cyclone, landslide and earthquakes.

In view of multi hazard risks, proper techno-legal regime will be established by providing adequate safety measures against natural hazards. Under different programmes and schemes, the Meghalaya Urban Development Authority (MUDA) which is the nodal agency for regulating building constructions has modified existing building bye laws, The efforts will be made to identify the gaps and requisite measures will be taken up to fill the gaps for achieving ideal techno-legal framework.

Development and promotion of incentives, insurance, disaster bonds, tax rebate, etc. against disaster may be explored by the State Government to help compensate the loss suffered. Hazard Risk & Vulnerability Analysis for different natural and man-made disasters prone to state has to

be carried out to achieve this end. Activities like Conduct of study, Analysis, Mapping and Micro zonation have to be done by the competent authorities.

5.8 Medical Preparedness

Identification of the hospitals- Private and Government, doctors and Para-medic teams including Trauma Counseling and psycho-social service providers at district levels will be carried out by Health Department through District Medical and Health Officer (DMHO). The identified teams shall be available for deployment at short notice. Their names, addresses, telephone numbers, mobile numbers, email etc. should be available at the SEOC / DEOC The list should be up-dated on half yearly basis. The stock of medicines, accessories and equipments for each of the identified teams at the district and Sub-Divisions needs to be assessed in advance as per need and the type of disaster. Every Medical Institution and every medical practitioner is to be trained to handle situation of mass casualties. In order to build up the capacity in this aspect proper training and capacity building programmes have to be organized by the respective institutional heads in a phased manner. Hospitals Emergency Plans have to be updated regularly and mock drills will have to be conducted at regular intervals. (Annexure XV and XVI: List of Equipments and List of Hospitals)

5.9 Communication

Emphasis should be given to provide common frequency for wireless sets among the different stakeholders working in disaster management. Study should be made to establish fail safe two way communication – communication system from state level to disaster site connecting the state and district, block and city level. Study should also be carried out to explore the feasibility of establishing alert/siren with multi-lingual recorded massages in districts.

5.10 Mock Exercises

Regular or annual emergency drills/mock-drills provide the opportunity to validate the DM Plan at all levels. It will facilitate the adequacy, efficacy and preparedness of the departments and the district administration and identify gaps in resources and their capabilities. The SDMA in coordination with the vulnerable districts should embark on conducting mock exercises on various types of natural and manmade disasters which will help in inculcating a culture of preparedness in the State.

5.11 Computer based programming

Develop GIS based information system for different sectors viz. medical and health, civil supply, fire and emergency services, etc. for collection of information and generation of maps. Develop software for cyclone and earthquake Disaster Management Information System (DMIS), create and disseminate database of contact details, resources, response agencies, NGOs, trained personnel, most vulnerable groups, evacuation routes, available shelters, relief centers, critical infrastructures, storage godowns, etc.

5.12 Knowledge Management

Networking of knowledge is essential for strategic thinking in DM. Disaster preparedness is achieved, among others, by developing a strong knowledge base on the subject. While dispersed and non-coordinated knowledge generation related to state specific hazards is going on, there is a need for establishing a platform which can feed to the needs of information sharing in DM as well as providing access to knowledge database on DM in Meghalaya and the North-East region. The Meghalaya Administrative Training Institute (MATI) conducts wide range of trainings to state as well as other stakeholders. The MATI will be strengthened to develop as a knowledge resource centre in disaster management. The DM centre at MATI is currently engaged in training state government officials, district officials, communities and NGOs on disaster preparedness. The centre will be further strengthened as a knowledge hub of DM.

5.13 State Disaster Response Force (SDRF):

State has created response capabilities from within its own existing resources. In the first phase the Home Guards and Civil Defense would be equipping and training one company of State Disaster Response Force (SDRF). National Disaster Response Force (NDRF) battalions and their training institutions will be used for capacity development.

Training and Equipping of SDRF:

Training and equipping of Search & Rescue Teams of SDRFs is being undertaken by the Department of Home Guard and Civil Defence in consultation with the NDMA and MHA. Each SAR team will be trained for search, rescue and evacuation in collapsed structure and medical first aid response. Some SAR teams will also be trained and equipped for deep-water rescue, and industrial accidents. Besides the SAR teams, the Police, Home Guards, Fire and Forest protection Guards will also be imparted general training in search and rescue at the time of induction and as a part of refresher training. This will cover all gazette officers and subordinate officers.

5.14 Fire and Emergency Services (F&ES):

The Fire Services in the States will be strengthened and made multi-hazard response team. They will be appropriately equipped depending upon their location and the disasters they will be tackling. (Annexure VII- List of Equipments Available With Fire & Emergency Service Organization)

5.15 Home Guards and Civil Defence:

Home Guards and Civil Defence volunteers will be enrolled for voluntary services in accordance with the provisions of the Civil Defense Act. The services of HG&CD volunteers would be utilized during response to disasters. The volunteers will be trained in Search and Rescue and First Aid. (List of Equipments and Volunteers Available With Home Guards & Civil Defence, Government of Meghalaya, Annexure IV)

5.16 Armed Forces/NDRF:

Being a border and mountainous state the role of Army and Para military forces are very critical in responding to emergency situations in remote and inaccessible pockets. Even though Armed Forces would be deployed only when the situation is beyond the coping capacity of State Government and local Administration yet the requirement of Army support would be crucial in times of emergencies. (The list of armed forces in the state and their location are included in Annexure I)

5.17 Improving access to inaccessible areas by creating a network of helipads

In hilly areas the immediate impact of any disaster would be the disruption of road connection to the affected areas. In order to provide immediate response and relief in all such eventualities, Government has to establish a network of helipads throughout the state. All DDMAs and district administration will identify places suitable for helipad and provide their latitude and longitude. They will also ensure connectivity to all helipads and keep them in the state of readiness for emergency situations.

Address	Latitude	Longitude
HQ Eastern Air Command helipad, Myliem, Meghalaya	25-32-17.46N (25.538183)	091-49-35.58E (91.826550)
Indian Army Helipad, Shillong, Meghalaya	25-32-39.3N (25.544250)	091-52-54.18E (91.881717)
Baljek Airport, baljek, West Garo Hills District, Meghalaya,	25-39-41.3553N (25.661488)	090-20-42.1417E (90.345039)
Shillong Airport, Umroi, East Khasi Hills District, Meghalaya, IndiaBorder Security Force, Dobasipara Tura	25-42-13 N (25.703600) 25-30-12.46 N	91-58-43E (91.978699) 90-12-30.08 E

Table: 13: Location of the Helipads and Airports along with the Latitude and Longitude

Source: http://airportguide.com/airport/India/Meghalaya

5.18 Social Inclusion

Needs of Special Vulnerable Groups:

While addressing the preparedness and relief requirements of the disaster victims, focus would be placed on the special needs of the vulnerable population that is, children, women, aged and the disabled. Socio-cultural needs would be accounted for in all phases of disaster management planning. A specific strategy for addressing the risk reduction needs of these vulnerable groups will be developed by every line department. Representatives of Department of Social Welfare and Commissioner of Disability, Government of Meghalaya have to ensure that issues relating to special vulnerable groups are taken care of under different phases of the State Disaster Management Planning.

5.19 Role of National Cadet Corps (NCC), National Service Scheme (NSS), Nehru Yuva Kendra Sangathan (NYKS) and Bharat Scouts and Guides (BS&G):

Potentialities of the youth based organizations like NCC and NSS, NYKS and BS&G will be optimized to support all community based initiatives and DM training would be included in their programmes. Special training campaign will be launched to strengthen their capacities.

Chapter 6: Partnership with other stakeholders

Disaster Management is a wide-ranging field and it requires contribution from all partners in order to effectively manage disaster. Networking and Coordination amongst various partners therefore becomes necessary to achieve the desired outcome. For better implementation of the plan, it needs vertical and horizontal linkages with Government and NGOs, local bodies, agencies, educational institutes/training institutes and community organizations. The SDMA will play a pivotal role in the co-ordination amongst these organizations/ agencies for efficient management of any given crises situation or disaster.

A brief note on the role and activities of such functionaries and the existing system of coordination established by the State Government with them is mentioned below.

6.1 National Disaster Management Authority (NDMA)

The NDMA, as the apex body in the GoI, has the responsibility of laying down policies, plans and guidelines for DM and coordinating their enforcement and implementation for ensuring timely and effective response to disasters.

The NDMA supports the different ministries and departments of centre and states to prepare their respective plans. It takes such other measures as it may consider necessary, for the prevention of disasters, or mitigation, or preparedness and capacity building, for dealing with a threatening disaster situation or disaster.

It also oversees the provision and application of funds for mitigation and preparedness measures. It has the power to authorize the departments or authorities concerned, to make emergency procurement of provisions or materials for rescue and relief in a threatening disaster situation or disaster. It also provides such support to other countries in times of disasters as may be determined by the Central Government.

The State keeps in touch with the NDMA for implementing various projects / schemes which are being funded through the Central Government. The State also appraises the NDMA about the action taken by the State Government regarding preparation of DM plans and implementation of guidelines issued by NDMA for various hazards from time to time. (The list of important contact names and numbers are included in Annexure I)

6.2 National Institute of Disaster management (NIDM)

NIDM is a research and training institute of Government of India and capacity development as one of its major component, along with training, research, documentation and development of a National level information base. It maintains good network and coordination with best knowledge-based institutions and function. It organizes training of trainers, for DM officials and other stakeholders as per the training calendar finalized in consultation with the respective State Governments. MATI shall maintain continuous contact with NIDM.

6.3 National Disaster Response Force (NDRF)

For the purpose of specialized response to a threatening disaster situation or disasters/ emergencies both natural and man-made such as those of Chemical Biological Radiological and Nuclear (CBRN) origin, the National Disaster Management Act has mandated the constitution of NDRF.

Accordingly, in 2006 NDRF was constituted with 08 Battalion. As on date NDRF is having strength of 10 Battalions. The conversion/up-gradation of 02 Battalions from Shashastra Sima Bal (SSB) to NDRF is also approved. One battalion of NDEF is located in Guwahati.

NDRF units maintain close liaison with the designated State Governments and are available to them in the event of any serious threatening disaster situation. While the handling of natural disasters rests with all the NDRF battalions, four battalions are equipped and trained to respond to situations arising out of CBRN emergencies. (The contact details and their location are given in Annexure I)

6.4 State Disaster Response Force (SDRF)

As per the provisions of the National Disaster Management Act, the States are being encouraged to create response capabilities from within their existing resources on similar pattern of NDRF. SDMA, through the Home Department, has earmarkedone company of SDRF out of the existing Home Guard companies and has trained them. Effort is on to have a full fledged of SDRF equipped and trained in Search and Rescue for deployment during disaster. Equipping the SDRF with Search and rescue equipments is under process and has to be completed/ strengthened.

6.5 Armed Forces

The Army and Air Force have a significant presence in the State. HQ 101 Area comprising of Assam Regimental Centre, 58 Gorkha Training Centre and 24th Mountain brigade and Mountain Division are located at Shillong. The Eastern Air Command is also located at Shillong. Both Army and Air Force have well laid out disaster management Plan and can come to the aid of civil authorities in an emergency particularly in performing disaster management tasks relating to response and restoration. Every effort will be made to strengthen the institutional linkage between the State Govt. and the Armed forces. (The list of armed forces in the state and their location are included in Annexure I)

6.6 Meghalaya Administrative Training Institute (MATI)

The MATI was set up with the prime aim of providing Institutional Training for officers of the State Administrative Service. It also conducts in-service trainings, refresher trainings programmes, and short duration training programmes for various senior and middle level officers of the State Government. The MATI has been sanctioned a Faculty on Disaster Management, under the Central Plan Scheme in order to build up the training capability of the MATI in different aspects of disaster management. The facilities and the faculty positions in the MATI will be further strengthened and linkage with the Revenue and DM Department and SDMA will be further reinforced.

6.7 The State Institute of Rural Development (SIRD)

SIRD is the apex Training Institute under the Community & Rural Development Department, Government of Meghalaya for imparting training in rural development. The main objective of the Institute is to train various categories of people on rural development through training courses, seminars, workshops etc. The Institute is organizing training for grass root & middle level officials and NGOs working in the field of rural development. The Institute has established linkages with other Government Departments like Soil and Water Conservation Department, Social Welfare Department, Indian Council of Agriculture Research, etc and NGOs like Bosco Reach Out, KJP Synod, and World Vision etc. The SIRD has also prepared training modules for Department of Co-operation for imparting training on capacity building of Co-operative Officers and leaders of Co-operative Societies. It conducts research studies and assists in organizing off-campus programmes, seminars, workshops and conferences in collaboration with the Government and other organizations. The Institute has the capacity for undertaking Disaster Management Training also for rural development officials/NGOs/ CBOs/Co-operators and volunteers which will be further strengthened.

6.8 North East Remote Sensing Application Centre (NESAC)

The NESAC is an agency under Department of Space, Govt. of India providing space technology support such as remote sensing applications, satellite communications and space science research. The Agency implements the Disaster Management Support Programme using space technology for the entire NE Region. It has facilities for monitoring disaster affected areas, mapping of disaster prone areas, and providing satellite based emergency communication systems. NESAC is also installing a Telemedicine network and the Transportable VSAT System of NESAC can work as a backup communication network for post disaster rescue/relief operations.

NESAC has the potential of providing critical knowledge management support to Revenue and DM Department and SDMA by providing inputs like creation of GIS based Road Network Map, Disaster vulnerability map, emergency communication etc., in critical disaster management operations. Institutional linkages between NESAC and Revenue and DM Department and SDMA will be strengthened.

6.9 Information Technology Dept (IT)

The IT Dept is the computer application, development & training agency of the Government of Meghalaya. Its main activities include development of computer related plans and policies in the Government, providing total solutions for computerisation in the Government and PSUs, development of appropriate software organising training programmes for the Government employees. IT Dept has contributed to the steady growth of computerization in Meghalaya.

IT Dept. can play a promotional role to develop appropriate software, database and systems development for various departments and personnel involved in disaster management activities in the State and district levels including extending professional training and allied support to strengthen the IT network in disaster management related activities.

6.10 National Informatics Centre (NIC)

The NIC has facilities like VSAT-based video conferencing, Internet connections. It has district centres functional at headquarters of 9 (Nine) districts with VSAT facility. It also has district informatics officer attached to Deputy Commissioners. The services of NIC will be harnessed to strengthen the communication and information database systems related to disaster management at the State and district levels.

6.11 State Police and Fire Services

The State Police Forces and the Fire Services are crucial responders to disasters. The police force will be trained in disaster management skills and the Fire Services will be upgraded to acquire multi-hazard rescue capability

6.12 Home Guards and Civil Defence

At present there are three Civil Defence offices in the State with trained volunteers and emergency equipments. The Civil Defence Units impart training to its members on self defence, provide protection to any person or property against any hostile attack, rescue trapped and incapacitated persons using improvised techniques, search for survivors after an incident, etc. State Government can utilise the services of Civil Defence, including trained Civil Defence volunteers, during natural calamities. State of the art training on search and rescue operations will be imparted to the Civil Defence volunteers. They will be used to train members of different task forces/committees created at various levels. There will be adequate co-ordination with the Civil Defence for communication and information exchange with the Government to ensure their prompt response after disaster.

The Central Training Institute (CTI) of the Home Guards & Civil Defence at Shillong has been designated as the Resource Agency for Training of Volunteers in Search & Rescue and Disaster Management. The CTI is being strengthened through provision of equipments and is expected to fulfill its role substantially.

6.13 Voluntary Agencies and CBOs:

The existing network of Community Based Organizations and voluntary agencies in Meghalaya will be utilised in disaster management. These include the Indian Red Cross,

The Rotary Club, the Lions Club, the traditional authorities (Dorbars and Nokmas), and the religious welfare organizations, sports clubs, traders association etc. The SDMA will act as a main coordinating agency between the Govt. agencies and the NGOs. Coordination meetings will be held at the State, District and Block levels by SDMA and DDMAs officials respectively for forging partnership for efficient management of disaster.

NGOs and CBOs will be encouraged to participate in raising awareness of the communities, information dissemination, training and capacity building of local volunteers on search and rescue and relief, first aid, damage assessment, technical and material aid in reconstruction and monitoring for strengthening the disaster management efforts.

Similarly existing groups like NCC, NSS, Scouts and Guides and NYK will be strengthened and will be groomed to work in tandem with one another. (The list of NGOs in the state, national and International and their location are given in Annexure XII)

6.14 Research

Research studies of various aspects of disaster management will be encouraged to build on the existing skills and knowledge of communities and other expertise in the field and developing sustainable and cost effective solution. North Eastern Hill University (NEHU) and NESAC will be encouraged to take up such research works. NESAC is also taking up research on climatology of the NE Region, and earthquake risk assessment and landslide s and flood warning system in association with North Eastern Council.

6.15 Indian Meteorological Department (IMD)

The basic function of the Central Seismological Observatory (C.S.O.), IMD, Upper Shillong is to monitor the seismic activity in the country, in particular the NE Region.

In the event of a significant earthquake shock occurring in the region or in the state CSO IMD, Upper Shillong can pass the information to the concerned decision making Government bodies for planning relief and evacuation operations. This information can contain parameters such as epicenter, magnitude, intensity etc.

C.S.O. IMD, Upper Shillong also has a Meteorological and Atmospheric Radiation Observatory. Daily meteorological and radiation data are collected and passed to the Regional Meteorological Centre, IMD, Guwahati for issuing the weather forecast for the entire region. The Regional Meteorological Centre, IMD, Lokyapriya Gopinath Bordoloi Airport Guwahati-15 is the nodal agency to issue weather forecast for the entire North Eastern region. The daily forecast is issued to AIR, Doordarshan, Press Trust of India, local newspapers etc. For quick dissemination of the forecast data, C.S.O, Shillong can also obtain the data from the Regional Meteorological Centre, Guwahati and disseminate the information to the concerned decision making bodies of the state in the event of severe weather phenomena etc.

A digital telemetric seismic network comprising of twenty unmanned (Including five manned existing) stations equipped with V-SAT based communication facilities will soon be operational in the NE. Region with the central receiving station (CRS) at the C.D.O., IMD, Upper Shillong. Apart from this, the C.S.O. Shillong will be one of the 17 selected observatories for Real-Time Seismic Monitoring Network (RTSMN) for Tsunami early warning system in the country. The system will be equipped with the state of the art Broad Band Digital Seismic and Global Positioning System receiver data acquisition systems with V-SAT based communication facilities to enable the transfer of data on near - real time basis to the CRS at the IMD HQs, New Delhi. (The contact details and their location are given in Annexure I)

6.16 Geological Survey of India (GSI)

GSI is a prime National Organization entrusted with the task of studying various geological aspects of the earth. However for the past one decade it has expanded its activities to include study of the Geological Hazards specifically as its thrust areas of activities. The Organization

therefore, has initiated geological studies pertaining to the areas susceptible to hazards from earthquake and landslides and brings out thematic maps on various scales to be utilized by different agencies. At present the GSI is carrying out the following activities:

i) Landslide Hazard Zonation - regional and along the National Highways.

Thematic maps on macro, meso and micro level are prepared based on the objective of the investigation. The mapping helps in categorizing the hazards in the area of the study into low, moderate and high zones. Presently, the emphasis is on National Highways. The Organization has been declared as Nodal agency for Landslide studies in the country and any major slide occurrence in the region is being promptly attended to.

ii) Site specific studies of the chronic landslides such as the Sonapur land slide on NH-44 which is currently underway. Such studies are useful in working out the remedial measures to control and stabilize the slide.

iii) Seismic micro zonation studies of the principal cities-to delineate hazard zones to enable planners to recommend suitable designs. First and Second level thematic maps are prepared in such cases.

iv) Active fault mapping to study the seismic status of various discontinuities (faults, shears) and to establish probable seismogenic nature of the discontinuity and its capability of generating earthquake. In areas where instrumental records are lacking, such studies guide in knowing the hazard potential of the area.

Besides, the organization is entrusted with the task of preparing Isoseismal map of any area affected by a damaging earthquake.

The organization has its Regional Headquarters at Shillong and caters to the requirements of all the seven states of the northeast India. (The contact details and their location are given in Annexure I)

6.17 Mass Media

The role of media is vital in educating the people about disasters; warning of hazards, gathering and transmitting information about affected areas, alerting Government officials, relief organisations, and the public to specific needs and facilitating discussions about disaster preparedness and response leading to greater transparency in the whole operation. A regular and effective working relationship with the media will be developed. Regular, routine interaction, before a disaster is important for effective working relationships in the aftermath of a disaster. Relevant training for reporters and field personnel will be provided to enhance disaster preparedness, and the timely, quality and accuracy of reporting about natural hazards. Similarly the media organizations are expected to address disaster prevention and reduction in their coverage relating to disasters.

6.18 Bureau of Indian Standards (BIS)

The Bureau of Indian Standards (BIS) provides standards for construction in seismic zones, popularly known as Building Codes. The building construction in urban and suburban areas is regulated by the Town and Country Planning Acts and Building Regulations which are expected to follow BIS codes.

6.19 Religious Bodies

Religious bodies are one of the most important NGO groups that come to the immediate search & rescue and provide relief of the disaster victims during disasters. These bodies have a large and dedicated following in their communities. They also have control over the local places of worship, which can serve as emergency shelters for the disaster victims. Besides, they often have infrastructure and resources to feed the masses who are affected by disaster. District-wise inventory of all such facilities shall be prepared by respective DDMA.

Chapter 7: Financial Arrangements

7.1 Existing Financial Assistance

Financial assistance in the wake of natural calamities is provided in accordance with the schemes of relief funds. These schemes are based on the recommendations of the successive Finance Commissions. While the budgetary provision of these relief funds is dealt with by Ministry of Finance, the processing of request of the state government for these funds is done by the Ministry of Home Affairs (DM Division). The present scheme of State Disaster Response Fund (SDRF) and National Disaster Response Fund (NDRF) are based on the recommendations of the Fourteenth Finance Commission, operative from 1st April 2015 to 31st March 2020.

The Ministry of Finance GOI has allocated funds for strengthening disaster management institutions, capacity building and response mechanisms.

7.2 Responsibilities of the State Departments and Agencies

All State Government Departments, Boards, Corporations, and ULBS will prepare their DM plans including the financial projections to support these plans. The necessary financial allocations will be made as part of their annual budgetary allocations, and ongoing programmes. They will also identify mitigation projects and project them for funding in consultation with the SDMA/DDMA to the appropriate funding agency. The guidelines issued by the NDMA vis-a-vis various disasters may be consulted while preparing mitigation projects.

7.3 Capacity Building Grant

On the recommendation of the 14th Finance Commission, on the expenditure on immediate relief during natural disaster for the period 2015-2020, allocation has been made to the states for taking up activities for building capacity in the administrative machinery. The Ministry of Finance has issued the guidelines for the utilization of the fund in regard to the procurement of essential search, rescue and evacuation equipments, including communication equipments, etc in response to disaster. The total expenditure on this item should not exceed 10% of the total allocation of the SDRF. The expenditure is to be incurred from SDRF only (and not from NDRF), as assessed by the State Executive Committee (SEC)

The ministry also issued guidelines for training and capacity building of stakeholders and functionaries in states, the total expenditure on this item should not exceed 5% of the total annual allocation of the SDRF. The expenditure is to be incurred from SDRF only (and not from NDRF), as assessed by the State Executive Committee (SEC)

7.4 Flexi- fund: The introduction of flexi-funds within centrally sponsored schemes (CSSs) is to undertake mitigation/ restoration activities in case of natural calamities in the sector covered by the CSSs. Central ministries concerned shall keep 10% of their plan budget for each CSS as flexi-funds, except for schemes which emanate from a legislation, or, schemes where the whole or a substantial proportion of the budgetary allocation is flexible. Details SOPs of each department should be prepared to make provision in its annual budget for funds to carry out the activities set out in its own DM plan and role and responsibilities of all other stakeholders.

7.5 Techno-Financial Regime

Considering that the assistance provided by the Government for rescue, relief, rehabilitation and reconstruction needs cannot compensate for massive losses on account of disasters, new financial tools such as catastrophe risk financing, risk insurance, catastrophe bonds, micro-finance and insurance etc., will be promoted with innovative fiscal incentives to cover such losses of individuals, communities and the corporate sector. In this regard, the Environmental Relief Fund under the Public Liability Insurance Act, 1991, enacted for providing relief to chemical accident victims is worth mentioning. Some financial practices such as disaster risk insurance, micro-finance and micro-insurance, warranty on newly constructed houses and structures and linking safe construction with home loans may be considered for adoption.

Chapter 8: Review and Updation of plans

81. Review and Updation of SDMP and other plans

The state disaster management plan (SDMP) brings together risk assessment, preparedness/ mitigation measures and disaster response plan for the state on one platform. Mainstreaming disaster management concerns in development process, coordination/implementation mechanisms of the plan and identifying financial arrangements have been included as part of the plan to facilitate smooth implementation. While the state plan has been prepared keeping in view the framework suggested by NDMA, reviewing and monitoring of the progress of plan implementation is important. Reviewing and monitoring will be on-going exercise to be undertaken annually by the State Executive Committee and the updated state plan will be approved by the State Authority as prescribed in section 23 of the Disaster Management Act 2005.

8.2 Periodic update of the plans

Disaster management is dynamic. Ground realities, changing population characteristics, evolving government mechanisms in handling disasters/emergencies determine the effectiveness of the State Disaster Management Plan. The plan needs to be reviewed and updated *periodically*. The Disaster Management Act, 2005 section 23(5) requires the state plan to be reviewed and updated annually, accordingly the review and update of the plan will be taken up annually.

To achieve a level of 'state-wide absolute preparedness' and to meet disasters of any magnitude, scientific and technology-driven conduct of Hazard Risk and Vulnerability (HRVA) analysis of the selected districts will be taken up with CSIR-NERIST, Jorhat and NESAC, Umiam. Based on the outcome of HRVA the SDMP shall be reviewed and comprehensive revisions will be incorporated to suit HRVA.

The annual reviews and update of sections will be carried out in the plan. Considering periodic shifting of key personnel, both at the state and district level, yearly updates on contact information of key department personnel will be made an integral part of the plan updates. Similarly, updates of the inventory of equipments need to be part of yearly updates of the state plan.

Consultation with the key departments concerned with disaster management at the state level; consultation with the civil society, NGOs and training institutes in the state will form the basis of updates and revisions of the plan. State Disaster Management Authority (SDMA) and the State Executive Committee have the legal authority to update the plan as the need and demand arises. The district disaster management plans (DDMPs) will also be revised and updated annually on the similar process and procedure set for the state plan.

Chapter 9: Coordination and Implementation

9.1 Coordination

The district level will ensure co-ordination of resources to support operations when the scale of disaster grows. Operational co-ordination should also take place at the State level. If the magnitude of disaster is high, resource support from other States, Central Government and/or other agencies is sought. The involvement of NGOs and CBOs will be sought to supplement the efforts of the Government in emergency response.

9.2 Procedures

Where an agency/department requires resources for completion of a task it will request for assistance as appropriate:

- If at the village level, from the Block Development Officer (BDO).
- If the request cannot be satisfied at the local level, then via the BDO to the DC
- If the request cannot be satisfied at District level, then request will be made to the State Government.
- If a request cannot be satisfied from resources within the State, the State Government will seek Central assistance or external assistance.

9.3 Institutional Arrangements

Under the SDMP, all disaster specific mechanisms will come under a single umbrella allowing for attending to all kinds of disasters. The Chief Secretary as the head supported by the Principal Secretary, Revenue and DM. in order to avoid adhocism in the management of disaster, the State has adopted an Incident Response System (IRS) and under that system it has constituted an Incident Response Team (IRT) in the State in which the Chief Secretary is the Responsible Officer (RO), the Principal Secretary, Revenue and DM is the Incident Commander (IC) and the Commissioner and Secretary, Revenue and DM, is designated as the Deputy Incident Commander (DIC) in the State. The Command Staff and General Staff have also been nominated for the State which is explained in later part of this chapter in detail . Similarly at the district level respective DCs have been made RO who will constitute his/her own district IRTs.

State Level

It will be the main responsibility of the State Government to respond to natural disasters and provide relief to the affected people. Section 22(2) (G) of the DM Act, 2005 stipulates that the State Executive Committee (SEC) under the State Chief Secretary shall ‘coordinate response in the event of any threatening disaster situation or disaster’. SEC shall give directions to any Department of the State Government or any other authority or body in the State regarding actions to be taken in response to any disaster.

9.4 State Disaster Management Authority (SDMA)

The SDMA headed by the Chief Minister is the apex body for DM in the State. It has the responsibility for laying down the policy, plan and guidelines for the management of disasters in the State. It approves the SDMP and DM Plans of the various Departments of the State and it reviews the development plans of the different Departments of the State and ensures that prevention and mitigation measures are integrated in the development plans and projects of the development Departments of the State. It will take such other measures as it may consider necessary for prevention of disasters, or mitigation or preparedness and capacity building, for dealing with a threatening disaster situation or disaster. It will also oversee the provision and application of funds for mitigation and preparedness measures. Responsibility for the declaration of disaster at any level in the State rests with the SDMA or on any other Authority to whom this power is delegated by the SDMA. The declaration can be made on the recommendation of Revenue & DM Department. The DC will send proposals to the Government in the Revenue and DM Department for declaration of disaster in the affected areas. The SDMA consists of the following members, namely:-

- Chief Minister of Meghalaya who shall be the Chairperson, ex-officio;
- Minister in charge Revenue & DM– Vice Chair Person;
- Minister in charge Home Department;
- Minister in charge Health Department;
- Minister in charge Agriculture Department;
- Minister in charge Transport Department;
- Minister in charge PWD Department;
- Minister in charge Finance Department; and
- Chief Secretary shall be the Chief Executive Officer, ex-officio.

9.5 State Executive Committee (SEC)

The SEC comprises the State Chief Secretary as the Chairperson, and the Principal Secretaries/ Commissioners and Secretaries/ Secretaries in charge of the Departments of:-

- Public Works Department
- Revenue and Disaster Management Department
- Home Department
- Finance Department

as members. The Director General of Police and the Director General of Civil Defence and Home Guards will be special invitees to the meetings of the State Executive Committee.

The State Executive Committee will assist the SDMA in the performance of its functions and it will also coordinate action in accordance with the guidelines laid down by the SDMA and will ensure the compliance of directions issued by the State Government.

It will also examine the vulnerability of different parts of the State to different types of disasters and specify measures to be taken for their prevention or mitigation. The State Executive Committee will coordinate the response in the event of any threatening disaster situation or disaster. It will prepare the SDMP based on the State Policy on Disaster Management. It will also perform such other functions as may be prescribed by the State Government in consultation with the SDMA.

9.6 State Crisis Management Group (SCMG)

The SGMC has been constituted to deal with crisis arising out of extremists, terrorists' attacks, communal violence, riots and break down of law and order situations. The State Crisis Management Group will be responsible for threat assessment, deployment of resources, providing public service such as fire extinguishers and evacuations, medical transport, public works, media management and communications.

9.7 District Crisis Management Group (DCMG)

The DCMG is constituted with the DC as Chairman and will deal with the situation referred to in 9.6 above at the district level.

District Planning Officer/Additional DC in charge Crisis Management Group will be the Member Secretary of the DCMG, will be responsible for preparation of District Crisis Management Plan and to ensure maintenance of law and order during the crisis, to coordinate with the other sub-groups, to ensure timely supply of relief and issue of guidance and direction to set up the control room during the period of crisis.

9.8 District Disaster Management Authority (DDMA)

The DDMA shall consist of the following members, namely:

- Deputy Commissioner, Chairperson, Ex-officio
- Chief Executive Member, Co- Chairperson Autonomous District Council
- Additional Deputy Commissioner, Chief Executive Officer In charge Revenue and Disaster Management
- Superintendent of Police, Member
- District Medical and Health Officer of the District, Member
- Two District heads of Offices to be appointed by the State Government, Member

It will assess the disaster and provide instructions to the concerned departmental heads in the district for better management of the disaster situation. It will assess the situation by taking into consideration the reports from all sources and decide upon the level of the disaster. It will also give guidelines for handling the response, relief & restoration measures during the crises.

Update SDMA /SEC about the prevailing situation

It will make Assessment of the available resources and issue necessary direction for pooling resources from different sources.

Process requests for National Disaster Response Force (NDRF)/Army or any other specialized help.

Coordinate with civil society organisation for supplementing the efforts of Govt.

Monitoring and reviewing the situation on a regular basis.

9.9 District Emergency Operation Centre (DEOC)

District Emergency Operation Centre is located in the premises of DCs office. The main activities are as follows:

- On receipt of information on any disaster from SEOC/SEC or from any field office or from any other reliable source, DEOC will bring this to the notice of DDMA.
- DEOC shall issue necessary alerts to all authorities/ departments in the district or at state level depending on the prevailing situation.
- DEOC will send regular status and appraisal reports to SEOC.
- DEOC shall gather and synthesise information for consideration of DDMA.

9.10 State Emergency Operations Centre (EOC)

An EOC is an established control facility from which emergency operations can be directed and coordinated. In an EOC the local and State staff and officials receives information relating to an incident. This is where the decision makers and support agencies should report to supervise an evacuation.

The function of all EOCs is to collect, gather and analyse data; make decisions that protect life and property, maintain continuity of the organization, within the scope of applicable laws; and disseminate those decisions to all concerned agencies and individuals. At the State Level, the State Relief Commissioner is overall in-charge of the SEOC who will be assisted by the Executive Officer, SDMA and its officials and staff and at the District Level the DC/Additional DC will be overall in-charge of the District EOC who will be supported by the Officers and Staff of the DDMA.

A Shadow SEOC shall be located in neighbouring district of Ri-Bhoi, a place comparatively safer from hazard point of views. It will function alternatively as SEOC in case the Shillong SEOC becomes dysfunctional in case of major disaster. The Shadow SEOC shall also be developed as a resources centre for providing material support for relief and rehabilitation.

9.11 The Sequence of action at the State EOC

On receipt of information either from National Emergency Operation Centre (NEOC)/DEOC or from Early Warning Agencies or any other reliable sources, SEOC, shall be activated fully. It will issue alerts/warning to all designated authorities at the

State level and Districts level and for Public Information to All India Radio (AIR)/Doordarshan/ Press. It will send First Information Report to NEOC, Ministry of Home Affairs (MHA) and thereafter the Daily Situation Report till situation normalizes. It collects all the relevant information and appraises the status to the designated decision making authorities.

Sequence of Action at the State Level:

SEOC-

On receipt of information either from NEOC, DEOC or from early warning agencies at national or state level or from any other reliable source the following action will be taken:

i) SEOC shall bring the information to the notice of SEC

ii) Issue alerts / warnings to all DDMA's / Nodal Departments ESF and all other designated Departments in the State.

iii) Through public information directorate release the information for public through AIR, television and Press.

iv) Establish contact and provide status report to NEOC, MHA

v) Collect collate and synthesis information for consideration of SEC & SDMA

vi) Provide regular appraisal and status reports to all designated authorities in the State.

vii) Arrange meetings of SEC

viii) Activate ESF's if situation warrants.

State Disaster Management Authority (SDMA):

i. Meeting of SDMA shall be convened on the direction of Chairperson.

ii. SDMA will take stock of the situation

iii. SDMA shall assess level of disaster and outside assistance and cooperation required.

State Executive Committee (SEC):

i. Chief Secretary, Department of Revenue shall convene the meeting of SEC

ii. SEC shall assess the situation and level of disaster

iii. Based on the assessments SEC shall give directions for handling the situation and measures to be taken by role players in response to any specific situation or disaster.

iv. SEC shall review and coordinate response from all departments.

v. SEC shall call for NDRF, ARMY, AIRFORCE or any other outside support warranted for handling the situation.

vi. SEC may depute team for on the spot situation assessment and need assessment.

vii. SEC shall mobilise resources and dispatch them to concerned districts.

viii. SEC shall review the situation regularly as per demand of the situation.

ix. SEC shall maintain close liaison and contact with NDMA/MHA and keep them abreast of the situation.

x. SEC shall constantly evaluate their own capabilities to handle the situation and project the anticipated requirements central resources.

xi. SEC will take necessary steps to pool the resources for better management of crisis situation.

Role of Key Departments:

i) At the time of disaster and on activation of State ESF plan all the departments shall deploy nodal officers to SEOC for coordination measures.

ii) All concerned departments shall coordinate with their national counterparts and mobilize specialist resources and assistance as per requirement.

iii) All departments and organizations of the state shall place the resources at the disposal of DDMAs during disaster situation.

9.12 First Response

When there is no early warning signal available, the community members will be the first responder. However, immediate support and assistance shall be available from other important responders like the Police, Home Guards and Civil Defence, SDRFs, Fire and Emergency Service and Medical Services. Other important responders will be the community volunteers, NCC, NSS and NYKs drawn from local units.

9.13 First Information Report (FIR)

DEOC shall send the First Information Report immediately to SEOC, FIR shall invariably give an account of the nature of the disaster, damage & loss, locally available resources within 24 (Twenty Four) hours of the incident. (Annexure XI: Format of FIR)

District Emergency Operation Centre shall prepare and send First Information Report to SEOC/summarising the following:

- Severity of the disaster
- Action being taken
- Available District resources and coping capacity.
- Need assessment for relief along with quantities.
- Logistics for delivering relief.
- Assessment on future development including new risks.
- FIR should be sent within 24 hours of occurrence of calamity as per the standard format.

9.14 Daily Situation Report (DSR)

A standardized form for reporting of situation report on daily basis has been prepared for the District, State and National levels. The State Governments shall submit situation report to the NDMA/MHA on 6 (Six) hourly basis during first three days. (Annexure XI: Format of DSR)

Chapter 10 – Government–Non Governmental Organisation Coordination

10.1 Institutional and Legal Framework

The DM Act 2005 under Sections 22 (2)(f) of the Act mandates the SEC for collaboration with stakeholder agencies including NGOs for the purpose of improving the effectiveness of DM. Similarly the Act mandates NGOs to act in an equitable and non-discriminatory manner for the purpose of assisting or protecting the disaster affected communities or for providing relief to the affected communities or while dealing with any effects of threatening disaster situations and has fixed the responsibility to monitor this on DDMAs vide section 34 (l). The above provisions ensure that the concerned DM interventions being addressed are supported and facilitated by the civil society organizations working at the grass roots and also takes care of the ground realities.

(Section 22 (2)(f) of the Act stipulates that the SEC shall "advise, assist and coordinate the activities of the Departments of the Government at the district level, statutory bodies and other governmental and non-governmental organizations in the district engaged in the disaster management". The Act also directs the State Government under Section 38 (2) (a) to coordinate "actions of different departments of the Government of the State, the State Authority, District Authorities, local authority and other non-governmental organizations".)

Sections 35 (2) (a) and 38 (2) (a) specifically emphasize the coordination of actions with NGOs. The National Policy on Disaster Management (NPDM) also states the national vision for community mobilization and participation in DM and aims to provide momentum and sustenance through the collective efforts of all government agencies and NGOs. There is emphasis on community based disaster management, including last mile integration of the policy, plans and execution and early warning dissemination. Promoting a productive partnership with NGOs is a prominent thrust area in the NPDM.

There is a large scope for improving the engagement of NGOs in DM and on efficiently utilizing their unique advantages and core competencies by strengthening humanitarian coalitions, alliances and NGO networks. There is also a need to strengthen public awareness, capacity building and knowledge management through CBOs and NGOs. Institutional mechanisms for the advocacy and engagement of NGOs with government agencies on DM concerns are required to be strengthened. Replication and scaling up of community level good practices has to be promoted as well.

10.2 Advantages of Involving NGOs

i. NGOs can play a very important role in mobilising communities and in linking PRIs/ULBs with corporate sector entities for initiating DRR related activities.

ii. The strong linkages which NGOs have with grassroot communities can be effectively harnessed for creating greater public awareness on disaster risk and vulnerability, initiating appropriate strategies for strengthening the capacity of stakeholder groups to improve disaster preparedness, mitigation and improving the emergency response capacities of the stakeholders.

iii. In addressing the emerging concerns of climate change adaptation and mitigation, NGOs can play a very significant role by working with local communities and introducing innovative approaches based on the good practices followed in other countries.

iv. NGOs can bring in the financial resources from bi-lateral and multilateral donors for implementing pragmatic and innovative approaches to deal with disaster risk and vulnerability, by effectively integrating and converging the various government programmes, schemes and projects to create the required synergy in transforming the lives of at-risk communities.

10.3 Actions to be taken by the SDMA

i. Developing a database of NGOs, CBOs and Faith Based Organizations at all levels working in the field of disaster management and emergency response and others focusing on geographic outreach and thematic capacities of the organizations.

ii. Developing the capacity of identified NGOs, CBOs and organizations in disaster management and emergency response.

iii. Constitution of Inter-Agency Group (IAG) for the district with an objective to:

- Promote and institutionalize unified response strategy in humanitarian crisis.
- Mainstreaming the emergency preparedness as in integrated development strategy.
- Systematize the emergency response mechanism.
- Bringing in the culture of "working together" in emergencies and normalcy.
- Engagement in activities that will build the capacities of stakeholders and local communities to cope with calamities.
- Development of Criteria for membership of IAG:

Any of the following criteria is proposed for becoming a member of the District IAG:

- District Level agencies working in emergency response and preparedness for minimum of five years.
- International and national funding agencies supporting emergency preparedness and community led risk reduction initiatives for a minimum period of three years.
- Academic and /or research institutions actively involved on disaster related knowledge management and practices.

Membership claim may be scrutinized by a committee of SDMA/DDMA for authentication of the prospective member organization.

Issues	Action Points
Geographic spread of NGOs	Develop a database of NGOs at all levels working on disaster management focusing on geographic outreach and thematic capacities of the organizations. **(Action: SDMAs with the help of NGOs)**
Volume of support provided by NGOs	Compile statistics on quantum of support provided by NGOs at all levels, both international and national. **(Action: SDMA)**
Coordination	Establishing inter agency mechanisms for coordination and networking activities (information and knowledge management, training and capacity building, collaborative advocacy, quality and accountability) at all levels. **(Action: SDMA)**
Accessibility	Establish protocols for cooperation and ensure access to the affected areas with support from government agencies at respective levels like NDRF and SDRF that have good logistics base to reach inaccessible areas. **(Action: SDMA, NGOs, CBOs)**
Hazard and vulnerability based planning	Conduct community centric hazard and vulnerability analysis at all levels, and develop disaster management plans accordingly. **(Action: SDMA, NGOs)**

Chapter 11 - Knowledge Management

11.1 Approach

There is a need to create a network of knowledge institutions in the field of DM, to share their experiences and knowledge. The SDMA would forge ties with knowledge institutions such as NITs, IITs, NESAC, GSI, CWC, IMD, etc., and UN Agencies and other national and international agencies dealing with emergency response through MATI and utilize their experience and knowledge for DM in the State.

In acknowledgment of the need for a knowledge sharing platform on DM, and to facilitate interaction and dialogue with related areas of expertise, the SDMA website would be created. It will connect all Government Departments, statutory agencies, research organizations/institutions and humanitarian organizations to share collectively and individually their knowledge and technical expertise. ICT would be utilized to disseminate knowledge to the stakeholders so that they can benefit from it.

11.2 Documentation of Best Practices

The indigenous technical knowledge would be documented and promoted. And in the immediate aftermath of any disaster or incident, field studies will be carried out, with the help of experts wherever needed, as an institutional measure. These studies will concentrate on identifying gaps in the existing prevention and mitigation measures and also evaluate the status of preparedness and response. Similarly, the lessons of past disasters will also be compiled and documented.

Chapter 12. Climate Change, impact & adaptive responses in Meghalaya,

India, as an emerging economy with a population of over a billion, is also characterized by nearly two thirds of its population being rural, with high dependence on climate sensitive natural resources. The likely effects of climate change in the agriculture and livelihood sectors due to increased frequency of extreme weather, floods, droughts and increase in sea levels are a concern to the Government of India. Recurring droughts and yearly floods, coupled with limited options of alternative livelihoods threaten livelihood security of millions of small and marginal farmers in the rain fed agriculture region. Food security of India may be at risk in future due to the threat of climate change leading to increase in frequency and intensity of droughts and floods, thereby affecting production on small and marginal farms. The impact on forests and on biodiversity will have adverse socio-economic implications for forest dependent communities and the national economy.

Climate change is a foremost concern for India because the major sectors in India like agriculture, forestry and fisheries are climate susceptible (Chatterjee et al. 2005) - and also because around two-thirds of the population is rural and depends on climate sensitive natural resources such as forest biodiversity and water availability (National Communication on Climate Change, 2004). Agriculture represents 35 percent of India's GNP and sustains the livelihoods of nearly 75 percent of the population (Naveen Kalra et al. 2003). India is highly dependent on the southwest monsoon (June - September), and 60 percent of the crop area under rain fed agriculture is in areas highly vulnerable to climate variability and change (National Communication on Climate Change, 2004).

12.1 Climate change and North Eastern States

This region, which boasts of a large forest cover and very high biological diversity, is known as the Green Belt of India. North East India is nestled in the globally recognized biodiversity hotspot and an eco-region and is renowned for its high species diversity and endemism. It is also recognized as one of the centres of origin of cultivated plants. The dependence of the population on forest's resources is high which provides livelihood to an estimated 483 different tribes, with a comparable number of languages and dialects.

The north eastern region of India is expected to be highly prone to the consequences of climate change because of its geo-ecological fragility, strategic location vis-à-vis the eastern Himalayan landscape and international borders, its trans-boundary river basins and its inherent socio-economic instabilities.

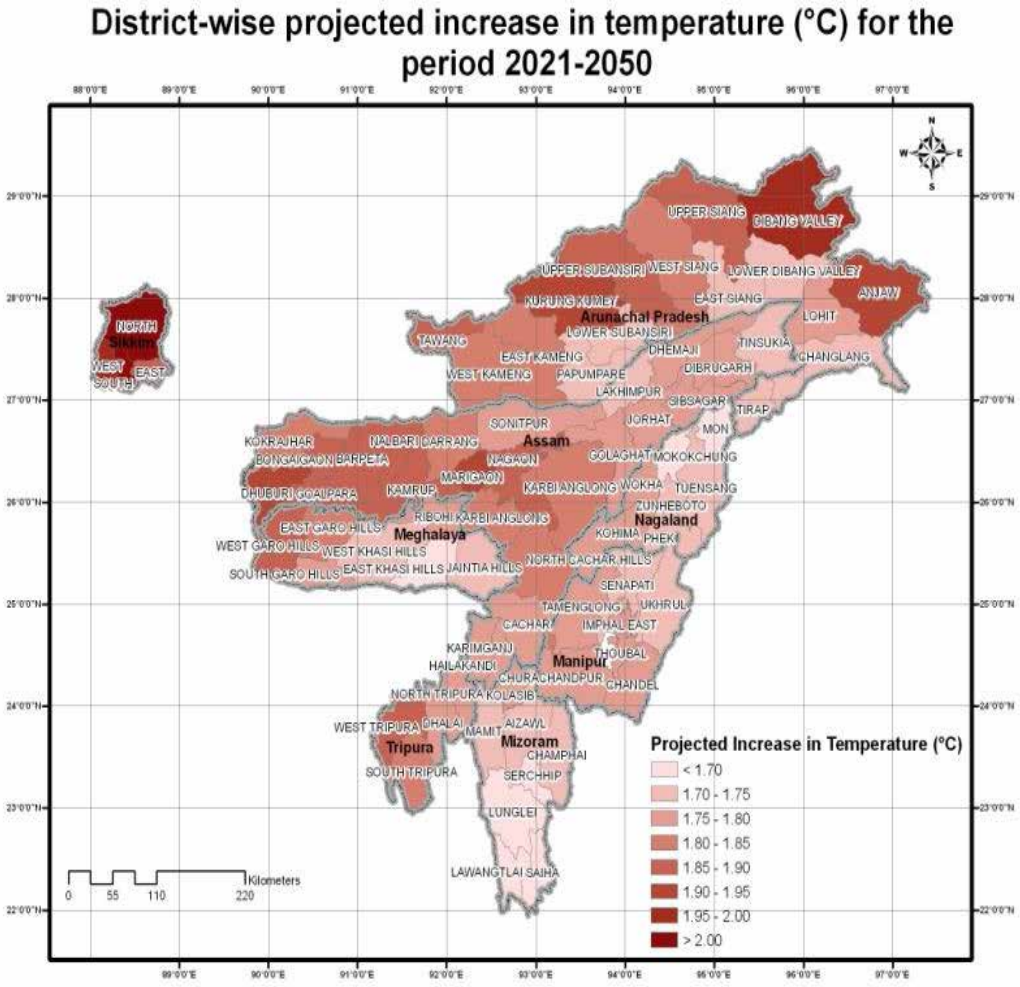
Extreme precipitation events (heavy rain storm, cloud burst) may have their own impacts on the fragile geomorphology of the Himalayan part of the Brahmaputra basin causing more widespread landslides and soil erosion. The response of hydrologic systems, erosion processes, and sedimentation in the Himalayan river basins could alter significantly due to climate change. Two extremely intense cloud bursts of unprecedented intensity- one in the western Meghalaya hills and in 2004 and 2014 caused two devastating flash floods in Meghalaya which resulted in heavy loss of lives and damage to property and enormous loss of domestic animals and agricultural crops

Studies on rainfall and the temperature regimes of Northeast India indicate that there is no significant trend in rainfall for the region as a whole i.e. rainfall is neither increasing nor decreasing appreciably (Das and Goswami, 2003; Das, 2004). However, for a part of the region that the meteorologists of the country officially refer to as the 'South Assam Meteorological Subdivision' (that covers mainly the hill states of Nagaland, Manipur, Mizoram and Tripura and parts of the Barail Hills in southern Assam), the summer monsoon rainfall is found to be decreasing at an approximate rate of 11 mm per decade (Das 2004, Mirza et al., 1998).

Analysis of long-term temperature data for the region points to a distinctly rising trend in surface air temperatures. The annual mean maximum temperatures in the region are rising at the rate of +0.11°C per decade. The annual mean temperatures are also increasing at a rate of 0.04°C per decade in the region (Das 2004). This may well be a manifestation of the regional impact of global warming/climate change.

12.2 Climate Change Projections

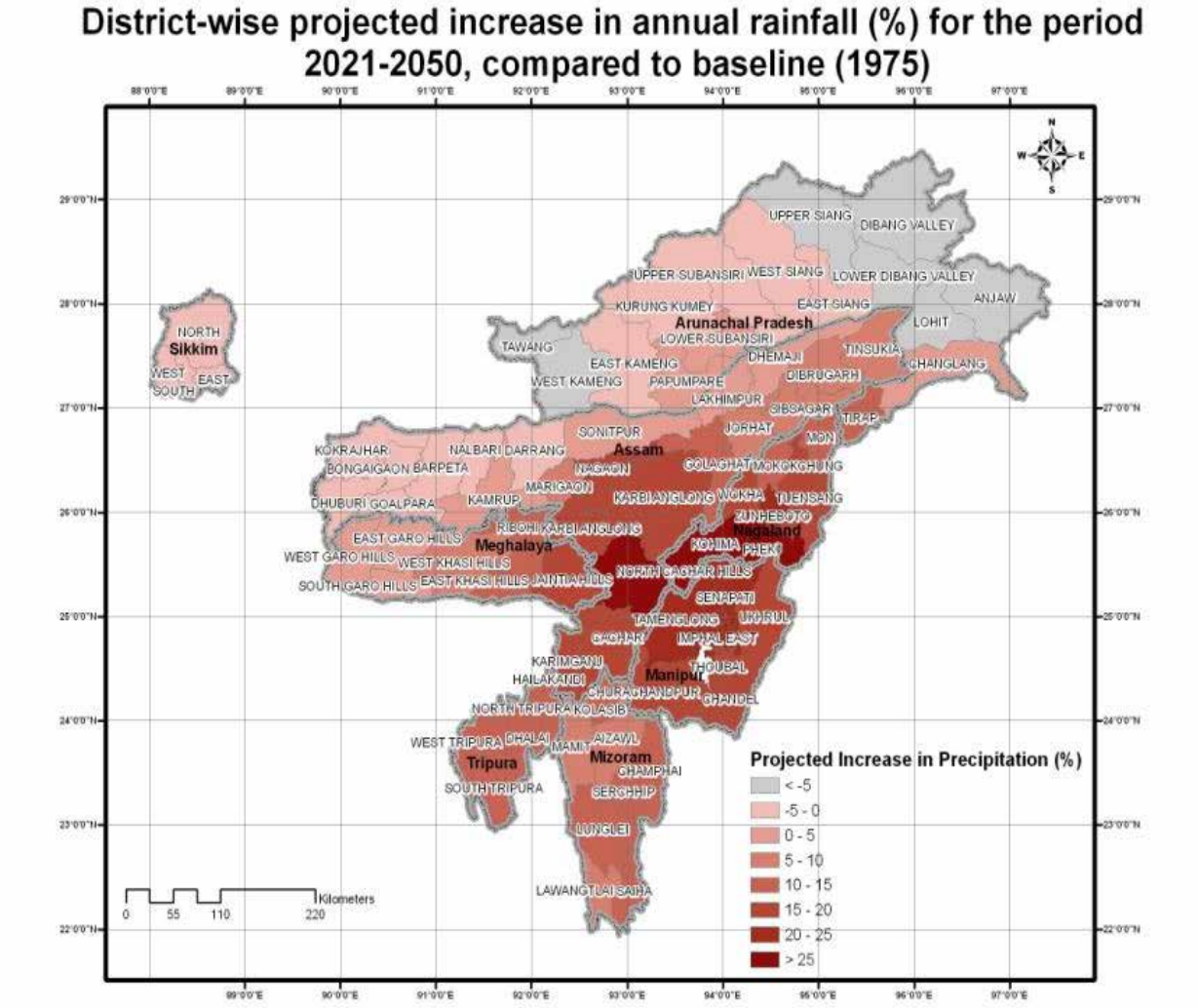
Projected Increase in Temperature: There will be increase of temperature in central and western parts of north-east (parts of Meghalaya and Western Assam). These regions are expected to experience a warming of about 2 degrees Celsius by 2030s. As far as the western part of the region is concerned, the observed minimum temperature trend (1901-2007) already shows a warming trend.



Map No7: District-wise projected increase in temperature (°C) for the period 2021 – 2050

12.3 Projected Increase in Annual and Seasonal Rainfall

The increase in annual rainfall is high in the central and eastern part of the region (Manipur, Mizoram and eastern parts of Assam). This is significant, as there is already an increase in rainfall observed in the eastern part. Many districts of Arunachal Pradesh and north Assam are expected to have a decline in rainfall (as much as 11%).



Map No 8: District-wise projected increase in annual rainfall (%) for the period 2021 - 2050, compared to baseline (1975).

12.4 Projected Increase in Extreme Rainfall Events

The number of days with less rainfall (lesser than 5mm per day) goes up slightly. The number of days when rainfall is greater than 100 mm goes up by 0.5 days (from 1.8 days to 2.3 days). This is significant, as this number was quite low (1.8 days), to start with. The number of days where the rainfall exceeds 100mm per day but less than 150mm per day (signaling a flooding event) is likely to increase significantly (around 20%). The number of days when the rainfall exceeds 150mm per day (signaling a heavy flooding event) is likely to increase significantly (around 38%).

12.5 Climate change impact on the state of Meghalaya.

Meghalaya is one of the wettest places in the world and has a very fragile ecosystem. But it has experienced a change in the monsoon pattern, a decline in precipitation, and a rise in temperature. Global warming affects the hydrological cycle which could result in further intensification of temporal and spatial variations in precipitation and water availability.

Climate change may increasingly alter the distribution and quality of Meghalaya's natural water resources and adversely affect the livelihood of its people. With an economy closely tied to its natural resources base and climate-sensitive sectors, such as agriculture, water and forestry, it is obvious that Meghalaya will faces a major threat because of the projected changes in climate.

The Average Annual Rainfall in Meghalaya is 2818 MM (source: rainwaterharvesting.org), whereas, Sohra or Cherrapunjee and Mawsynram in Meghalaya receive the highest rainfall in the world i.e. about 11000 mm annually, but this huge rainfall is concentrated only in monsoon months. 11, 667 sq km of the State drains into the Brahmaputra basin and the rest 10,650 sq km into the Barak Basin (Source: Central Water Commission). In less than 12 hours all the rainfall run-off water reaches the plains of Bangladesh and Assam taking along with it top soil, boulders and logs besides creating flood-havoc in Bangladesh. In contrast during non-monsoon months, most of the rain-fed surface sources and spring sources get dried up, leading to water scarcity, which is a major problem as the people living in these areas with highly variable rainfall, experience droughts like situation and floods and often have insecure livelihoods. In many dire cases people do not even have regular access to water for drinking purposes.

Meghalaya's rich natural resources like high potential horticulture, with tropical and subtropical fruits and vegetables, plains suitable for tea, are highly sensitive to climate change. Short but heavy rainfalls have destructive effects on agriculture. It is difficult to breed crops for a rapidly changing climate. A two-degree Celsius increase in temperate could wipe out up to 15 per cent of the regions species. This would also affect non-agricultural sectors such as tourism that are dependent on wildlife diversity and pre-empt development of fish farming and game ranching. To forestall the impact of climate change on species, the region will need to double conservation areas in the face of growing demand for land by the growing population.

12.6 Mitigation measure

- Agro-forestry with multipurpose trees, crops and animal components for improving hydrology.
- Integrated farming systems and watershed development
- Screening short duration varieties for their drought resistance.
- Popularization of technologies like system of rice cultivation (SRI) and aerobic rice cultivation for water saving and mitigation of green house gas (GHG) emission.
- Rain water harvesting: in-*situ* (land configuration, mulching etc.) and ex-*situ* (Ponds, micro water harvesting structure -*jalkund* etc).
- In-*situ* biomass management in shifting cultivation
- Promotion of technologies that enhance biological Nitrogen fixation and improve nutrient and water use efficiency to reduce N2O emission and dependence on non-renewable energy.

- Change in planting dates and crop varieties
- Building climate-smart economies that take advantage of the vast amounts of scientific knowledge available.

12.7 Opportunities

With the changing climatic condition farmers are finding that growing broomstick in slope lands/Jhum is a lucrative option as its fetches Rs.50-60 per kg. Communities now concentrate on growing high value crops such as Ginger, Areca-nut, Banana, Jackfruit, pumpkin, Colocasia, Turmeric, Chillies, Beatle-leaf, pepper, Eri silk worms and Cocoon as potential marketable commodities under changing environment. These crops have better prospect to survive under water stress compared to other vegetable crops in home gardens and in the sloping land. Besides, these crops require less cropping areas and more crops can be produced per unit area.

In addition to agricultural activity, the village community now prefers to increase rearing of livestock; chicken, koilure, emu, pig, cattle and goat and are trying to be self dependent for meeting poultry and pig feeds throughout the year from their own resources (processing yam, maize, tapioca). Villages closer to urban centres have focused their attention to cater to urban markets demands for the agricultural produce, specific to vegetables and high value rice (sticky rice) for cash generation.

12.8 Initiatives undertaken by Government of Meghalaya:

Government of Meghalaya has understood the importance of climate change issue and its impact on growth, development and poverty reduction and has formulated a Climate Change Action Plan (CCAP) for the state.

Nine sectoral working groups were formed, namely, Forests and Biodiversity, Water Resources, Sustainable Agriculture, Sustainable Habitat/ Urban, Energy, Mining, Crosscutting areas and Climate Change Adaptation Project, Knowledge Management and Skill Development, Improving Governance in context of Climate Change Adaptation.

Understanding the importance and urgency of climate change issues and its impact on growth, development and poverty reduction, the State of Meghalaya has established a Climate Cell led by the Planning Department to address issues and activities for combating the effects of climate change. In order to have policy convergence, the State is now in the process of formalizing the **Meghalaya State Council on Climate Change and Sustainable Development (MSCC&SD)** under the Chairmanship of the Chief Minister, as well as a **Steering Committee on Climate Change** chaired by the Chief Secretary that would coordinate the State Action Plan for assessment, adaptation and mitigation of climate change.

The measures for protection and conservation of biodiversity through identification and mapping of existing biodiversity hotspots, preparation of micro-plans for conservation, use of Reduce Emission from Deforestation and Degradation (REDD & REDD+) assessment to account for positive contribution of the state forest cover as a carbon sink, improvement of existing forest cover and eco-restoration of degraded wastelands by plantation activities were undertaken. Other strategies include mapping studies, training and promotion of non-timber based forest based

products by building market linkages. Safeguarding elephant corridors and reduction of man-animal conflict also finds a place in the key priorities. Participatory research and community mobilisation form important tools towards achieving these objectives.

The State's agrarian population is envisaged as a highly vulnerable group to the changing weather patterns, unpredictable floods and dry spells as well as soil and water contamination from acid mine drainage in mining areas. Intensive research and pilot studies on stress tolerant varieties of crops, promotion of low volume high value crops, optimisation of Jhum through improved measures such as contour bunding, documentation of traditional adaptation practices, soil and water conservation, rainwater harvesting for irrigation, treatment of catchment areas, vaccination programmes for control of vector-borne diseases and widespread capacity building of farmers on sustainable agricultural practices are the key priorities of the plan

The negative impacts of mining on the environment, sustainable mitigation actions to check unscientific mining, improving mining operations based on environment management plans, protection of water bodies around mining areas, eco-restoration of abandoned mining areas, strengthening of environmental regulations to prevent ecological degradation from mining activities, have been addressed as priority actions in the plan.

Mitigation measures include improvement of solid and liquid waste management systems to eliminate the impacts of methane emissions from waste streams, promotion of rainwater harvesting, solar water heating, and other energy and water conservation measures in city infrastructure and control of vehicular pollution through policy enforcement.

Chapter 13: Indigenous knowledge and coping strategies in Disaster Risk Reduction

The United Nations Conference on Environment and Development at Rio in 1992 strongly emphasized the need for development of capacity building for indigenous communities, based on the adaptation and exchange of traditional experience, knowledge and resource-management practices, to ensure their sustainable development. Furthermore the 2005 Hyogo Framework for Action seeks to ensure that disaster risk reduction is a national and a local priority requiring both national platforms and community participation

Indigenous Coping Mechanisms largely depend on Indigenous Coping Knowledge approach to reveal the body of knowledge built up through observation and hand-on-experience by people living in close contact with nature which, in turn, is transmitted from one generation to the next through oral tradition.

Community Coping Strategy (CCS) refers to a set of measures that the community adapts to:

- Avoid (an anticipated) disaster: these actions are mostly related with preparedness and mitigation measures
- Manage an exceptional circumstance and
- Bring about a normalcy in life and livelihoods (after a disaster)

Many people in rural areas of Meghalaya depend on indigenous knowledge to cope with the extreme climate such as flood, cyclone wind etc. Communities have their own way of defining when conditions become worse which will constitute a crisis or disaster. This threshold varies between communities, according to their vulnerabilities and the threats they face. Seasonal flooding is not necessarily seen as a disaster in some places. Crop growing may depend on it, and poor families may supplement their diets with fish that are more readily caught as flood water spreads from the rivers over the fields.

Some of the local improvised knowledge and technique used by the local community in protecting houses and securing roof of houses from cyclonic winds in West Khasi Hills District and East Khasi Hills District are as follows.

a) **Planting of bamboo bushes (Naga bamboo)**: Normally bamboo has high resilience and it is thin like a stick and short in height and forms a bushy mesh. When planted around a house, it does not overshadow the house yet protects it from cyclonic wind by breaking the speed of the wind and thereby minimising the impact of the disaster.

Photo No 1: Planting of bamboo bushes (Naga bamboo)

b) Early Warning:

i. **Cloud Formation:** According to a version of the local people if the sky is clear, then clouds make a thread-like formation very high up in the sky and if clouds are seen to move from west to east or east to west and if these continue for a few days, then it indicates that cyclonic wind is brewing up somewhere. Local people also say that reddish clouds also begin to appear in the sky from the direction of the probable cyclone and when these clouds turn dark wind starts blowing and it starts raining.

ii. **Observation of insects:** Bees would not go into the hive, they will be busy in their movement as if there is an emergency to collect and stock food. If bees are moving very fast it means cyclone is just round the corner and if they are moving slow, it indicates that there is still time for the arrival of cyclone.

During the normal times, the red ants move slowly and not much in a line, but before cyclone or rains, the ants move faster and in groups.

C) **Construction of houses:** In hilly regions houses are more vulnerable since they are built on the slope of the hills, as a result they are more exposed to the direct impacts of the cyclone. To mitigate this, the only solution to save the houses from the direct impacts of the winds is to construct the houses inside the hill. These traditional practices are remarkably effective in protecting the houses from cyclonic winds. There are two benefits from such construction, firstly, it will save the house from direct impact of the cyclonic winds and also the foundation of the house will be more solid when it is constructed on level land than on slopes. The reason behind cutting the hillock is simple. 'L' shaped portion is cut from the side of the hillock creating an empty triangular space with base of the triangle parallel to ground and the side perpendicular to it. When a house is erected in this space, it is only vulnerable to winds coming from the front, yet the vulnerability is reduced as at the back of the house there stands the perpendicular wall of the cut out hillock. Winds coming from the opposite direction can do no harm as it blows over the hills.

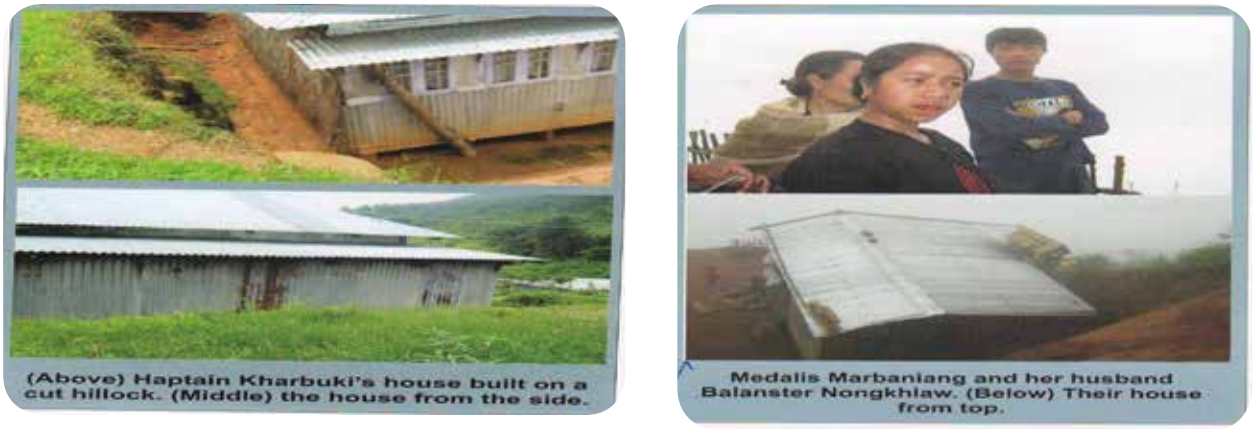


Photo No 2: Construction of Houses to avert cyclone impact

d) Tying Roof of a House with Veranda and Mud Walls with Heavy boulder Fixed Underneath the Ground: This method prevents roofs of houses from being blown away by cyclonic winds as the roofs have been tied securely with bamboo placed on top of the tin roof. These bamboos are tied with thick galvanized wires and pulled down to the base of the house and again tied to boulders.

Photo No 3: Tying Roof of a House to reduce the impact of Cyclone

Coping strategies and indigenous knowledge are important in reducing risk. But like any knowledge system, they have their strengths and weaknesses in different contexts and at different times. Local knowledge, skills and coping strategies must be assessed logically and scientifically on the basis of their effectiveness. The changing environment, economy and society also adversely affect communities' ability to develop and promote indigenous practices for disaster risk reduction. Any effort aimed at replicating indigenous knowledge based practices should take this element into consideration.

Chapter 14: Livestock Management: During Emergencies & Disasters

The Department of Animal Husbandry and Veterinary, Government of Meghalaya is entrusted with the responsibility of all aspects of Livestock and Poultry Development, as well as preparation of disaster management plan for livestock.

The two major causes of disasters for livestock are epizootics and geophysical events. Throughout history, epizootic diseases have killed large populations of animals and reduced the production efficiency of many animals. In addition to epizootics, and sometimes exacerbating these, numerous geophysical disasters affect livestock agriculture every year. These geophysical events can also cause considerable loss of animal life and spoilage of processed foods for humans.

14.1 Animal health concerns that result from disasters

The most important causes of deterioration in animal (livestock and equines) health in disasters are poor nutrition and subclinical diseases which result from contagious diseases and geophysical events.

14.2 Impact of floods on animal health

Flooding occurs in two ways: flash-floods and cresting floods. Flash-floods occur following heavy rain falls in low-lying and drainage areas and in areas where irrigation is not adequate. Flash-floods often pose the greatest immediate threats to animal and people's lives as animals and peoples can be trapped and drowned. Cresting floods usually arrive after a warning of several days or weeks.

Prolonged flooding of pasture land kills vegetation therefore reducing the nutritional value of pastures to grazing animals. Flooding also removes organic matter from the soil which reduces the water-holding capacity of the soil. Soils that have a low content of organic matter are more prone to droughts and landslides and are less productive for plant growth. It also deposits large amount of sediments which reduce the plant growth for the livestock.

Subsistence farmers may move animals to higher ground when floods are imminent or, in rare cases, build rafts for minor species (pigs, chickens, sheep, goats) to float on when waters rise. However, most subsistence farmers take their animals with them when they are displaced. This means that relief shelters for displaced subsistence farmers are often inundated with animals, thereby presenting considerable public and animal health problems. Public health concerns may also arise due to outbreaks of zoonotic disease, including vector-borne diseases, hydatidosis and visceral larva migrants.

Species	Disease	Treatment
Poultry (chickens, turkeys, ducks)	Abscesses	Antibiotic supplemented feed
	Respiratory diseases	Antibiotic supplemented feed
	Mites	Topical treatment with parasiticde
Swine	Cholera	Kill and remove affected animals
	Scabies	Topical treatment with parasiticide
	Foot rot	Pare foot and treated with penicillin

Cattle, goats, camelids	Foot rot	Pare foot, wrap with copper sulphate bandage, treat with penicillin
	Respiratory tract infections	Treat with long tetracycline
	Vector – borne diseases (Rift Valley fever)	Quarantine
Horses	Vector – borne diseases (Venezuelan equine encephalomyeclitis)	Vaccination
Dogs	Rabies	Kill all aggressive dogs and those suspected of being infected. Vaccinate all other dogs
	Scabies	Topical treatment with parasiticide

Table No 14: Some typical problems that arise in floods affected subsistence farmers

14.3 Impact of droughts on livestock

Drought is a silent disaster (along with famine and pestilence) because it has a slow onset period that does not encourage monitoring because of its discomfort. Susceptibility to drought is associated with low rainfall but droughts also commonly occur in previously flooded areas, where soils have been leached of organic matter. The key elements to managing animals in drought disaster are food, water and shelter. The lack of any of these factors, or a scarcity of one or more, can lead to a slow death for livestock, young ones of animals also experience a rapid reduction in weight and reproductive efficiency Animal reaction to drought is slow and vague until at critical health levels. As a result it leads to considerable economic loss and a reduction of the food supply for humans

14.4 Phases of emergency management

14.4.1 Mitigation

The most effective mitigation of any disaster in developing countries is to strengthen the animal health services of those countries. A strong Veterinary Service is one that is well trained in all aspects of veterinary medicine, including public health and epidemology, and that operates under the authority of the government of the country in question. Mitigation (strengthening the veterinary profession) against trans boundary diseases is a global issue in which every country plays a role.

The common approach to mitigation in Meghalaya is to attempt to prevent the transmission of trans-boundary diseases through extensive International and State border with Bangladesh and Assam. For this purpose, Meghalaya has four veterinary check posts, which are as follows

Location	District	Controlling Officer
Byrnihat	Ri – Bhoi	District A.H & Veterinary Officer, Nongpoh
Aradonga	West Khasi Hills	District A.H & Veterinary Officer, Nongstoin
Ratachera	Jaintia Hills	District A.H & Veterinary Officer, Jowai
Depa	North Garo Hills	District A.H & Veterinary Officer, Resubelpara.

Source: Annual Administrative Report 2013-14, Directorate of A. H. & Veterinary Department, Government of Meghalaya

Meghalaya can only expect to prevent the introduction of diseases by forming partnerships with their neighbouring state to deal with diseases at their endemic sites. States with well-developed veterinary professions must offer and share their resources. Only a strong network of veterinary community will be able to reduce the impact of all types of disasters, especially those due to epizootic disease.

Mitigation programmes that should be supported are those that focus on epidemiology and clinical and laboratory diagnosis of disease, herd health management, nutrition and public health. Furthermore, programmes that improve animal identification should be developed, so that trace-back procedures become an efficient component of disease control and eradication. Finally, mitigation for the livestock industries should involve financial planning for post-disaster recovery. Effective financial mitigation includes the insurance of the livestock industries of the entire state against catastrophic losses (known in insurance terms as uncorrelated risks).

Mitigation programmes for geophysical disasters also involve implementing early-warning systems for impending floods (river water flow metres) as well as building of multi-purpose livestock shelters in flood/cyclone-prone areas. Such livestock shelters are very effective in protecting animals during floods and cyclones and at all other times they can be used as fodder stores, veterinary centres or government training centres where technical experts can provide advice and training on animal management, vaccine awareness and disease prevention. Construction of holding facilities for livestock using indigenous technology developed over the centuries can also prevent losses from common natural hazards such as cyclonic winds and earthquakes. The farmers need to be made aware of the simple but effective steps they can take to mitigate the effects of disasters e.g. un- tethering animals at the first sign of a storm, moving them to cattle shelters or safer areas, performing pre-monsoon vaccinations against certain diseases and quickly disposing of carcasses.

Care of birds

Birds need special care during disasters. The following are some of the recommendations for birds:

a) Birds should have sufficient supply of water. Adding chlorine to water (ten drops of chlorine bleach per gallon of water) will prohibit the growth of bacteria. This chlorinated water should be stored in large containers away from sunlight

b) Aviaries should be equipped with overhead sprinkler systems which minimize smoke inhalation, cool the air and reduce the chances of burn injuries

c) Farms should have enough carriers to evacuate all the birds during emergencies

d) Birds should not be left exposed to smoke and fumes as they are very sensitive to smoke and fumes and succumb more quickly than most other animals

e) Birds should be checked for injury and chemical. A veterinarian should be consulted if necessary. Any bird showing signs of lethargy, loss of appetite, depression or injury should be evaluated by a veterinarian

f) If the birds are moved to a new surrounding they should not be removed from their cages immediately as they may be frightened and may fly away. Keeping the birds warm can reduce stress. So if electricity is available, heating should be provided. If not, blankets placed over the cages will have a similar effect.

14.4.2 Preparedness

The essence of an effective preparedness phase of disaster reduction programmes in the state is in the development and implementation of timely (seasonal) education community based sensitization programme which includes weather forecasting and river flow monitoring to advise farmers on the optimal time to move cattle.

Educational programmes may provide an added incentive to ensure more rapid and thorough dissemination of knowledge. A 'pyramid of education' is an example, whereby government officials generate appropriate materials for education and offer this information to livestock farmers. Educational programmes can be carried out through different IEC campaigns.

To improve the facilities for treatment and for taking preventive measures against diseases through vaccination, a network of Hospitals, Dispensaries, Mobile Dispensaries and Aid Centres have been established covering a vast area of the State. In addition to these, schemes like Animal Diseases Surveillance, Rinderpest Eradication, Foot and Mouth Diseases Control, Systematic Control of Livestock Diseases of National Importance have been implemented. Many of animals have been treated by the technical Staff of Veterinary Institutions. Apart from treatment of animals, these institutions look after other aspect of livestock development through preventive inoculations, artificial insemination, removal of undesired scrub-bulls, recording of improved breed and development of poultry population both in public and private sectors etc.

14.4.3 Response

Animals should be evacuated and taken to shelter as soon as there is news of an imminent disaster. Every animal must have some form of durable and visible identification, for instance the animals should be branded or tagged and the community should have arrangements for appropriate transport suitable for specific animals. Since animals will be displaced and will congregate, resulting in the increased potential for disease transmission, early intervention to support animal health is likely to be highly cost-effective.

Facilities provided for displaced subsistence farmers should include separate facilities for animals in the relief camps as it is crucial to keep the animals and people apart. The animals should be vaccinated and treated if necessary upon arrival. Human vaccination programmes could be co-ordinated with animal vaccination programmes as vaccination programmes for humans have been shown to have a high success rate when conducted in concurrence with animal vaccination programmes.

Following floods or cyclonic storms, large numbers of carcasses are often found scattered while many carcasses in remote areas will be scavenged, carcasses lying close to human or animal habitation, or water sources, should either be removed or destroyed rapidly. Composting on site may be the most practical alternative in many cases to dispose of large carcasses.

Stranded animals should be rescued and taken to safer places. If the stranded place is considered safe for the next week or so, the animals may be left there but they should be provided with feed, fodder and drinking water. Arrangements should be made so that veterinary and para-veterinary personnel can quickly reach all affected animals to provide treatment, vaccination and de- worming. Officials and other personnel engaged in relief work should also gather intelligence on the extent and nature of the damage to individual farms and villages so that appropriate relief measures can be undertaken.

14.4.4 Recovery

An effective recovery phase from disasters commences with effective mitigation programmes which should include creating job avenues in animal husbandry and dairy sector and appointing of feeders, milkers, breeders and herd health specialists on a regular basis.

Chapter 15: Equal Opportunity and Full Participation of People with Disabilities

Individuals with disabilities are disproportionately affected in disaster, emergency and conflict situations due to inaccessible evacuation, response (including shelters, camps, and food distribution) and recovery efforts. In normal times, People with Disabilities (PWDs) are marginalized and so they are worse off during disaster times. Women with disabilities are rendered critically vulnerable in disaster situations. This calls for taking into consideration the special needs of persons with disabilities in every stage of the disaster management cycle, so that they are able to uphold their dignity at family and community levels which take them forward to achieve their rights.

Different hazards pose different risks for PWDs and for development of new disabilities.

Possible Consequences And Disabilities Resulting From Disaster		
Type of hazards/ Disaster	**Immediate consequences**	**Possible Impairment/ disability**
All Natural Disaster	• Malnutrition • Vitamin A deficiency • Psychological shock • Loss of medicines (for diabetes, epilepsy etc)	• Development delay • Visual impairment or blindness • Psychological disorders • Worsened existing disability • Increased risk of developing new disability
Flood	• Drowning	• Respiratory complication
Cyclone/ Earthquake/ Fire/ Landslides	• Trauma • Bodily injury • (+/- infection) • Head injury • Burn	• Paralysis, spinal cord injury • Limb loss/ amputation • Physical/intellectual disability • Limb deformity

Table No 15: Possible Consequences and Disabilities Resulting From Disaster

Brief Suggestion For Addressing Specific Needs		
Disability/ Impairment	**Risk/ Problem**	**What to Do Provide:-**
Physical Impairment	Decrease in body temperature, Bed-sores, difficulty for escaping unsafe situation, difficulty in accessing relief	• Blanket, warm clothing • Mattress, cotton sheet, dry place, hygienic kits etc • Personnel support • Assistive device • Adapted physical environment (ramps, handrails, etc) • Separate queues for ration/latrines/water
Hearing Impairment	Difficulty in expressing themselves/ understanding, Difficulty in hearing instructions	• Visual aid • Picture exchange communication • Separate queues for ration/latrines/water
Visual Impairment	Difficulty for escaping, Unsafe situation, Difficulty in accessing relief	• Use landmarks • Install hand rails • Personnel support • Good lighting • Separate queues for ration/latrines/water

Intellectual Impairment	Difficulty understanding/ following instruction or seriousness of the situation	• Speak slowly • Use simple language • Personnel support • Separate queues for ration/latrines/water

Table No 16: Illustration for Addressing the Needs of Persons with Disabilities

15.1 A legal framework to support the inclusion of persons with disabilities

Mainstreaming disability into emergency responses and preparedness by making disability issues and persons with disabilities visible in national and international action plans and policies is essential to ensure equality and human rights for all.

The United Nations Convention on the Rights of Persons with Disabilities was adopted in December 2006. The Convention makes a "paradigm shift" in attitudes and approaches to persons with disabilities. It takes to a new height the movement from viewing persons with disabilities as 'objects' of charity, medical treatment and social protection towards viewing persons with disabilities as 'subjects with rights' who are capable of claiming those rights and making decisions for their lives based on their free and informed consent as well as being active members of society. Article 11 of United Nations Convention states that all necessary measures to ensure the protection and safety of persons with disabilities in situations of risk, including situations of armed conflict, humanitarian emergencies and the occurrence of natural disasters shall be taken by states parties. India enacted the Persons with Disabilities (Equal Opportunity, Protection of Rights and full Participation) Act 1995 in fulfilment of its International obligation.

15.2 Disability as a Cross-cutting Issue

Disability is a cross-sectoral issue which includes social welfare, education, health, employment and income generation, accessibility issues relating to transport, infrastructure and built environment as well as access to water and sanitation. The needs of PWDs have to be considered during all the phases of disaster and interventions for PWDs need to be wide-ranging, including prevention, rehabilitation and inclusion (integration into mainstream programming). All interventions should be implemented using the rights-based approach.

It is important to consider the special/specific needs of persons with disabilities in every phase of disaster management and risk reduction which are indicated below:-

Disaster Management/ Risk Reduction Phases:	**Addressing Specific/Special needs of the PWDs:**
• **Preparedness** • **Immediate response/ Recovery** • **Mitigation/ Rehabilitation** • **Development**	• **Medical treatment/ therapy/medications** • **Assistive/mobility aids** • **Infrastructure/relief accessibility** • **Community attitude towards PWDs**

15.3 Awareness and Training

Training and exercises should be conducted for evacuation for persons with disabilities and they should emphasise on special aspects such as emergency sign language and finger spelling, use of specialised mobility equipment, safe handling procedures for people with different kinds of disabilities etc. In the immediate aftermath of a disaster it is equally important that a person trained for assisting PWDs is included in every search and rescue team

Options for different agencies are outlined below:

- Mainstreaming disability within the agencies and ensure that disability is included as a cross cutting issue in all activities/projects.

- Sensitizing staff , volunteers and officers towards disability through exposure is the first step in understanding difficulties encountered by PWDs (e.g. contact disabled people's organizations, visit organizations already involved in disability)

- Training and sensitization campaign at the grassroots level for community level disaster management committees and community volunteers on disability issues

- Basic training for grassroots level staff, volunteers on identification of PWDs and their specific needs, knowledge about referral resources and inclusion of disability issues in disaster management planning.

- Medium rehabilitation training for NGO staff and volunteers to build capacity to identify, refer and provide primary rehabilitation therapy to PWDs. For example, the Centre for Disability in Development (CDD) offers training to become a Community Disability and Handicap Resource Person (CHDRP).

- Recruitment of professional staff specialized in disability (e.g. physiotherapist, occupational therapist, Braille teacher, psychologist, etc.).

15.4 Preparedness:

Social structures, public health and general health services are often disorganised during disaster and consequently the population has difficulty or limited access to services. Therefore, potential causes of disability are increased as minor problems are not identified. For example, pregnant women are not followed up, and people with chronic health problems do not get access to adequate services, etc. Therefore, including disability issues in disaster preparedness through appropriate measures to deal with these effects will prevent possible impairment and disability.

Contingency Planning

PWDs need to be identified during the pre-disaster phase including the problems they face and what their needs will be during and after the disaster. It is also crucial to identify barriers or obstacles that PWD can face when trying to evacuate people out of the danger zone at the time when disaster strikes, So it is essential when preparing a contingency plan to consider disability

as a crosscutting issue (similar to gender mainstreaming initiatives) and to account for the special needs of PWDs in the plan.

Risk and Resource Mapping

During disaster preparedness, a risk assessment is imperative to identify potential areas vulnerable in disaster situations such as floods or earthquakes. By involving

PWDs in risk mapping, it can help to determine possible barriers they may face, should any of these risks become a reality during an emergency situation. For example, a person who has difficulty walking or seeing may not be able to negotiate over rubble to reach the relief shelter following an earthquake.

In addition to risk mapping, when resource mapping is carried out, resources specific to PWDs should also be identified. These may include accessible drinking water and sanitation facilities, accessible shelters, volunteers to provide physical support, rehabilitation centres, healthcare/hospital services for injured persons, special schools or schools that include children with disabilities, etc.

15.5 Address the specific needs of PWDs during risk and resource mapping.

Prepare the resource inventory taking into consideration three areas of disability: physical, sensory (hearing, speech, vision) and intellectual.

15.5.1 Early Warning

A comprehensive early warning system is very important in any community, however, it is even more so in a community with PWDs as they are frequently neglected in disaster situations. An early warning system is effective only if it reaches to all community members. Therefore it is essential to include PWDs when designing warning signals/signs so that they can help to ensure that such methods used will be appropriate to meet the needs of the PWDs.

Types Of Impairments And Warning Systems	
Types of Impairments/ Disabilities	**Warning systems**
Visual Impairment	• Auditory signals/Alarms • Announcement • Posters written with large characters and colour contrast
Hearing Impairment	• Visual Signal Systems Red Flag, Symbols • Pictures • Turn light off-on frequency
Intellectual Impairment	• Special Signals-Red Flag, Symbols • Clear and brief announcement by rescue workers
Physical Impairment	• Auditory Signal Systems/ Alarms • Announcement

Table No 17: Types of Impairments and Warning Systems

Shelter

During the preparedness phase, a participatory process should be used to plan for possible shelter or camp locations in the event of disaster. All locations including existing social institutions such as schools or community hall etc that may be used as shelter sites should be made accessible to all community members (such as building ramps, installing handrails, modifying water and sanitation sources and making other modifications).

15.5.2 Immediate Response

Response measures are taken immediately following a disaster, usually beginning with a Rapid Assessment of the entire area to determine the damage resulting from the disaster and the needs of the community, including those of PWDs.

If there are no databases/lists of PWDs available immediately after a disaster, it is important to prepare a detailed list of PWDs during loss and damage assessment which should determine their specific needs e.g. special food, specific medicines, urinary bags, mattress, etc. It will be important to ensure these needs are met, if such requirement are not met it may result in the deterioration of the person's health.

15.5.3 Search, Rescue and Evacuation

During immediate search, rescue and evacuation following a disaster, it may be necessary to employ special techniques or procedures for safely and evacuation of PWDS.

State of preparedness measures and duties	
When preparedness measures are in place there will be	**Warning systems**
• Team dedicated/trained to rescue PWDs • Utilization of existing database/list of PWDs • Adapted evacuation means • Adequate materials to remove someone from rubble • Evacuation to accessible pre-identified location	• Allow the PWD to advise you on his/her special needs (i.e. special technique to move him/her, need for assistive devices, medicines to bring) • Evacuate the persons to location where he/she will best be able to meet his/her immediate needs (i.e. accessible water, toilets, etc)

Table No 18: State of preparedness measures and duties

15.5.4 Security in Camps and Shelters

Persons with disabilities and other vulnerable groups are often more vulnerable to physical, sexual and emotional abuse when staying in shelters or camps due to their reduced ability to protect themselves or to understand the situation. For this reason, it is necessary to orient relief staff and volunteers on ways to minimize risk of these abuses.

PWDs may be at greater risk of injuring themselves due to difficulty in seeing, moving or hearing. To help prevent undue injury or prevent new disabilities:

- Fence the shelter compound or areas that are unsafe (open manholes, piles of rubble, etc) to prevent accidental injury.
- Ensure sufficient lighting in shelter areas so obstacles can be easily visualized.
- Install handrails where there are stairs, or install ramps.

15.5.5 Food Security

In particular, some PWDs are more susceptible to malnutrition in emergency situations due to difficulty accessing rations, difficulty eating rations, insufficient food quantities etc

Nutritional risk	Possible solution
Difficulty chewing and /or swallowing	Provide food ration which are easy to chew / swallow such as “puree” or mash (potatoes)
Reduced food intake	Provide high energy food items
Need for modified position/posture when feeding	Ensure space to eat in privacy
Reduce mobility affecting food access and access to sunlight (affecting Vitamin D status)	Accessible food distribution spot Placement near areas of sunlight
Discrimination affecting food access	Specific distribution spots, control on rations, separate queues
Constipation (particularly affecting individuals with cerebral palsy, spinal cord injury, etc)	Vegetables or eggs in food rations
Separation from family members or usual caregivers (anxiety, lack of physical assistance)	Try to unite with caregivers or relatives

15.5.6 Water and Sanitation

All individuals including PWDs should be informed about when and where the water sources and sanitation facilities are available in shelters or camps and they should be provided with information on prevention of water and sanitation related diseases. For example, tube wells, hand pumps and water carrying containers should be designed or adapted for access to water quickly and easily and temporary toilets in camps and shelters need to be accessible to all. If PWDs are denied equal access to water sources or latrines due to discrimination, it may be necessary to monitor their access or they should be asked to form separate queues.

15.5.7 Health Services

For people with existing disabilities, without prompt attention towards securing medication, assistive devices or personal care assistance, their existing disabilities may worsen, even to a critical stage. For example, a person unable to move due to severe physical disability requires regular changes in position to prevent sores on his/her body from developing.

15.6 Reconstruction and Mitigation

During reconstruction and mitigation, the needs of PWDs should be taken into consideration in all activities aimed at the community. Activities specific to PWDs may also need to be initiated.

15.6.1 Housing

Simple modifications to make houses disabled friendly during reconstruction will ensure that houses are accessible to all, and should be considered not only for houses where a person with disability resides, but for all houses, as a preventative measures. Housing reconstruction should also take into account mode of access to the house.

15.6.2 Water and Sanitation

Latrines

Latrines should be designed, built and located so that they are easily accessible and can be used by anyone, including children, elderly, pregnant women and PWDs. The following features should be considered while constructing latrines:

Latrines and doors may need to be wider and without raised ledges if the person uses a wheelchair. Handrails, potties (over toilet chairs) or commode with varying seat heights may be necessary for persons who have difficulty squatting or for children. A clear access-way from the house is needed (i.e. even walking surface, wide path for wheelchairs, a handrail or other marker for someone who is blind, etc.)

Water Sources

When constructing or repairing water sources, ensure that they should be easily accessible for PWDs. Water sources should be built as close to the house as possible and a clear access-way from the house should be ensured. The ground surrounding the water source should be cleaned up regularly to avoid falling/slipping; adequate drainage around the water source will also help minimize risk of falling on wet and slippery surfaces. If the person using the water source has difficulty climbing, a ramp may be needed for access.

Sl.No	Name of the Organisation
1	Asha Rehabilitation Centre, (Army Welfare Society), New Delhi, C/O Hg 101 Areas Shillong.
2	Bethany Society, Arai Mile, Near Tura, West Garo Hills.
3	Dwar Jingkyrmen School For Children in need of Special Education, Stony land, Shillong
4	Monfort Centre for Education, Danakgre, Tura, P.O. Meghalaya
5	Society for Welfare of the Disabled, Lady Veronica Lane, Laitumkhrah, Shillong.
6	Ferrando Speech and Hearing Centre, Umiam Khwan, Ri-Bhoi.

Table 19: List of Organization working with People with Disability in the state

Source: Directorate of Social Welfare Government of Meghalaya, Shillong

Age Group (yrs.)	O.H	Blind	Low Vision	H.H	M.R	Mental Illness	Leprosy Cured	LCH/ Multiple D	Total
0-3	544	319	65	312	488	49	50	95	1922
Above 3 to 6	1238	474	76	680	427	56	50	147	3148
Above 6 to 18	3786	1374	131	1975	1711	97	55	338	9467
Above 18 to 59	4789	2005	168	2852	1652	87	58	363	11974
60 & above	481	552	88	496	243	49	52	77	2038
Total	10838	4724	528	6315	4521	338	265	1020	28549

Table No 20: The number and types of person with Disabilities (PWD) in the State

Source: Directorate of Social Welfare Government of Meghalaya, Shillong

District	Total No. of Certificates issued Till 31stMarch, 2014	No. of Disability Certificates issued from 1st April, 2014 till date	Total No. of Certificates issued till date	Remarks
East Khasi Hills	9675	590	10265	
West Khasi Hills	2127	121	2248	
Ri-Bhoi District	2681	55	2736	
Jaintia Hills	4245	--	4245	Yet to receive the data
East Garo Hills	1457	--	1457	Yet to receive the data
West Garo Hills	5650	22	5672	
South Garo Hills	1790	18	1808	
South West Garo Hills	1	117	118	
Total	27626	923	28549	

Table no 21: No. of Disability Certificates Issued Age wise till February 2015

Source: Directorate of Social Welfare Government of Meghalaya, Shillong

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MEGHALAYA STATE DISASTER MANAGEMENT AUTHORITY
DIRECTORATE OF LAND RECORDS AND SURVEY
LOWER LACHUMIERE, SHILLONG - 793001

Phone : 0364 - 2503022 / 2502188 / 2226678 / 2226579 (O)/ 1070 / 2505707 (seoc) Fax : 0364 - 2502098 (seoc) / 2226671 (O)
Email : eo.sdma-sdma@nic.in / sdmadeptt007@gmail.com