United Nations International Conference on Space-based Technologies for Disaster Risk Reduction
"Building Resilience through Integrated Applications"

23-25 October, 2017
Beijing China

Status of Using of Space-based and In-situ Information in DRR in Bangladesh

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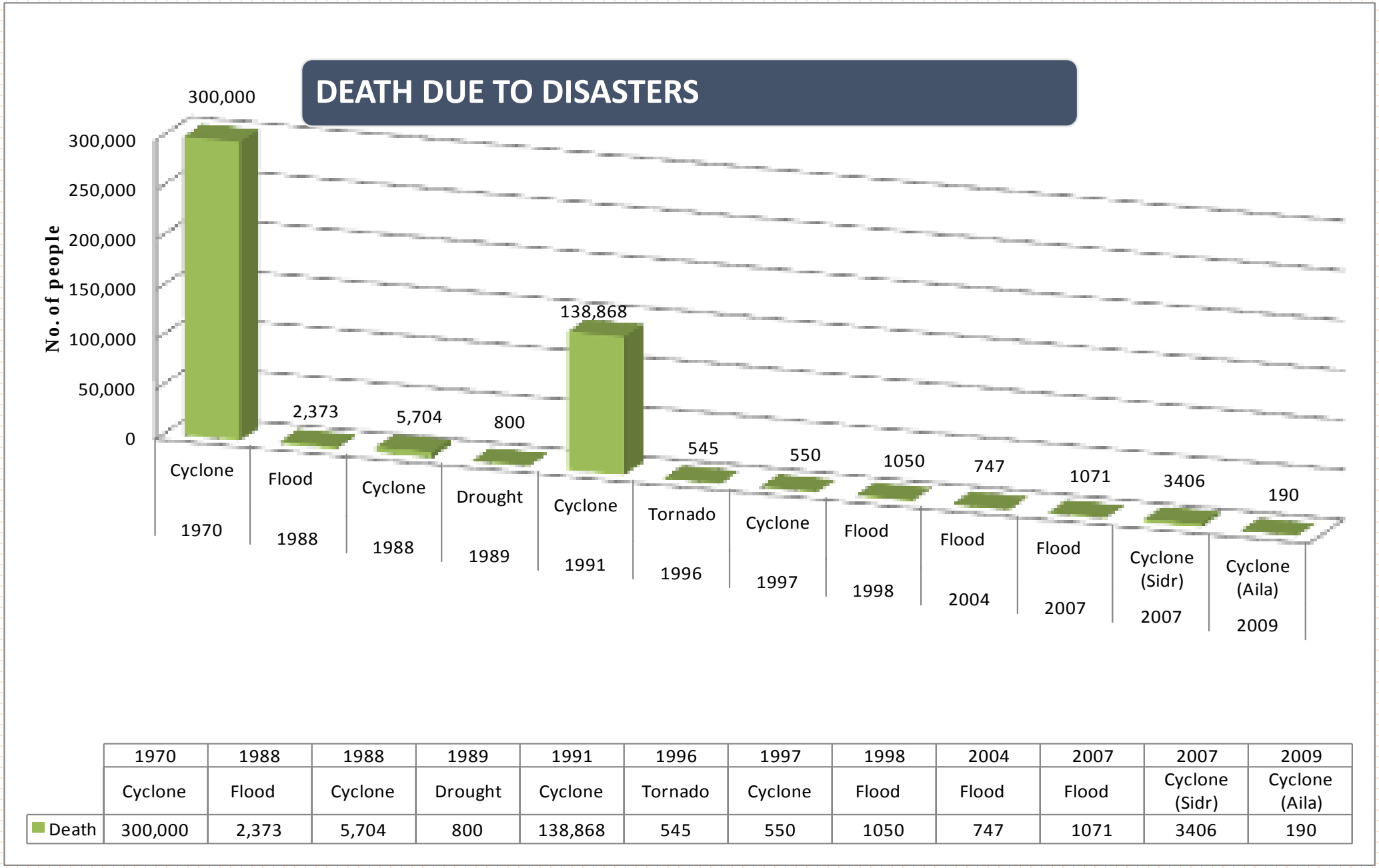
Introduction (University of Dhaka)

- *Department of Disaster Science and Management (DSM) is only 4 years old*
- *An outcome of UNDP managed Comprehensive Disaster Management Programme (CDMP)*
- *Blending of science with social aspects*
- *Teachers from multidiscipline – Geology, Geography, Anthropology, Development Studies, Computer Science, Civil Engineering, Urban and Regional Planning, RS & GIS.*
- *Use of Geoinformatics in Disaster Management (19 credits out of 160 (around 12%))*

Death due to Disaster



	1970	1988	1988	1989	1991	1996	1997	1998	2004	2007	2007	2009
	Cyclone	Flood	Cyclone	Drought	Cyclone	Tornado	Cyclone	Flood	Flood	Flood	Cyclone (Sidr)	Cyclone (Aila)
Death	300,000	2,373	5,704	800	138,868	545	550	1050	747	1071	3406	190

Mission of BD Govt:

To bring a paradigm shift in disaster management from conventional response and relief to a more **comprehensive risk reduction culture**

Risk Reduction Approach

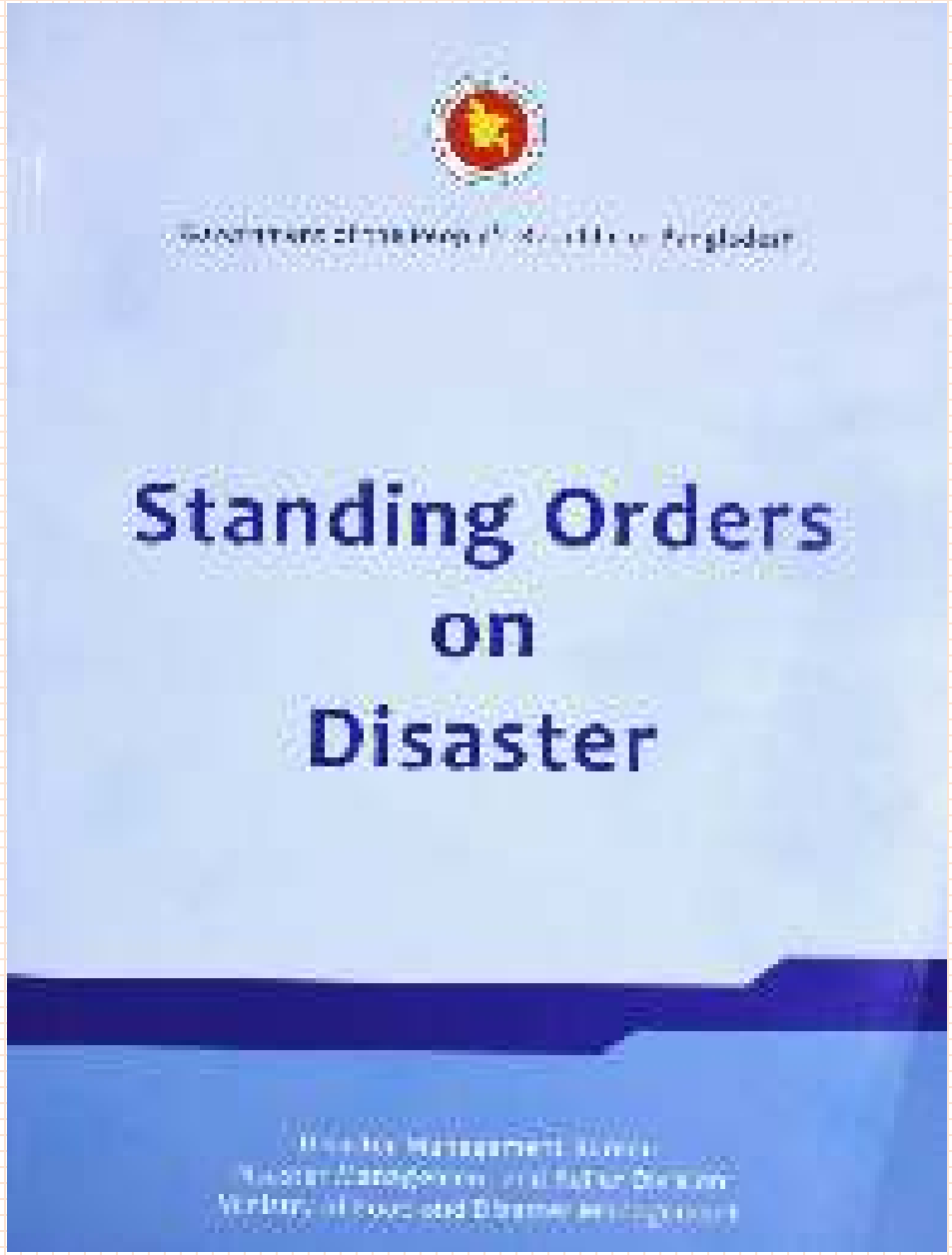
DRR BELIEF

PEOPLE AND THEIR IMMENSE CAPACITY TO COPE WITH, IS OUR BEST RESOURCE TO DISASTER AND RISK MANAGEMENT.

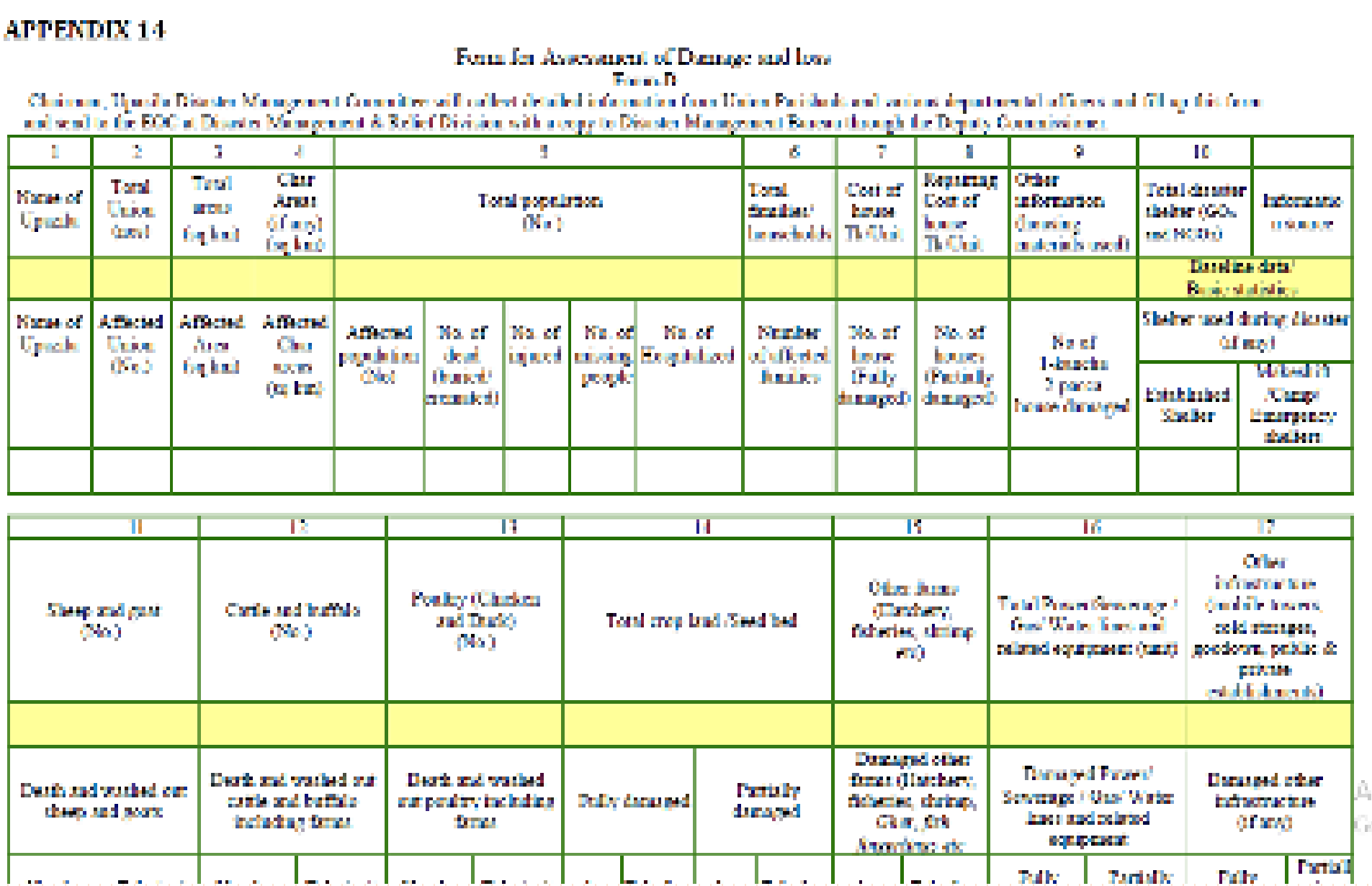
Standing Orders on Disaster

- The standing order (2010) creates the opportunity to establish disaster management committee at every level.
- The standing orders for disaster management provide ample scope for the Government, NGOs and private sectors to think locally and plan need based program involving the community.
- Different committee and their responsibilities during normal, warning, onset and post-disaster

Disaster Law 2012



Form – D: Stock and Flow



APPENDIX 14

Form for Assessment of Damage and Loss

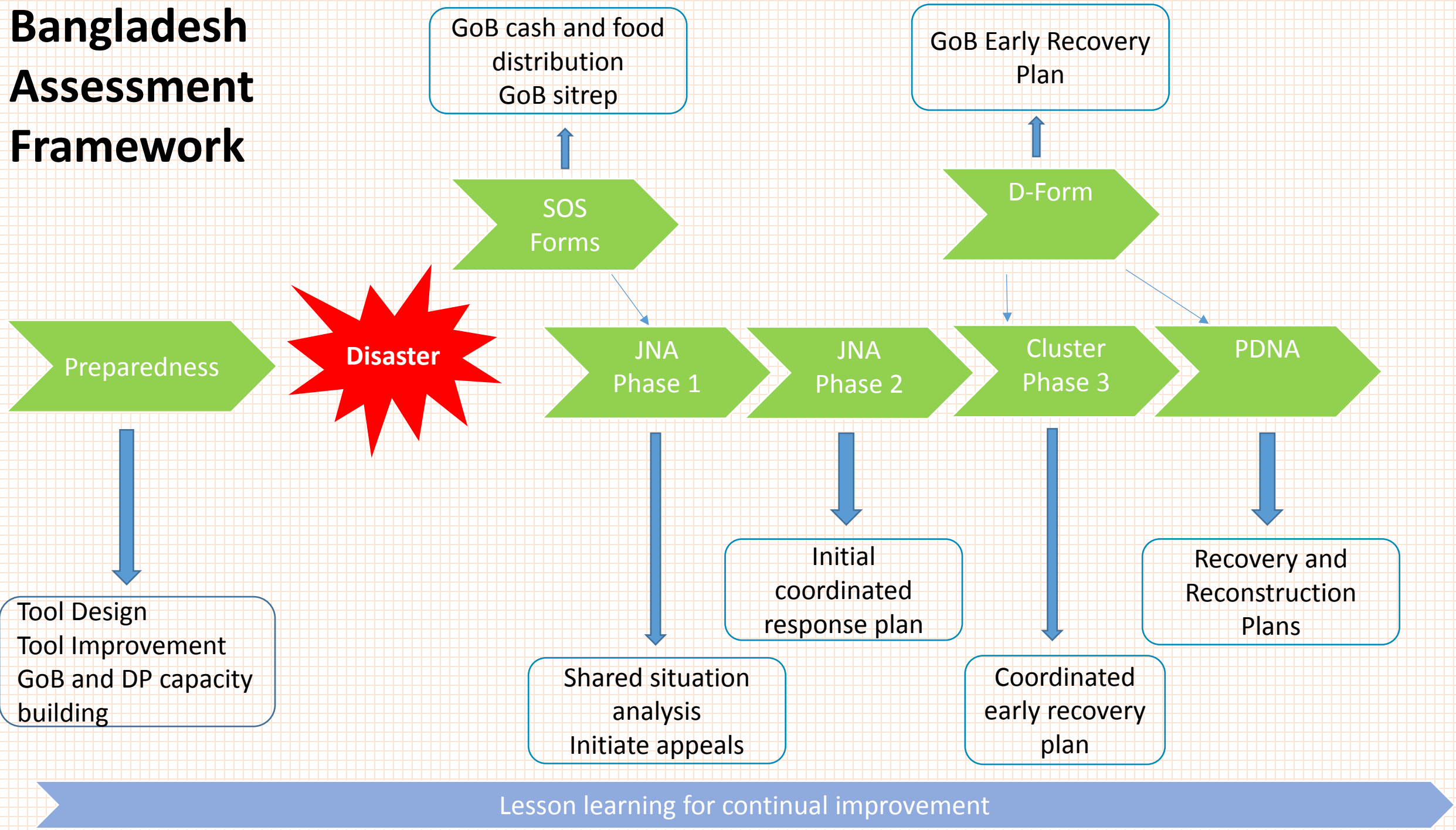
Form D

Chairman, Uganda Disaster Management Committee will collect detailed information from District Political and various departmental Heads and fill up this form and send to the RDC at Disaster Management & Relief Division with a copy to Disaster Management Bureau through the Deputy Commissioner

1	2	3	4	5					6	7	8	9	10	
Name of Upazila	Total Union (Nos)	Total area (sq km)	Char Area (if any) (sq km)	Total population (No.)					Total families' (households)	Cost of house Tk/Unit	Repairing Cost of house Tk/Unit	Other information (housing materials used)	Total disaster shelter (GOs and NGOs)	Information sources
													Baseline data' Basic statistics	
Name of Upazila	Affected Union (Nos.)	Affected Area (sq km)	Affected Char areas (sq km)	Affected population (No)	No. of dead (human/ cremated)	No. of injured	No. of missing people	No. of Hospitalized	Number of affected families	No. of house (Fully damaged)	No. of house (Partially damaged)	No of Latrine & pucca house damaged	Shelter used during disaster (if any)	
													Established Shelter	Unidentified /Camp Emergency shelters

11	12		13		14		15		16		17	
Sheep and goat (No.)	Cattle and buffalo (No.)		Poultry (Chickens and Ducks) (No.)		Total crop land /Seed bed		Other Assets (Machinery, fisheries, shrimp etc)		Total Power/Sewerage / Gas/ Water lines and related equipment (unit)		Other Information (mobile towers, solid sewages, goodown, public & private establishments)	
Death and washed out sheep and goats	Death and washed out cattle and buffalo including farms		Death and washed out poultry including farms		Fully damaged	Partially damaged	Damaged other farms (Machinery, fisheries, shrimp, Chick, fish Aquaculture etc		Damaged Power/ Sewerage / Gas/ Water lines and related equipment		Damaged other information (if any)	
									Fully	Partially	Fully	Partially

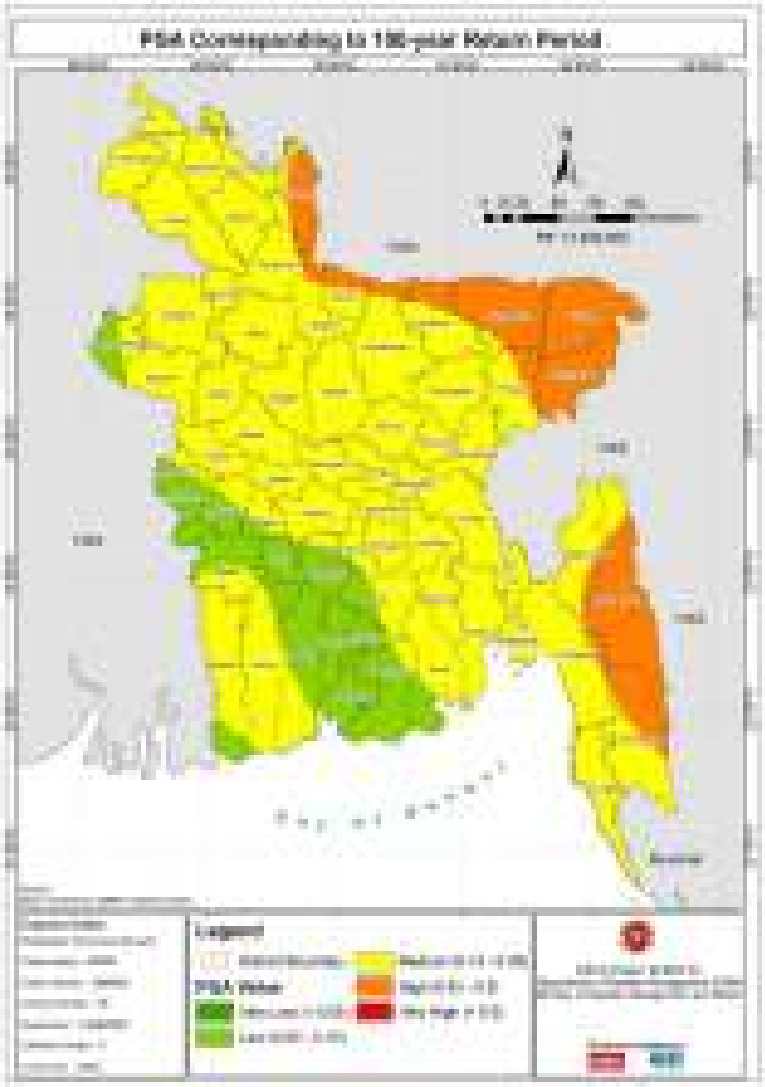
Bangladesh Assessment Framework



Department of Disaster Management

Multi Hazard Risk and Vulnerability Assessment Modeling and Mapping

Sl. No	Description
1	MHVA Atlas Volume-1 Part-1 [File Size : 35.5MB]
2	MHVA Atlas Volume-1 Part-2 [File Size : 35.5MB]
3	MHVA Atlas Volume-2 [File Size : 22.6MB]
4	MHVA Atlas Volume-3 [File Size : 321 MB]



Space Research and remote Sensing Organization (SPARRSO)

TYP SATELLITE IMAGE

MISAT SATELLITE IMAGE

TERRA SATELLITE IMAGE

AQUA SATELLITE IMAGE

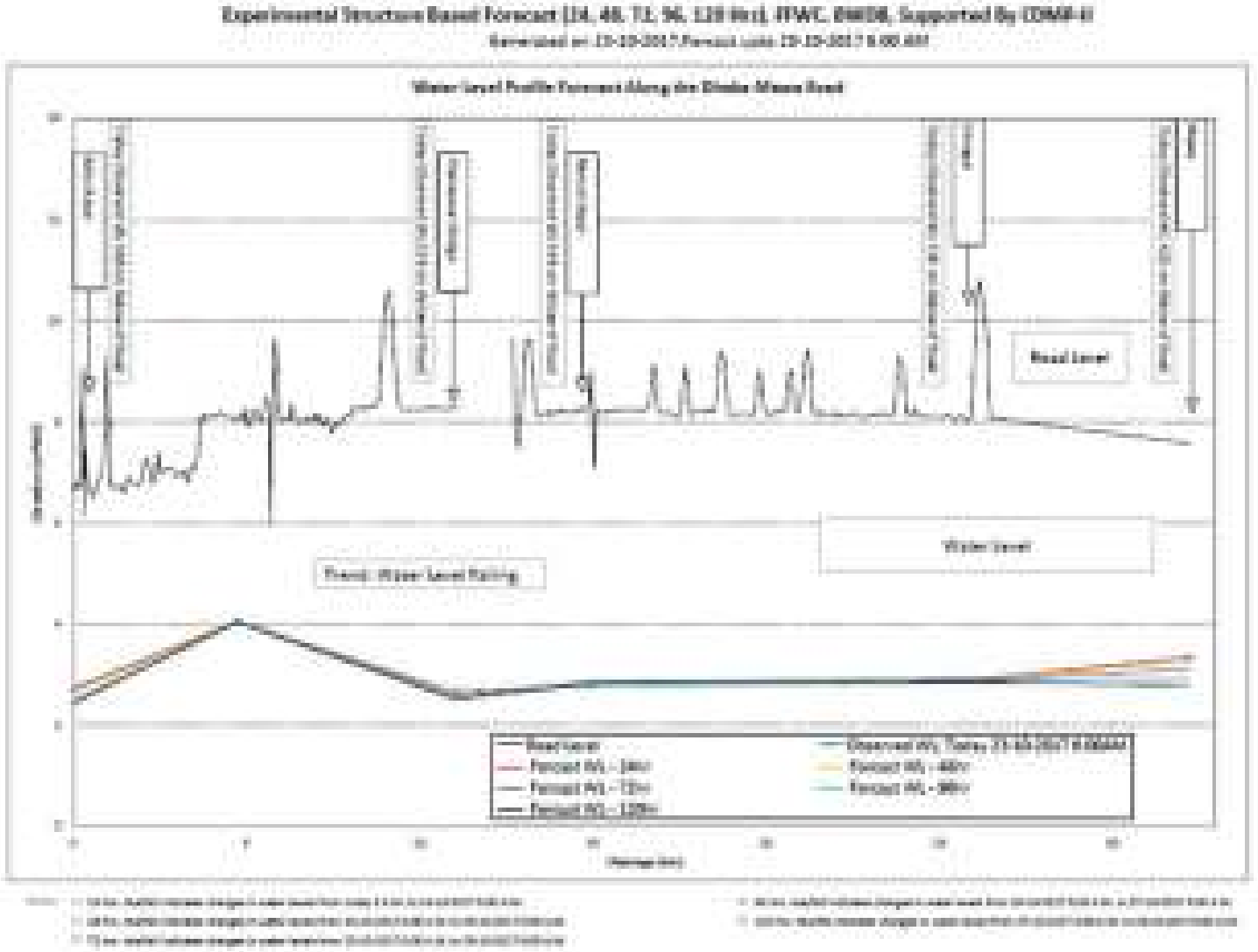
MET DATA RECEIVED AT SPARRSO

Survey of Bangladesh (SOB)

Basic Information

- **Metadata:** Specification: ISO 19139.
- **Projection System:**
  - Reference Ellipsoid: WGS84
  - Grid Name: BUTM2010.
- **Datasets for 1:25,000 and 1:5,000 Geo-database:**
  - Administrative Boundary
  - Building and Structure
  - Facilities
  - Forest
  - Geodetic Control Point
  - Hydrographic Feature
  - Industrial
  - Relief
  - Transportation
  - Vegetation

Flood Forecasting and Warning Centre (FFWC)



Flood Inundation Depth Map

Available data from existing sources

Update Database

Data from other project activities

Update and Upgrade Regional Models

Calibrate & Validate the models

Boundary for extreme hydrological events

Simulation of Models

Boundary for climate change event

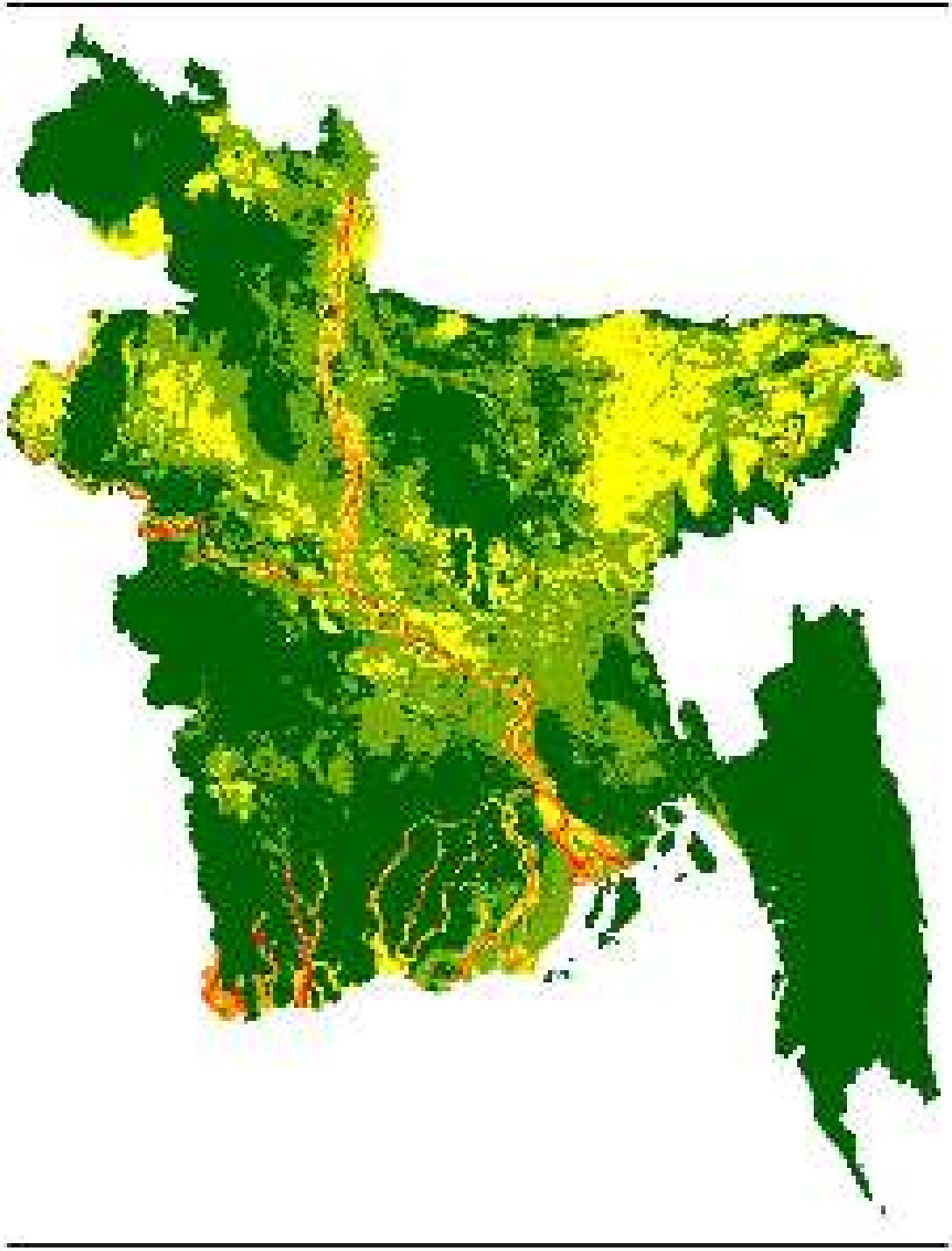
Simulation Water Levels

Existing DEM

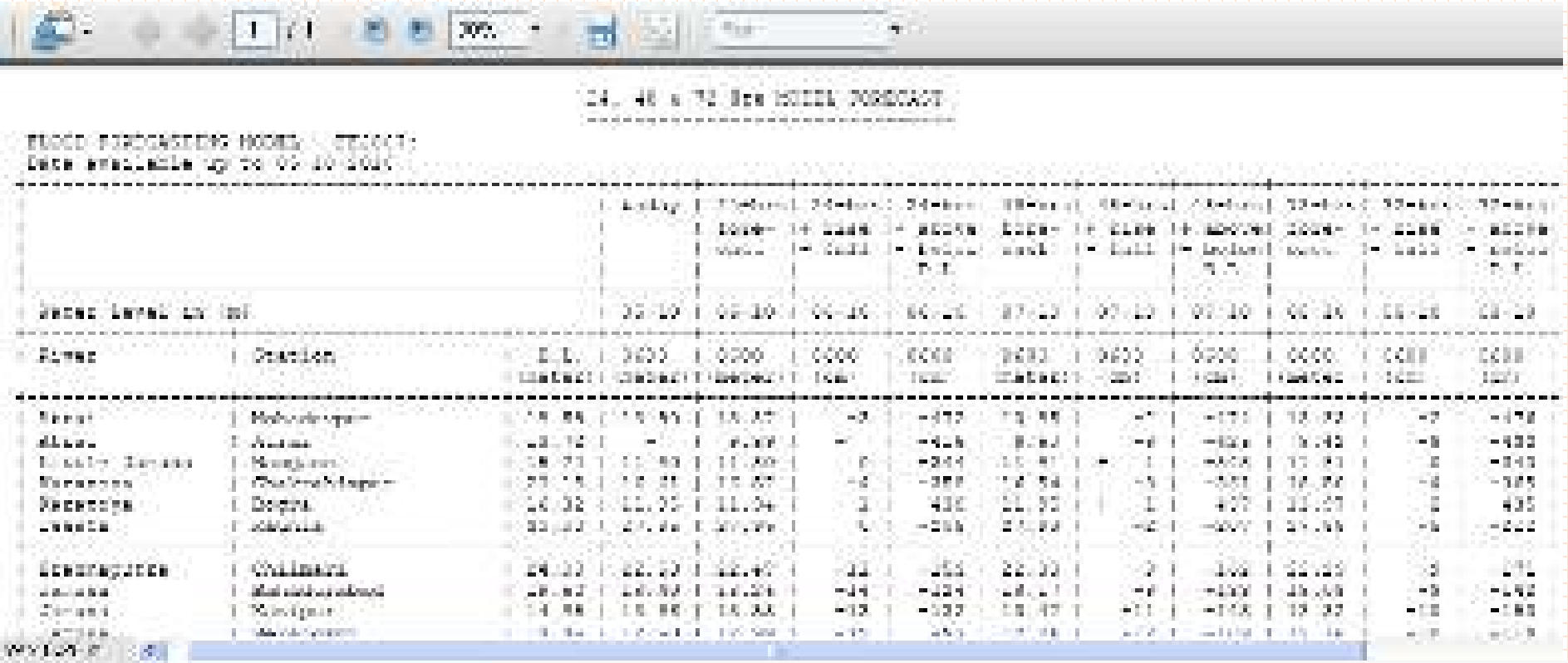
Maps, Flood Depth = WL – DEM using Mike 11 GIS

Accuracy check by field verification

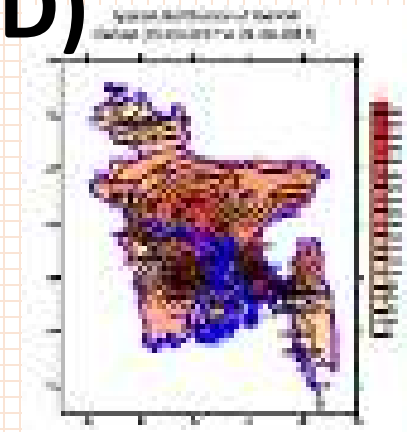
Flow Diagram for Flood Mapping

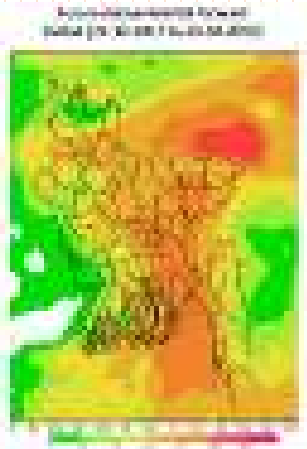


FFWC's Forecast

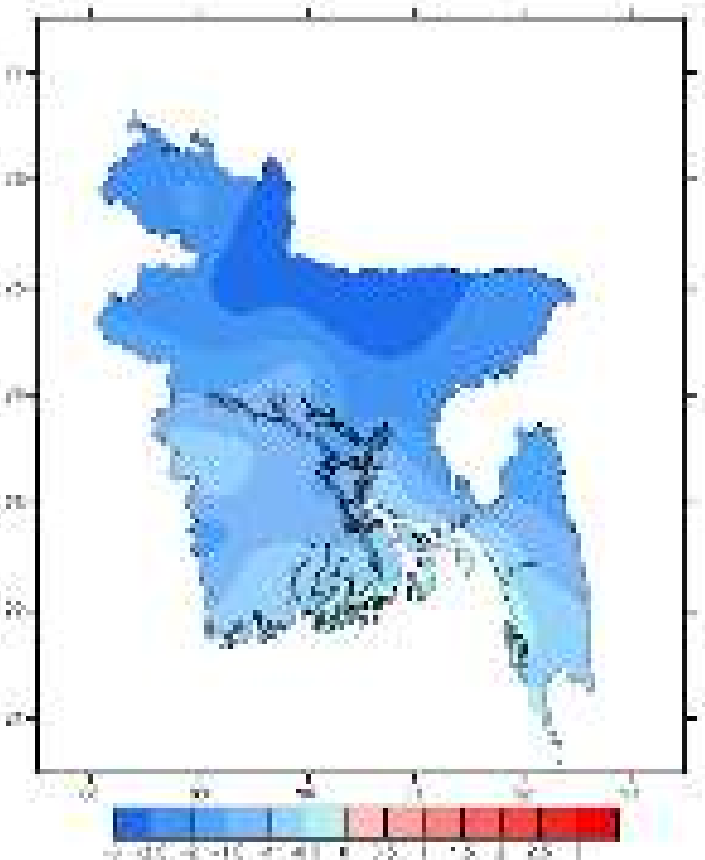


BD Meteorological Department(BMD)

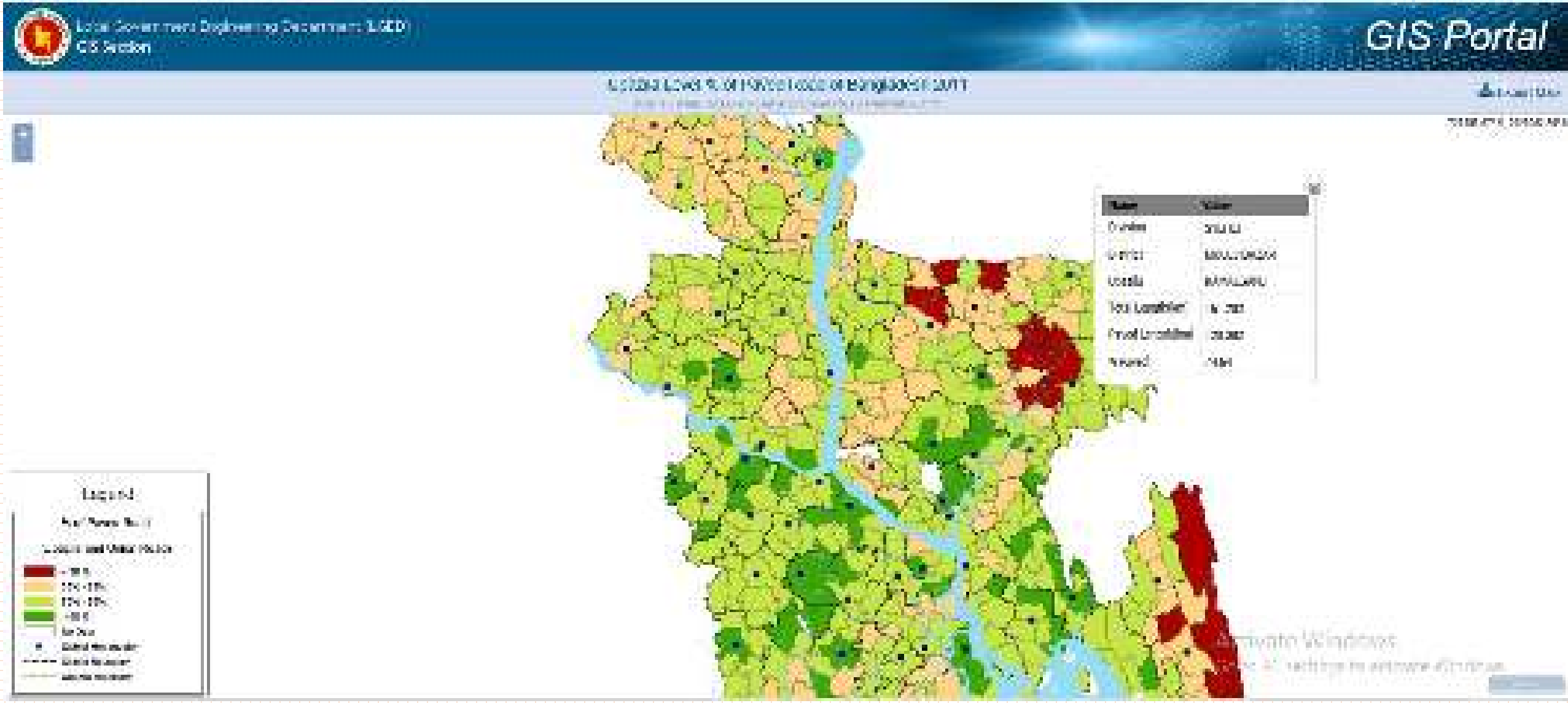




Deviation of Maximum Temperature (°C) during March 2017



Local Government Engineering Department (LGED)



Bangladesh Bureau of Statistics (BBS)

- Census Data
- Household data
- Economic Data
- Geocode/Place-code
- GIS Maps

LGED Provides-

- Roads/Bridges/Culverts
- Growth Center/Rural Market
- Primary School (also PED)

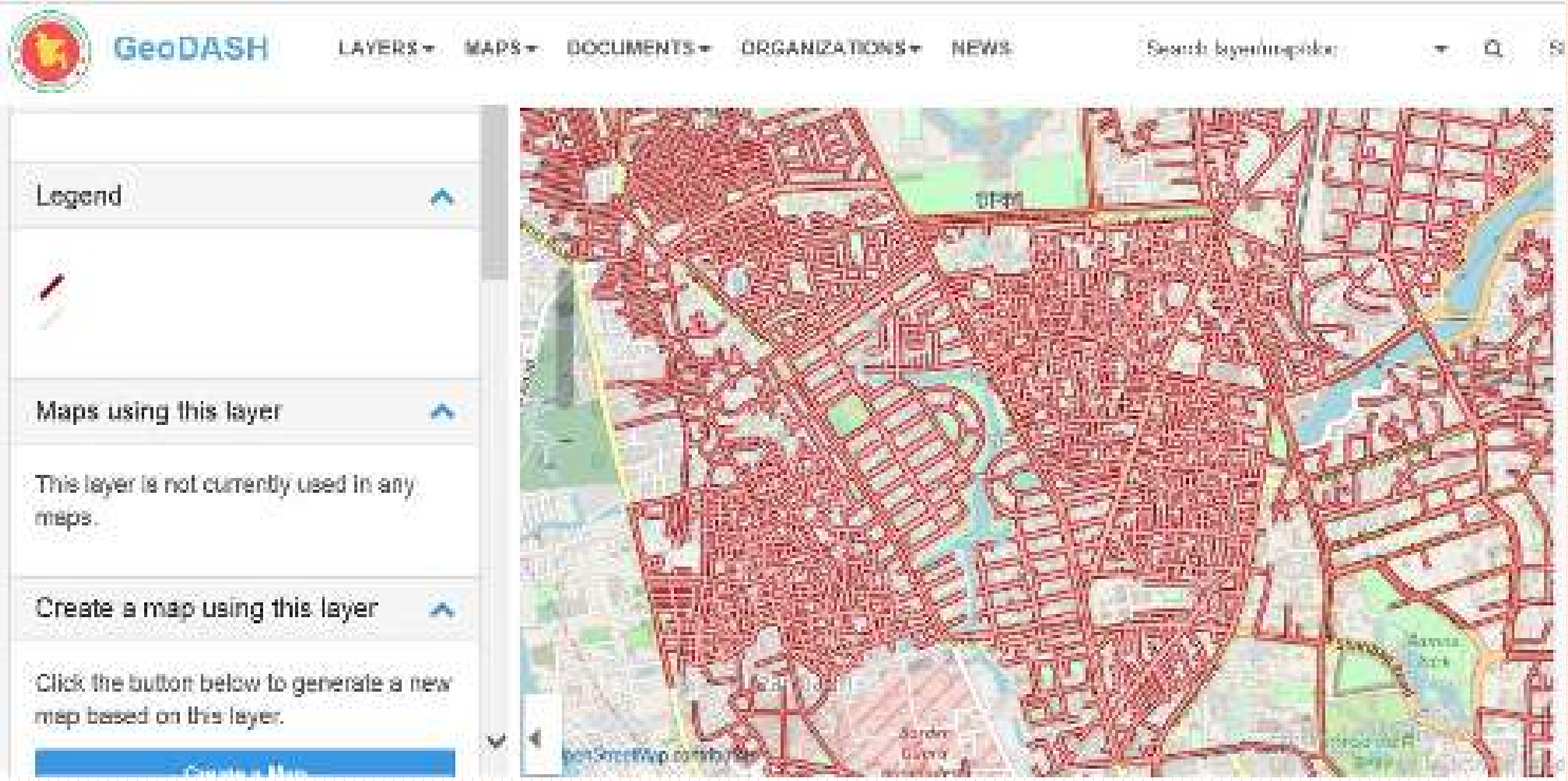
RHD Provides

- Highways/Large Bridges

DDM provides –

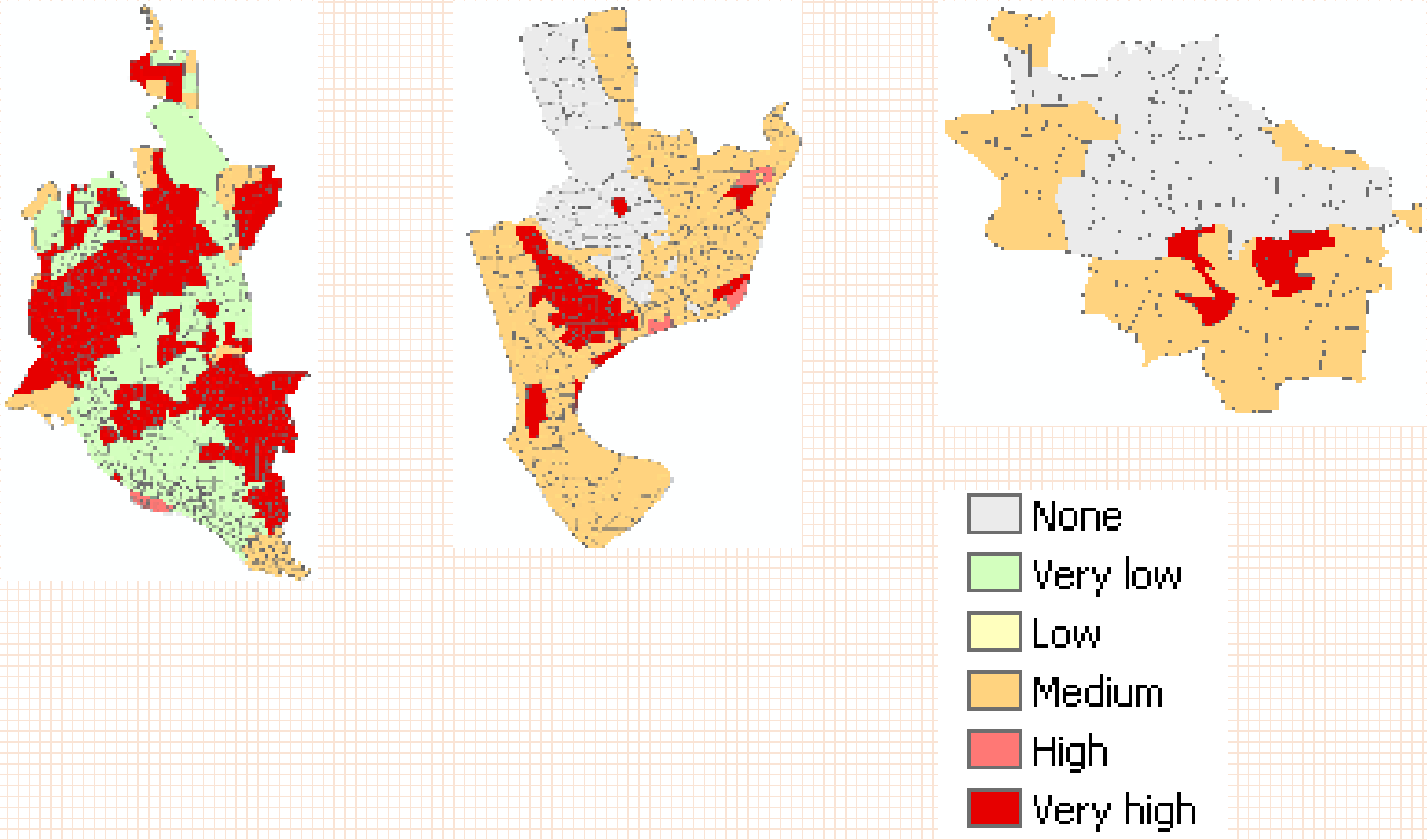
- Cyclone/Flood Shelters etc.

GeoNode Implementation for Geospatial Data Sharing (GeoDASH)



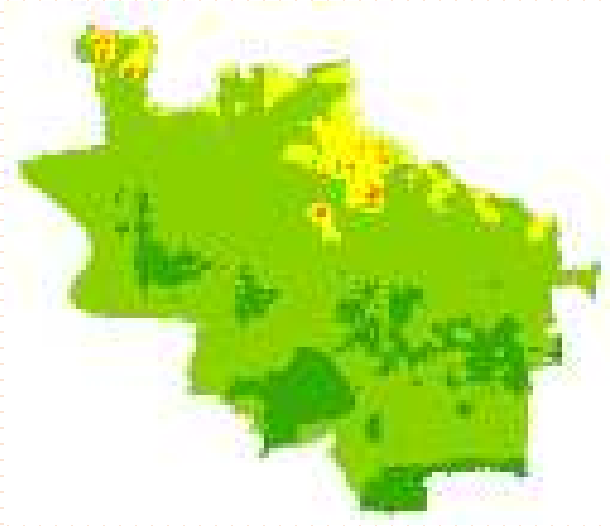
SEISMIC MICROZONATION
AND
VULNERABILTY / DAMAGE ASSESSMENT

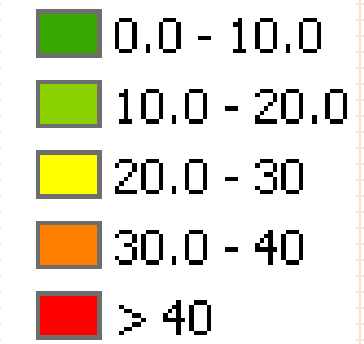
Potential Zone for Soil Liquefaction

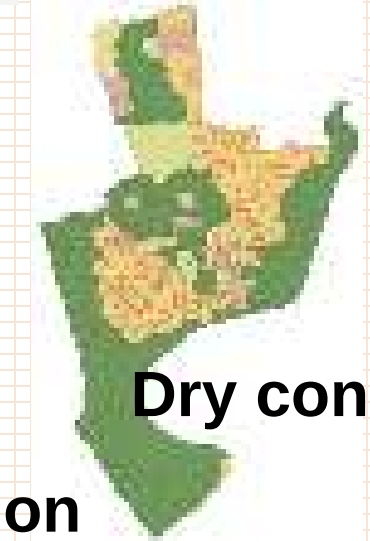


SUSCEPTIBLE ZONE FOR EARTHQUAKE INDUCED LANDSLIDE

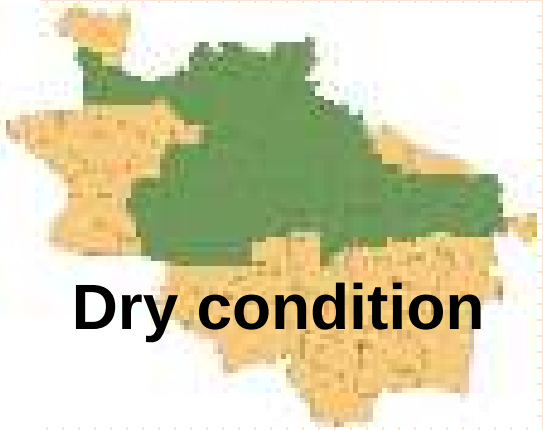
Digital Elevation Model







Landslide susceptible



Dry condition

Wet condition

Dry condition

Wet condition

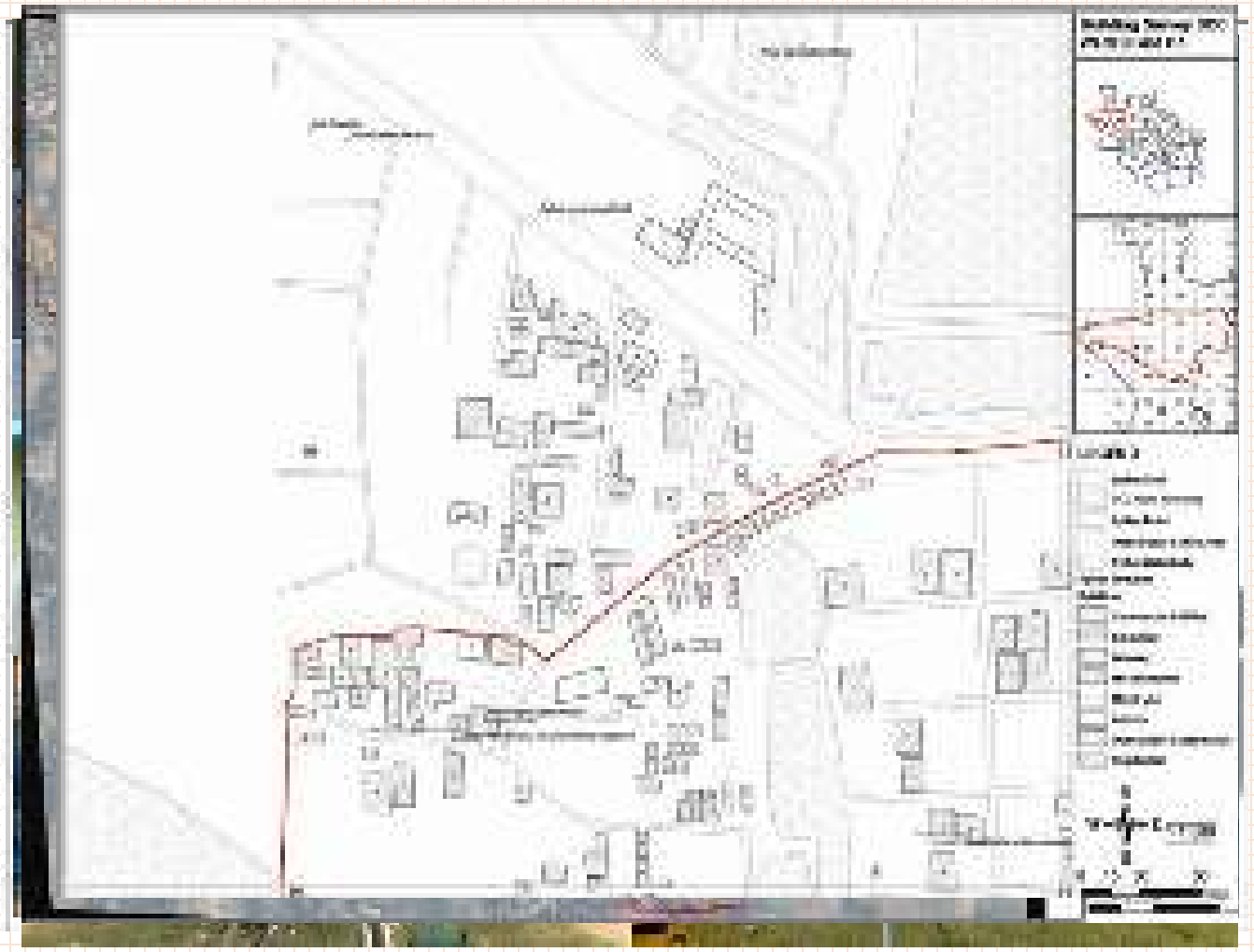
BASE MAP PREPARATION

- **Quickbird Image**

  - 60cm resolution

  - Georeferenced and projected in BTM

  - Physical feature survey



PHYSICAL FEATURES AND INFORMATION INCORPORATED IN THE BASE MAP

No	Physical Features	Attribute Information
1	Building	Building use, land use, structure type, storey number, structure name
2	Road	Pavement material, width, number of lane, length
3	Railway	Type (Broad gauge and Meter gauge)
4	Water body	Type (river, lake, khal, dighi, pond, marshy land)
5	Open Space	Type (play ground, park, graveyard)
6	Lifeline features	Type (Gas, Water, Electricity etc)

FIELD SURVEY

Field Survey Work

Level 0 | **Level I** | **Level II** | **Level III**

- Structural type (36 types)
- Occupancy class (33 classes)
- Number of stories
- Building age (<10, 10-30, >30 yr)
- Number of occupants (day, night)
- Visible physical condition *(poor, average, good)*
- Vulnerability factors *(soft story, heavy overhang etc.)*
- Photos of building

Level I

+

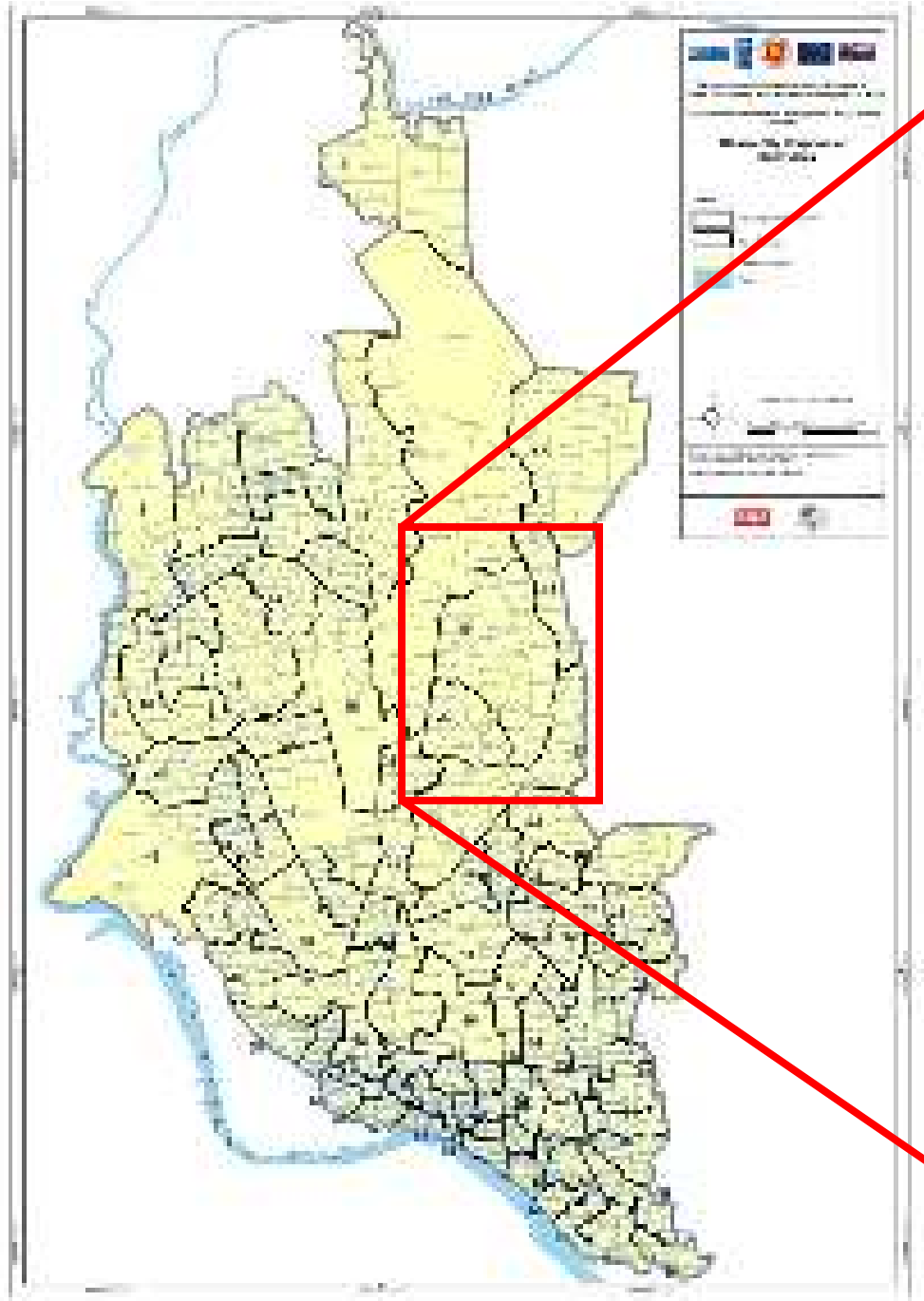
- Plan sketch
- Dimensions of key building components (column size, wall layout etc.)
- Slab system (cast-in-place, pre-cast)
- Vulnerability details (short column, floor opening etc.)

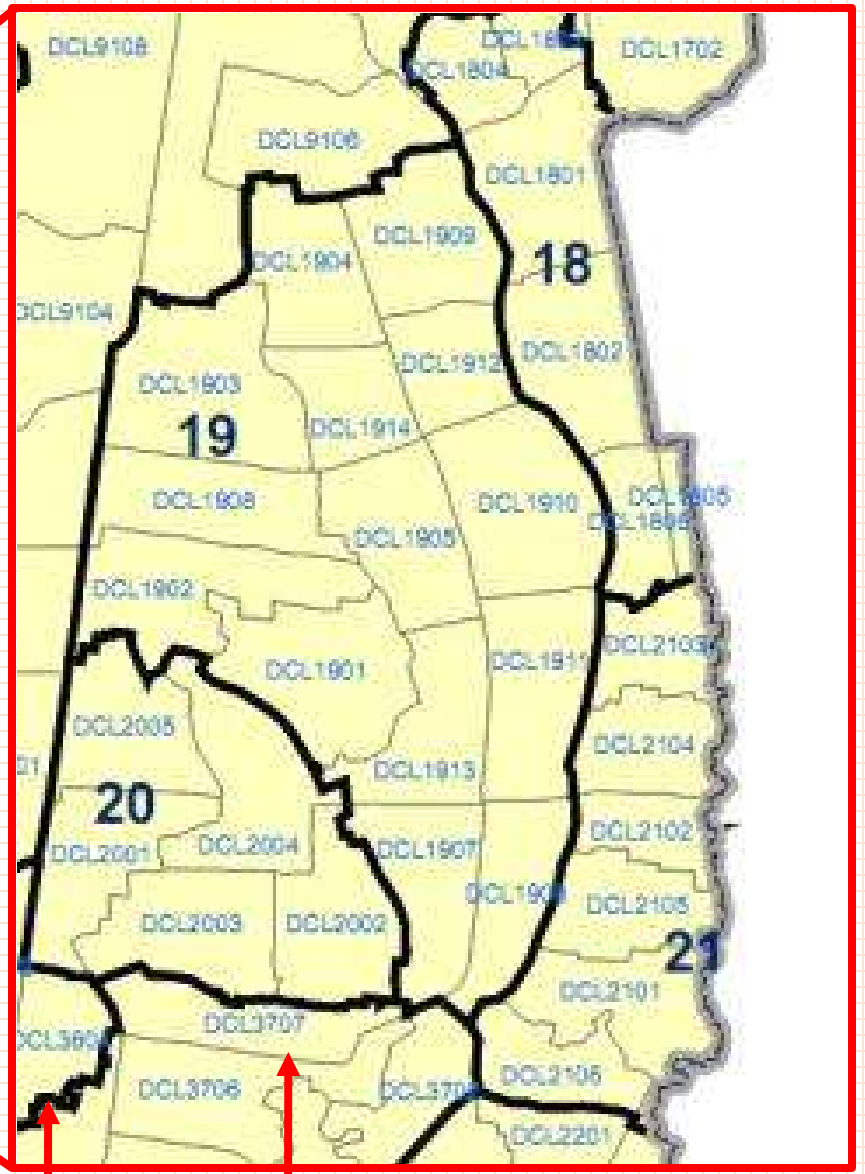
SAMPLE SIZE OF THE BUILDING SURVEY

Town	All Buildings in Database (No.)	Level I Survey		Level II Survey	
		No.	%	No.	%
Dhaka	326,825	8,741	2.67	875	0.27
Chittagong	182,277	6,175	3.39	494	0.27
Sylhet	52,176	3,536	6.78	507	0.97
Total	**561,278**	**18,452**	**3.29**	**1,876**	**0.33**

Note: Level I survey rate = 10 buildings/1 team/1 day
Level II survey rate = 1-2 buildings/1 team/1 day
1 team = 2 man, 1 day = 8 working hour (8.00-17.00)

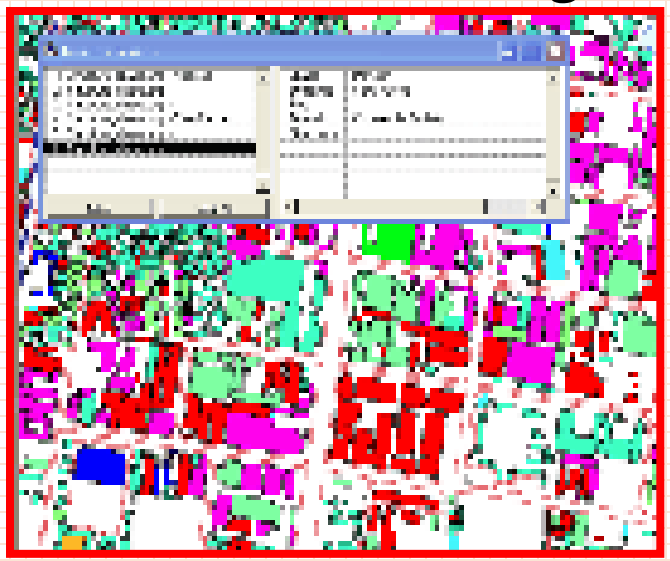
CLUSTER BOUNDARY MAP



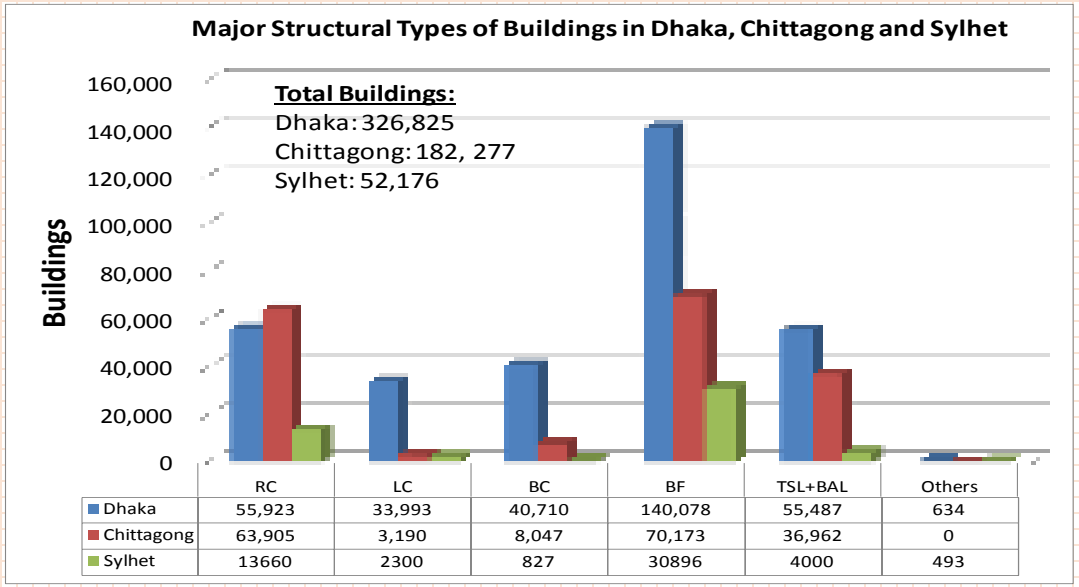


EARTHQUAKE VULNERABILTY AND DAMAGE ASSESSMENT

GIS-based Building Inventory Database:

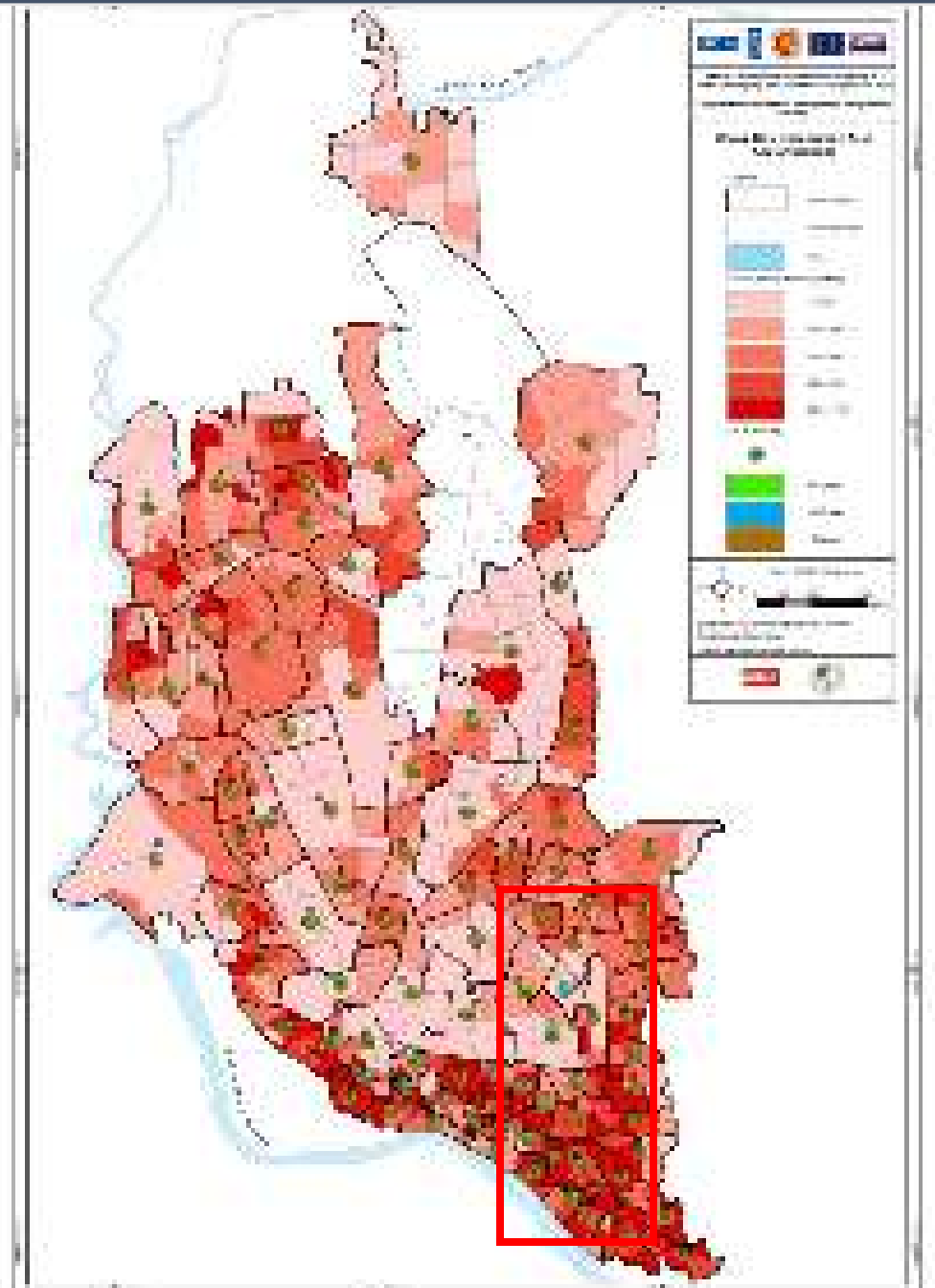


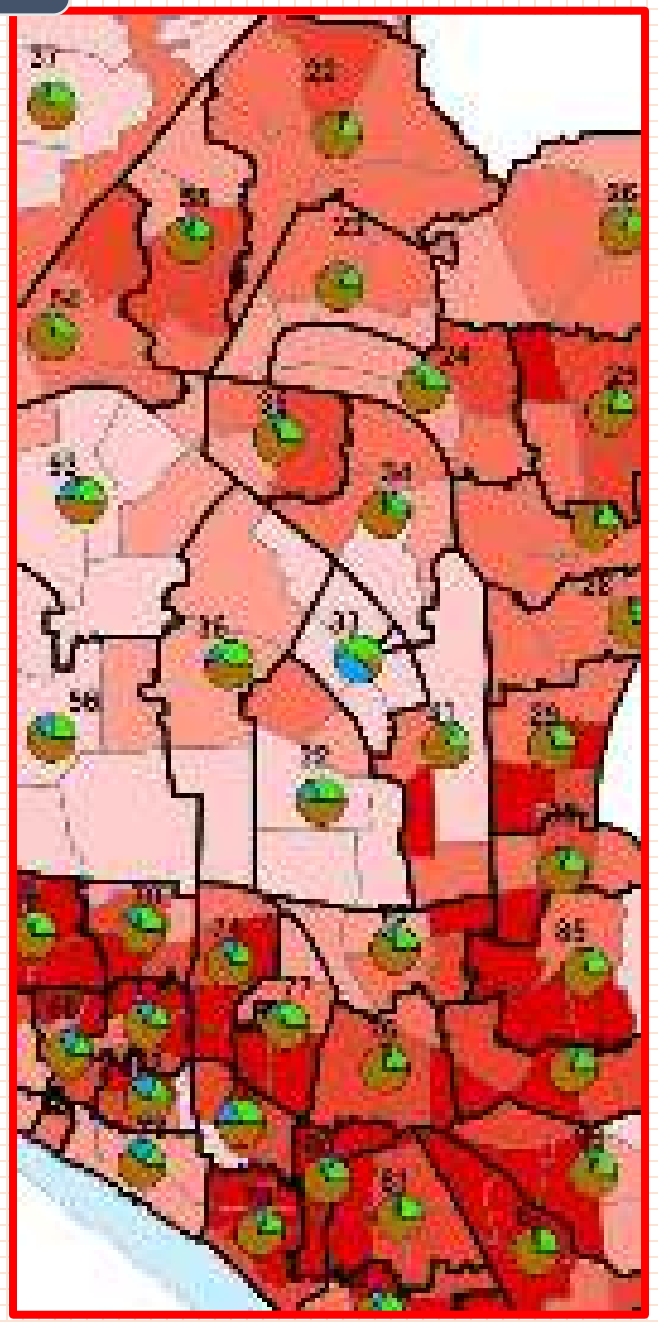
Dhaka : 327000 **Chittagong : 183000** **Sylhet : 52, 000**



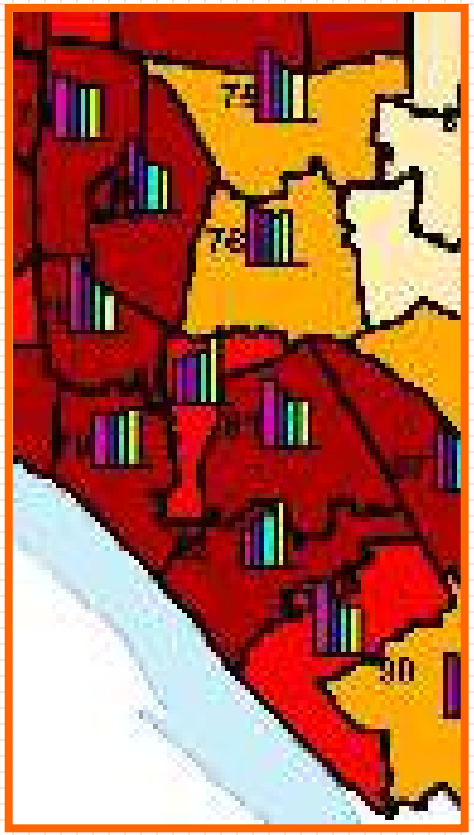
	RC	LC	BC	BF	TSL+BAL	Others
Dhaka	55,923	33,993	40,710	140,078	55,487	634
Chittagong	63,905	3,190	8,047	70,173	36,962	0
Sylhet	13660	2300	827	30896	4000	493

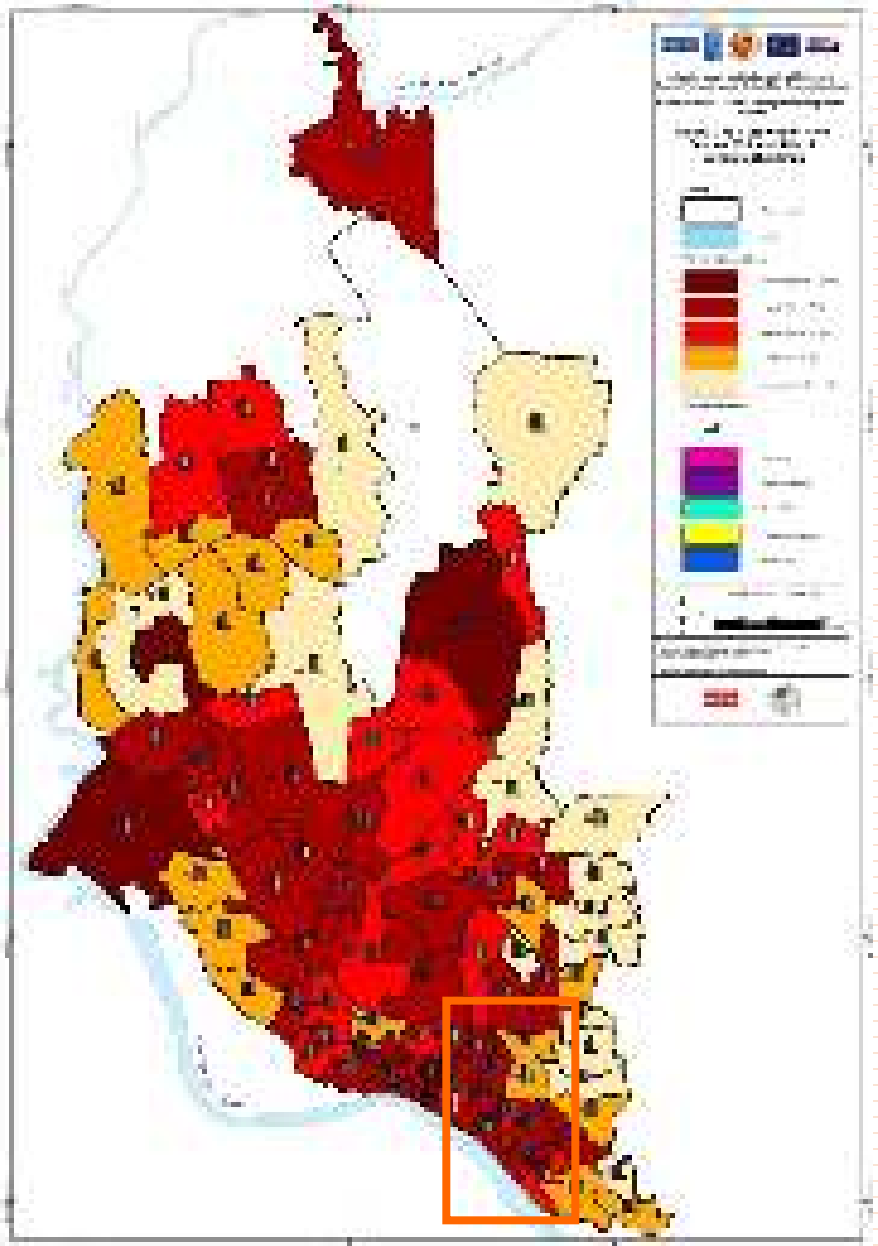
BUILDING AGE AND BUILDING DENSITY OF DHAKA



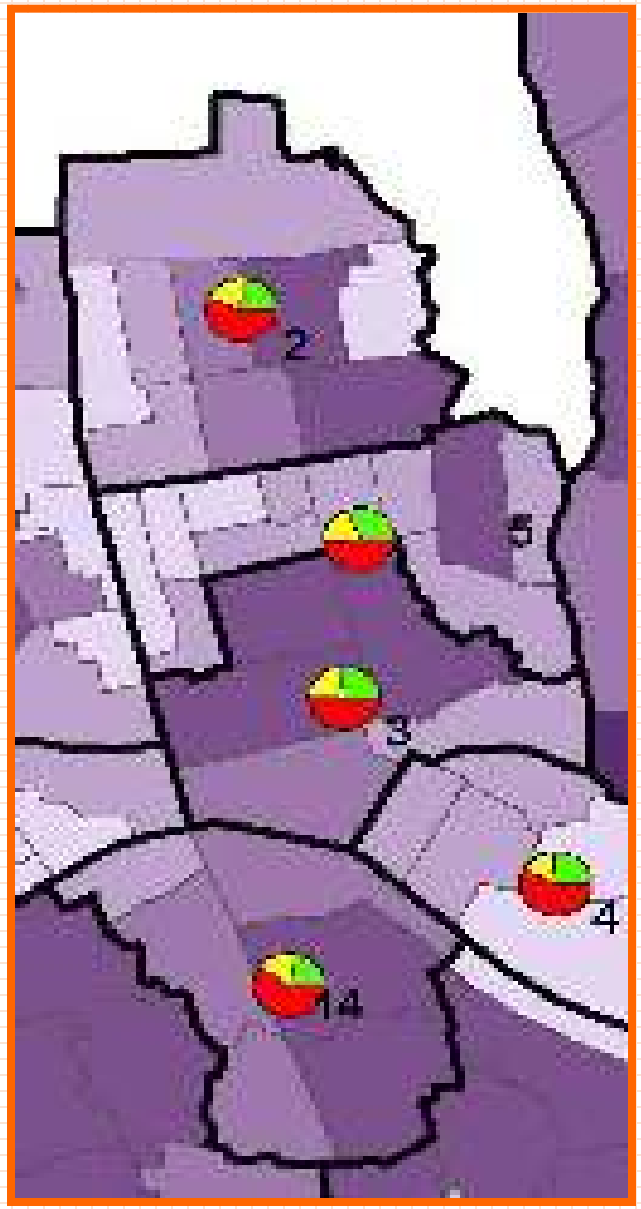


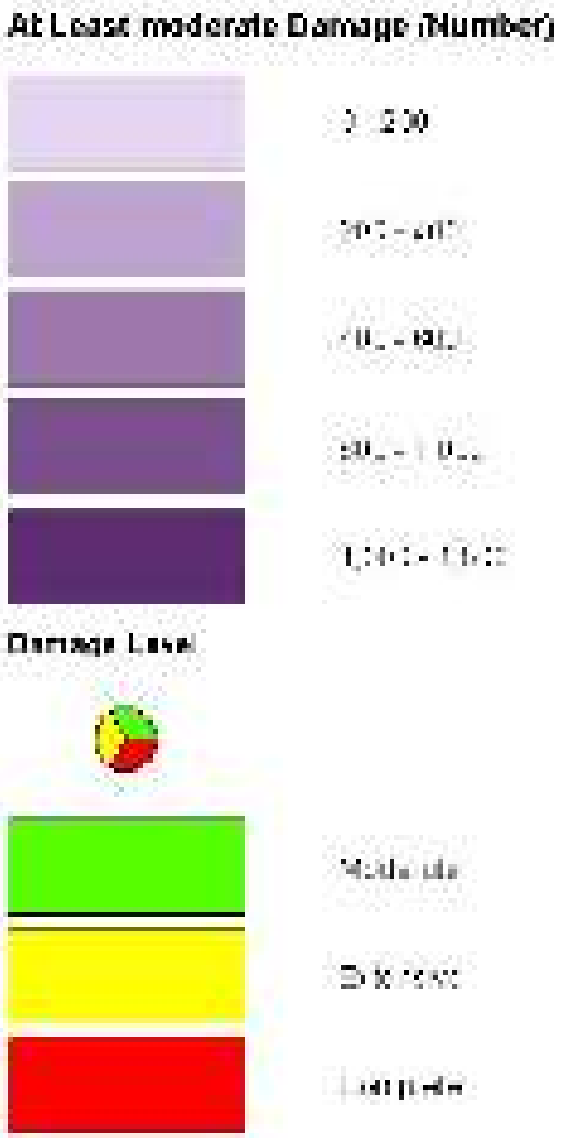
BUILDING VULNERABILTY

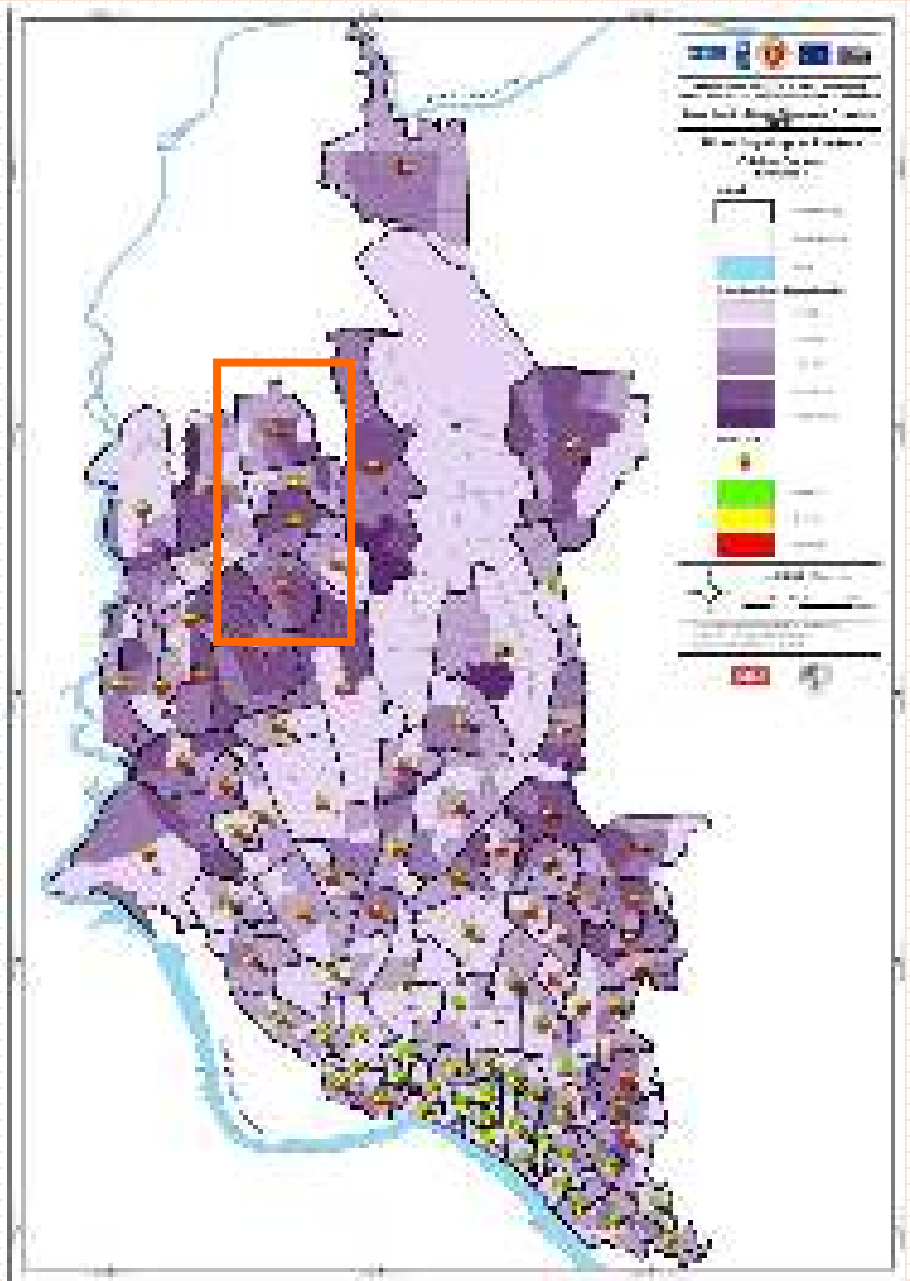




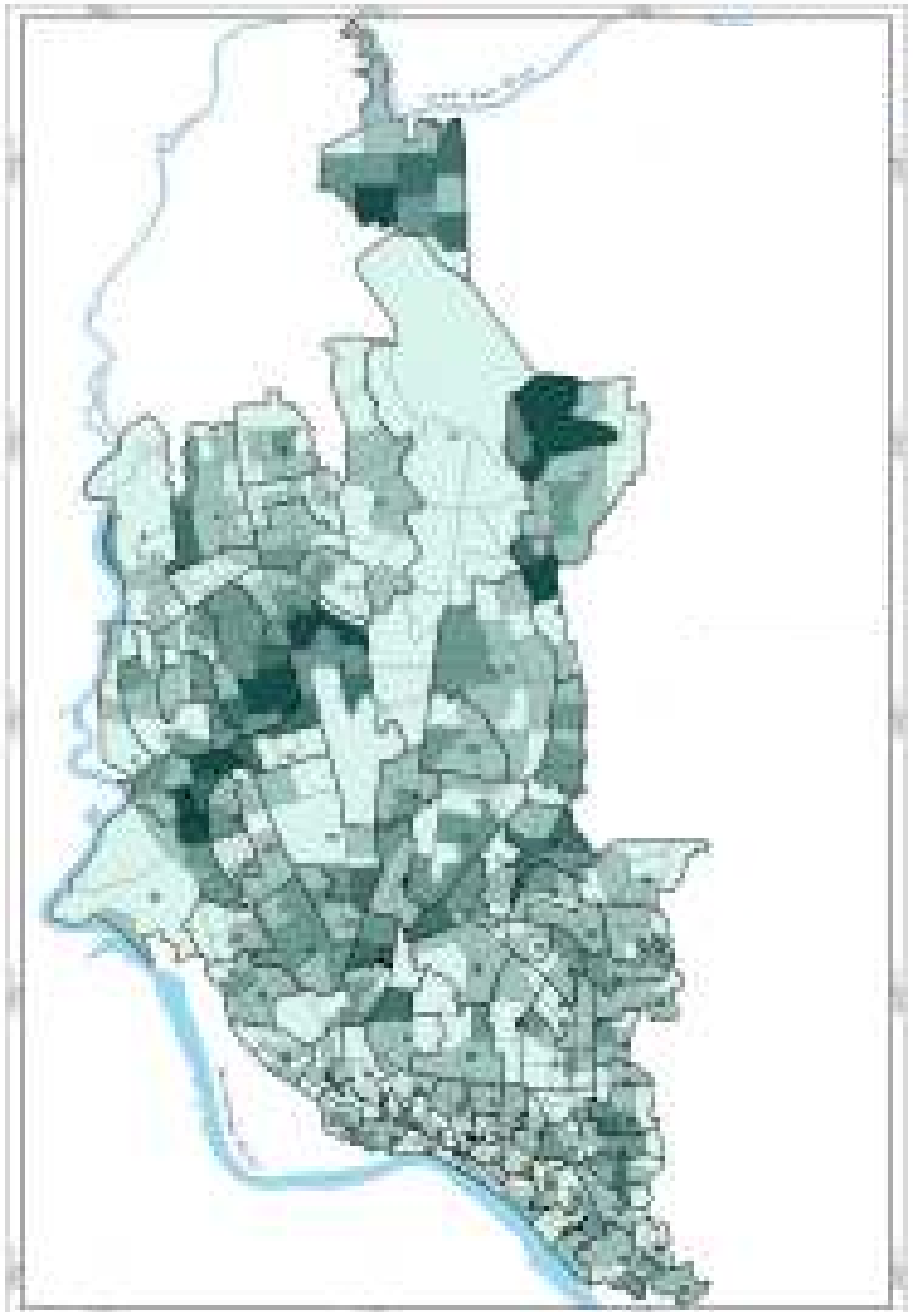
BUILDING DAMAGE MAP







Debris Generation Scenario



Legend

Ward boundary

Cluster boundary

River

Debris Expected

(In thousands of tons)

0 - 100

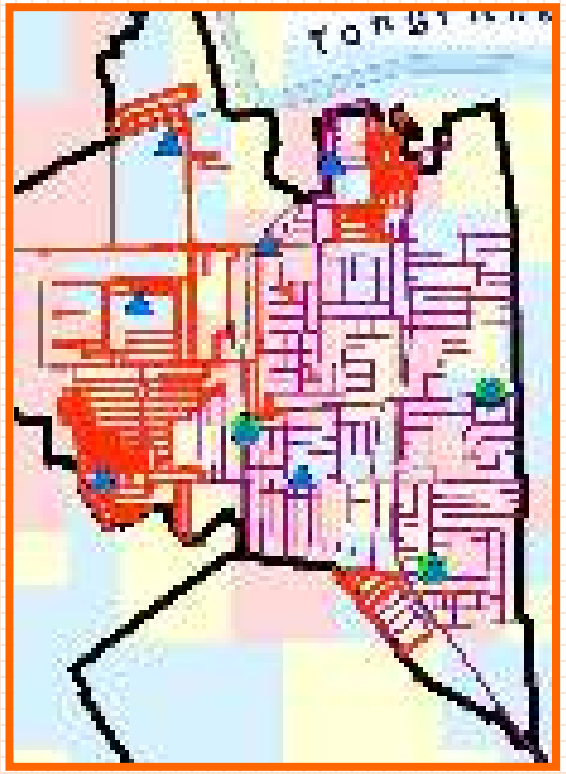
100 - 200

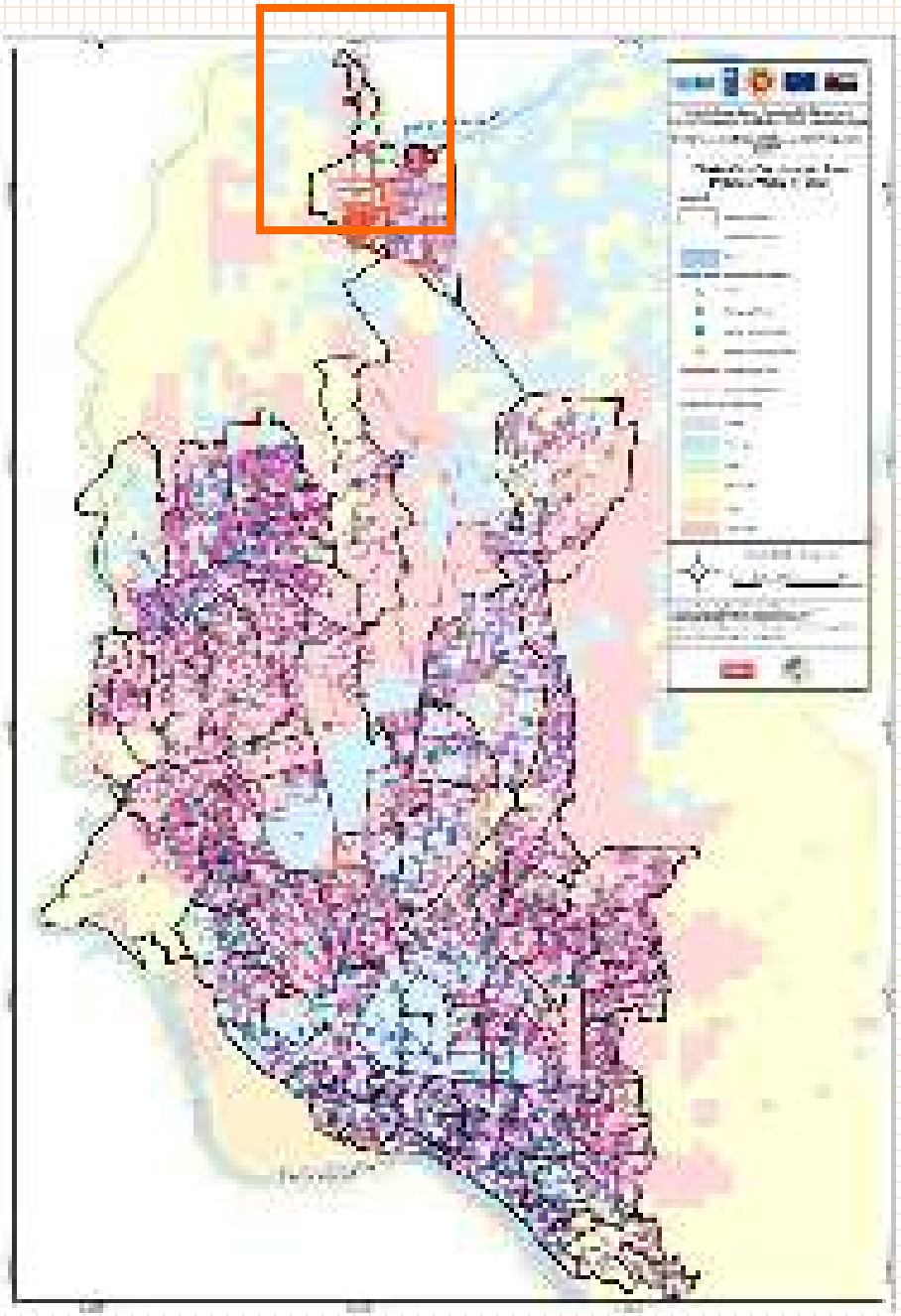
200 - 300

300 - 400

400 - 600

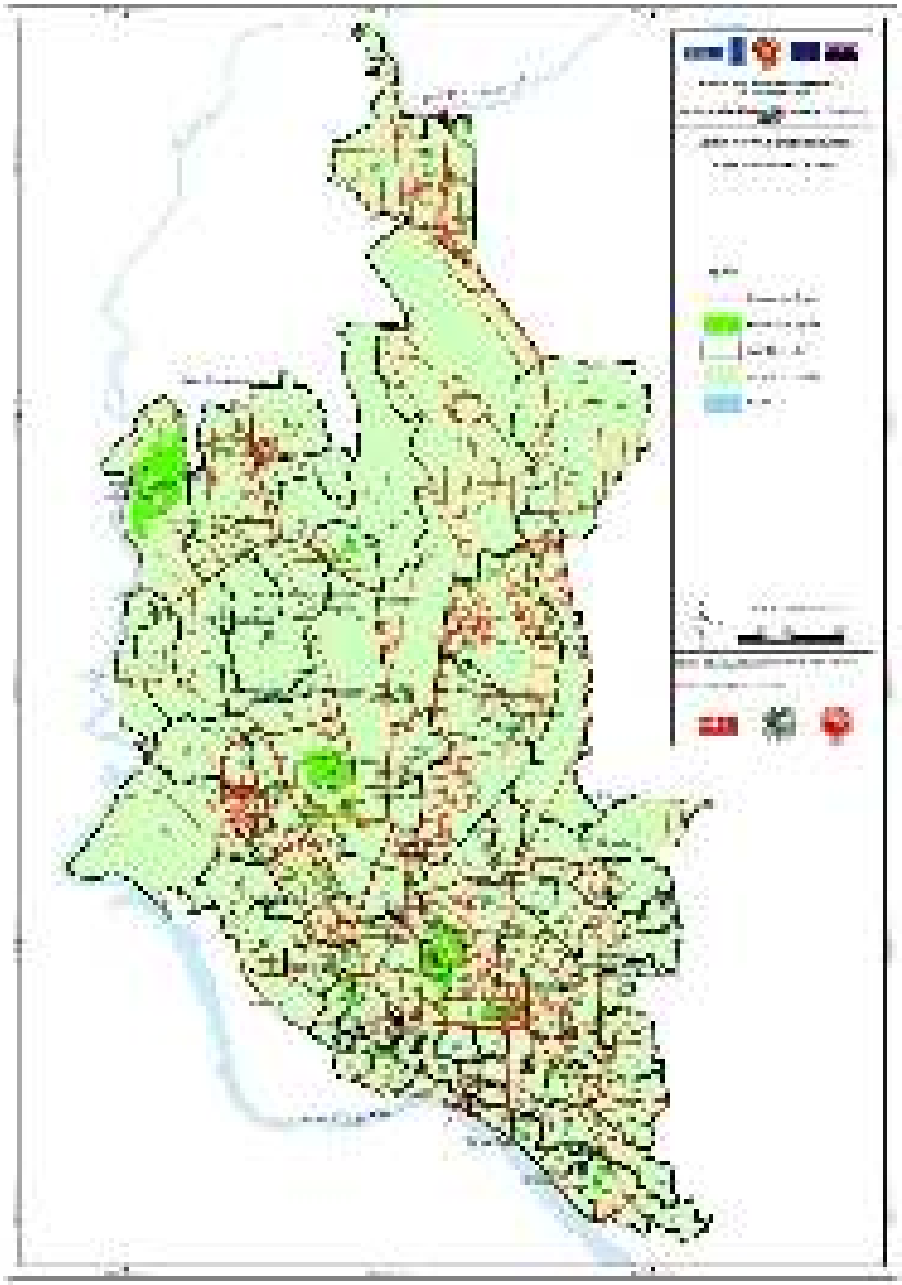
LIFELINE VULNERABILTY



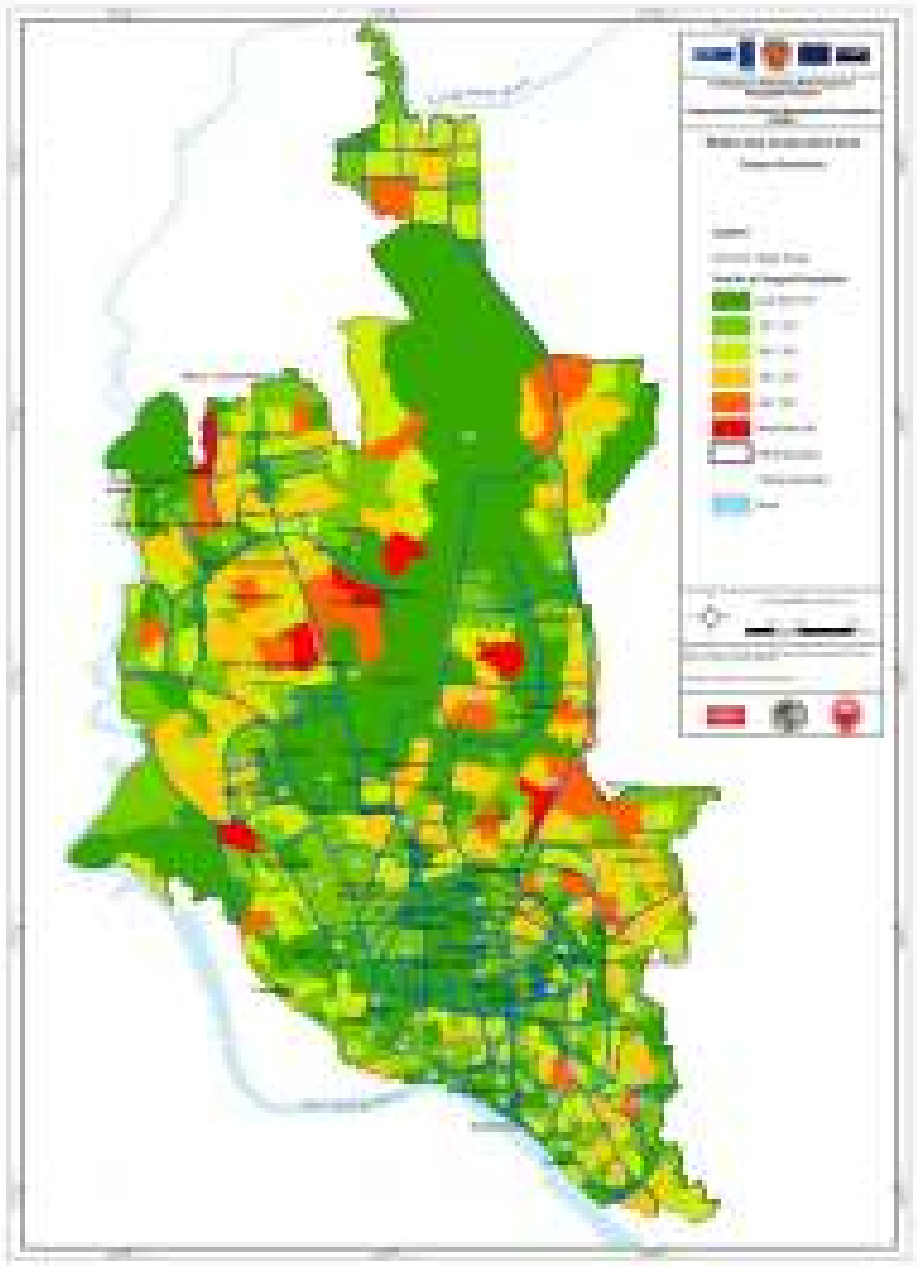


LOCATION OF TEMPORARY SHELTERS

POSSIBLE EVACUATION ROUTE



TRAPPED POPULATION IN DHAKA CITY

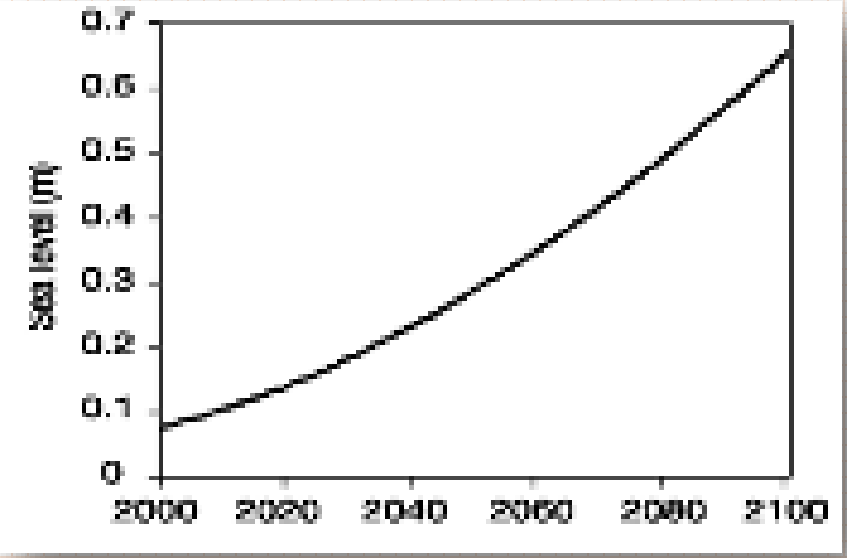


LOCATION OF SEARCH AND RESCUE CAMP

Sub-sub-district level Flood, Sub-district Storm Surge and Salinity Intrusion Mapping to facilitate Community Risk Assessment (CRA) having climate sensitive decision

SEA LEVEL RISE PROJECTION

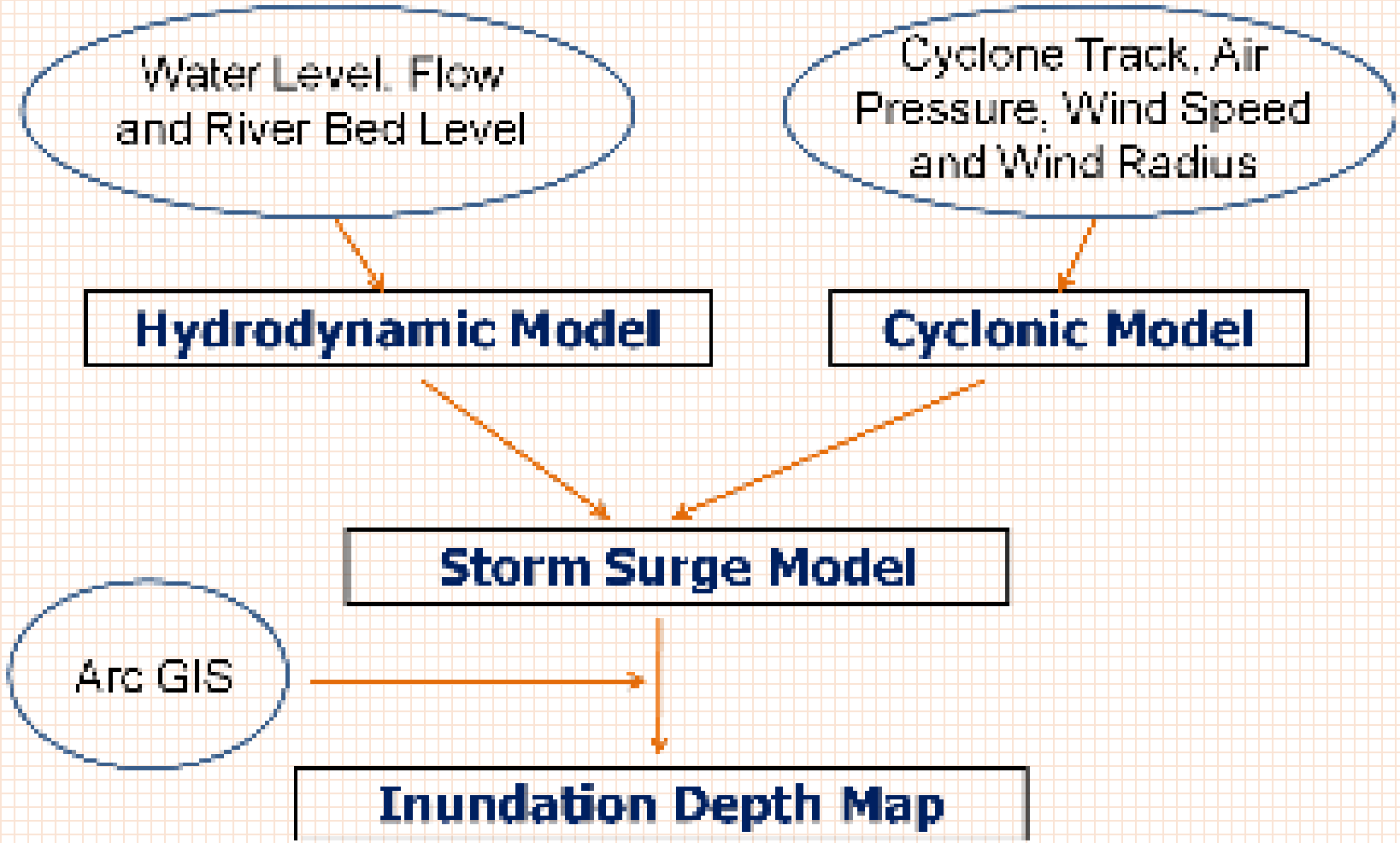
Projection from AR4



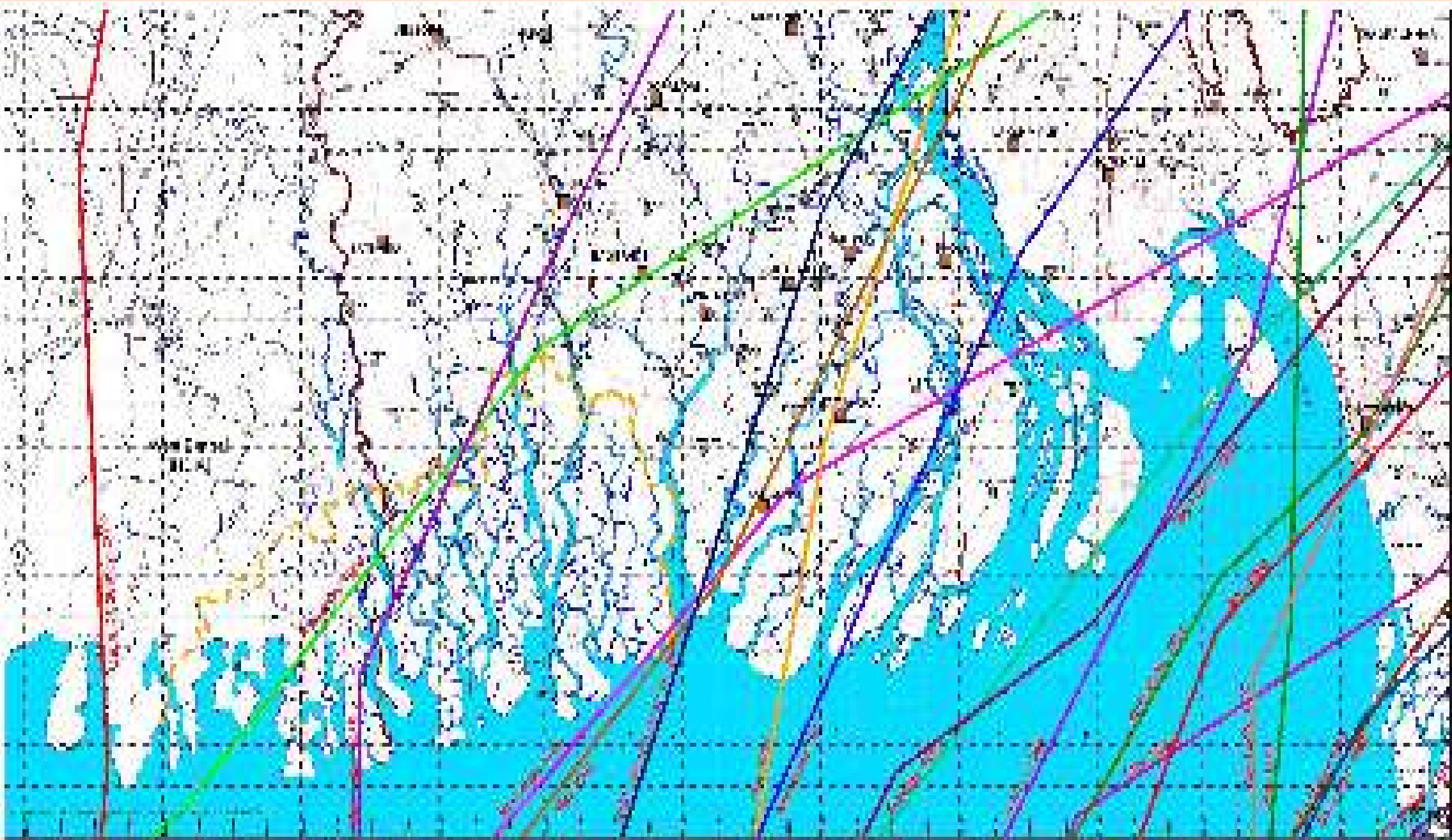
Year	Sea Level Rise (cm) above year 2000 level
2020	8
2030	12
2040	17
2050	23
2060	29
2070	36
2080	43
2090	51
2100	59

IPCC Synthesis Report 2009

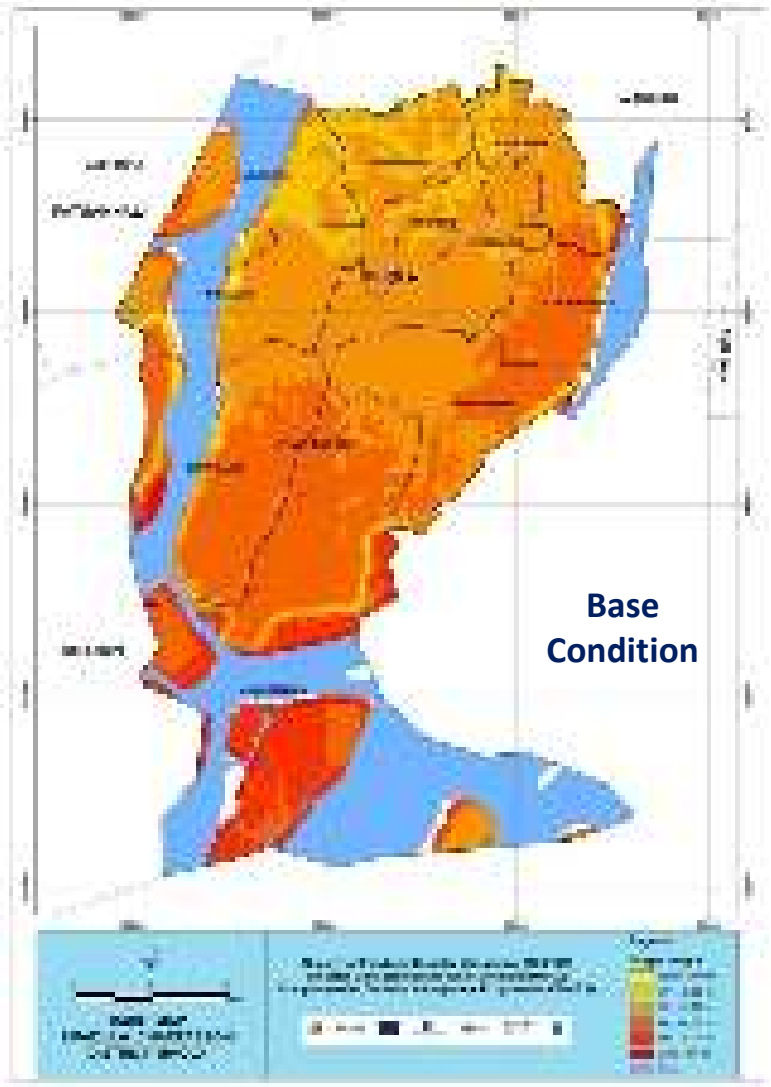
STEPS FOR STORM SURGE INUNDATION MAP

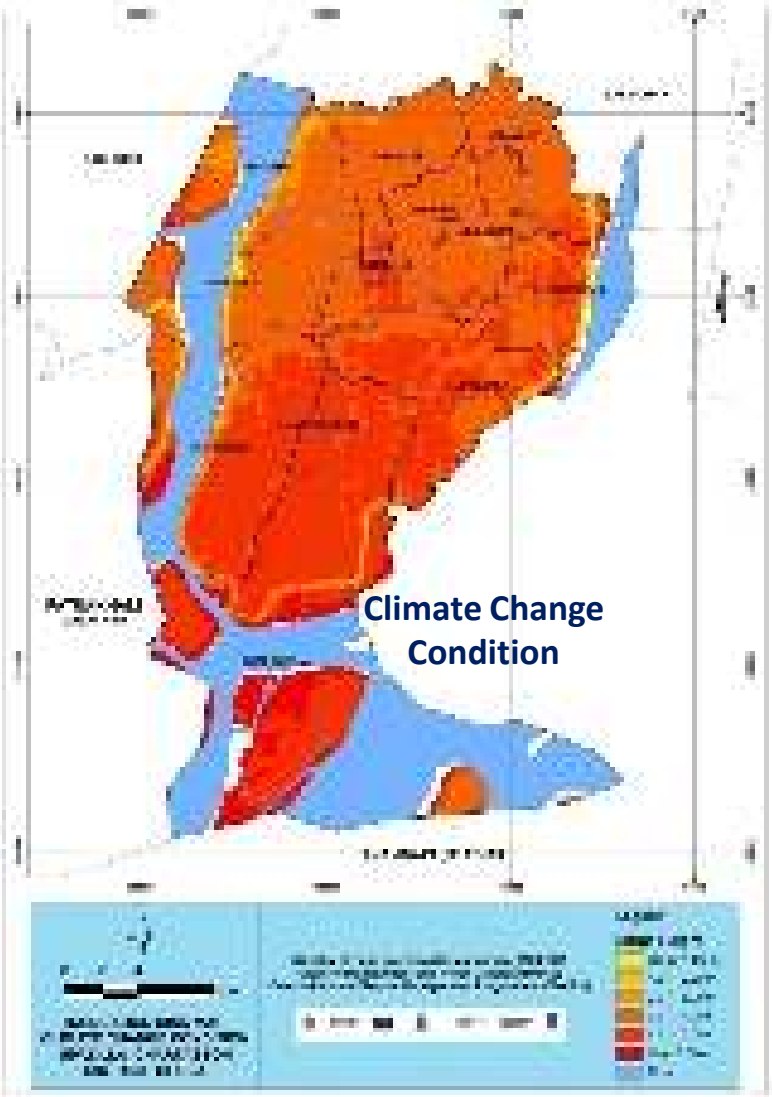


PAST 19 CYCLONES WITH 3 SYNTHETIC TRACK



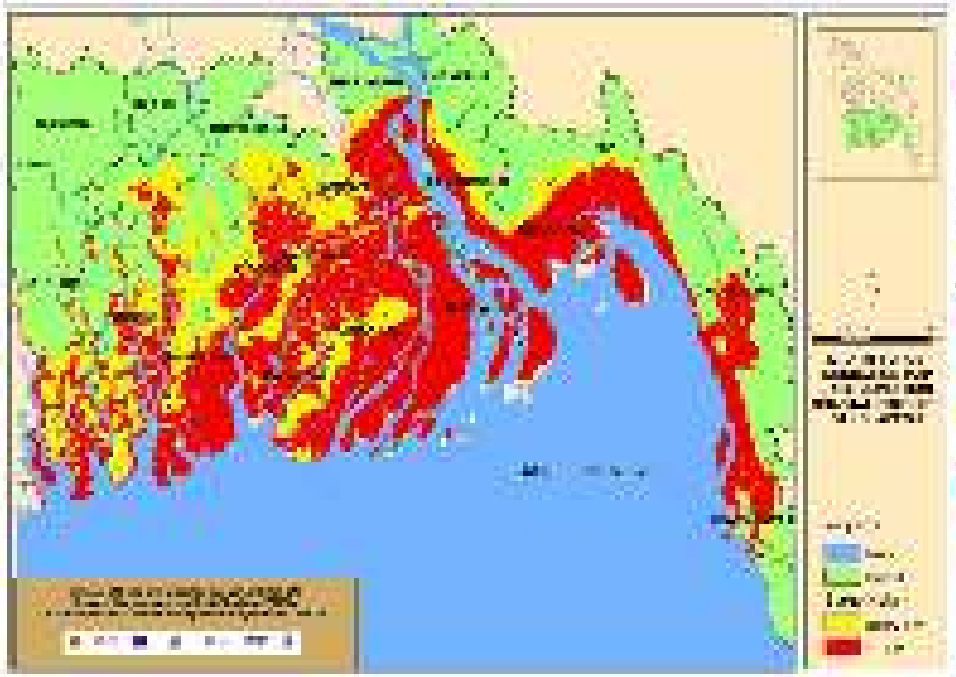
Storm Surge Inundation Depth Map



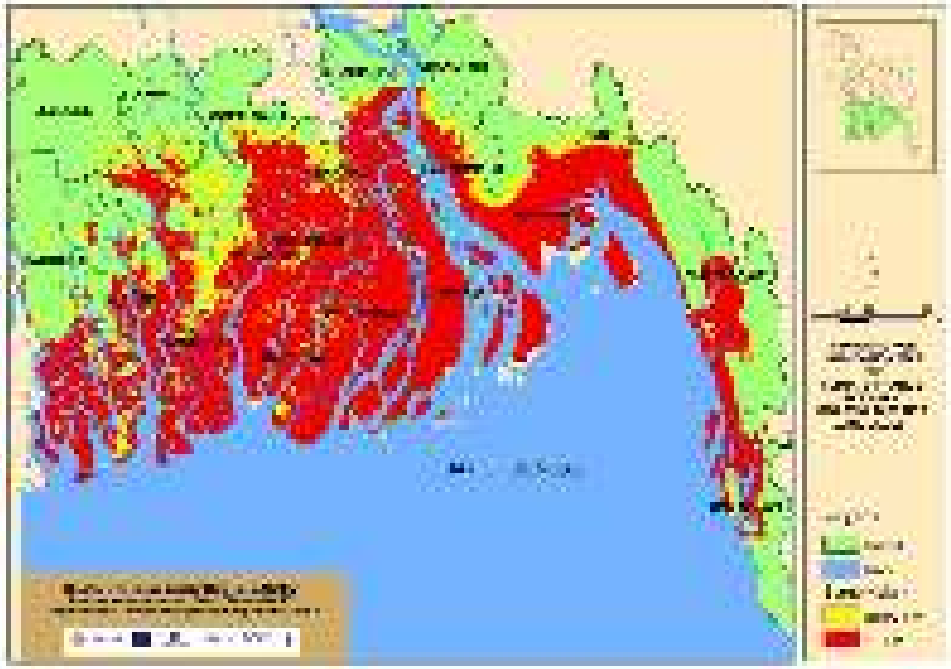


Sub-district: Charfasson, District: Bhola

INUNDATION DEPTH MAPS



Base Condition

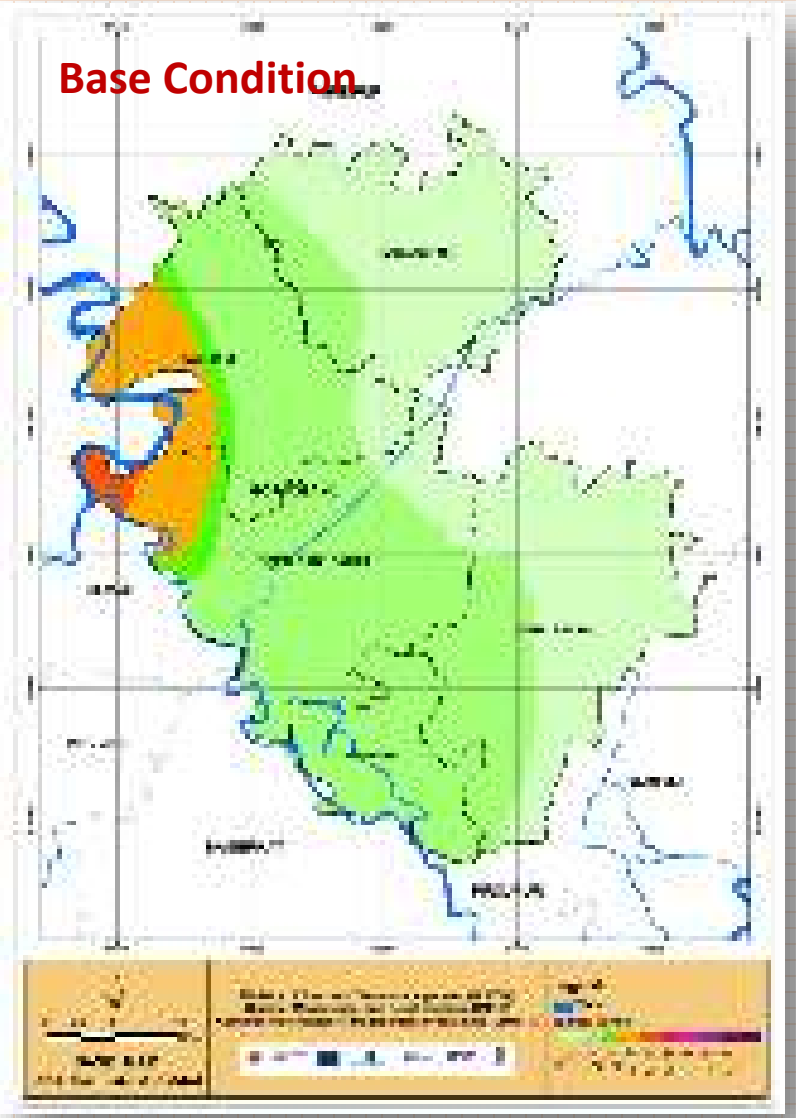


Climate Change Condition

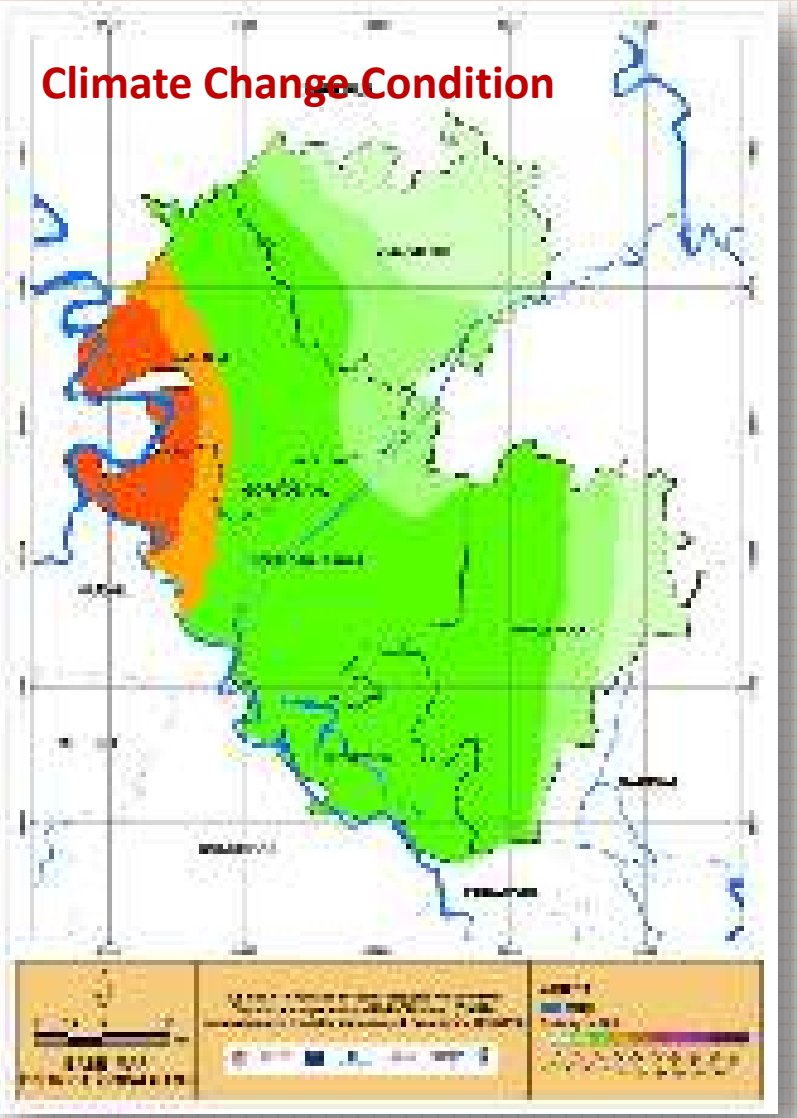
An area of 20,745 km^2 will be inundated by more than 1m water depth in the changing climate

SALINITY DISTRIBUTION

Base Condition

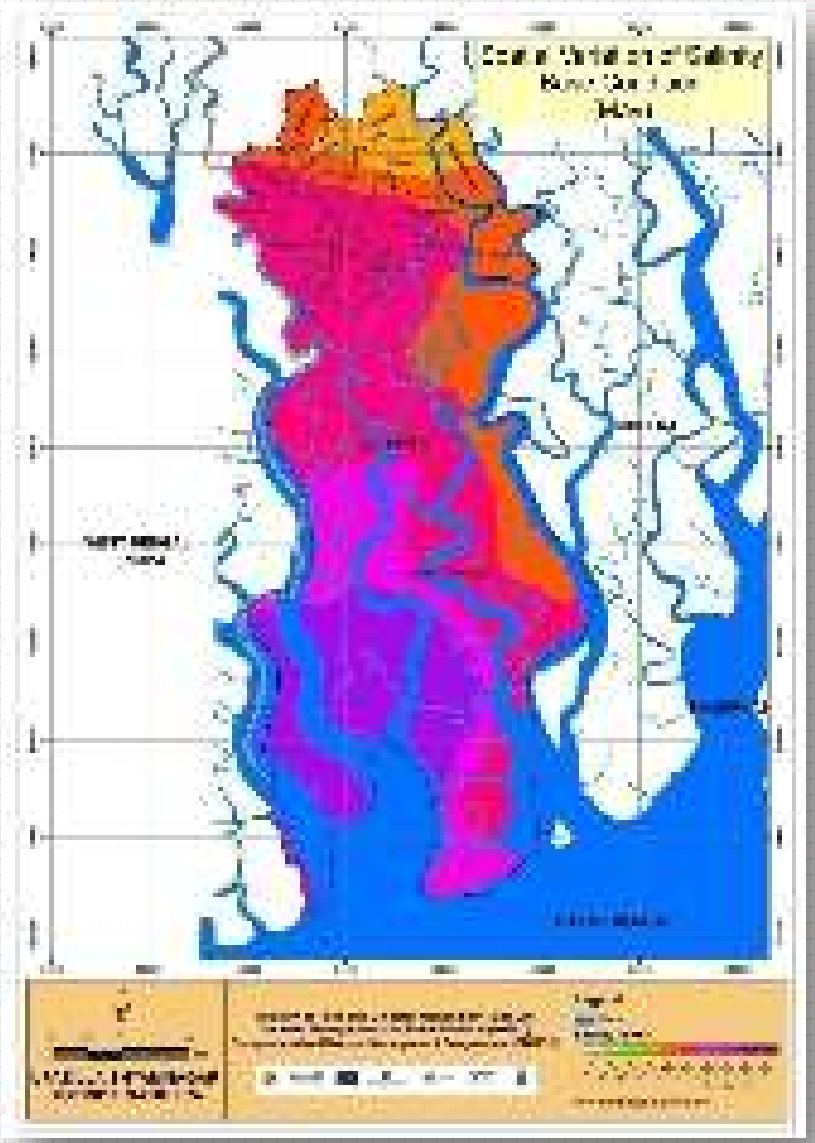


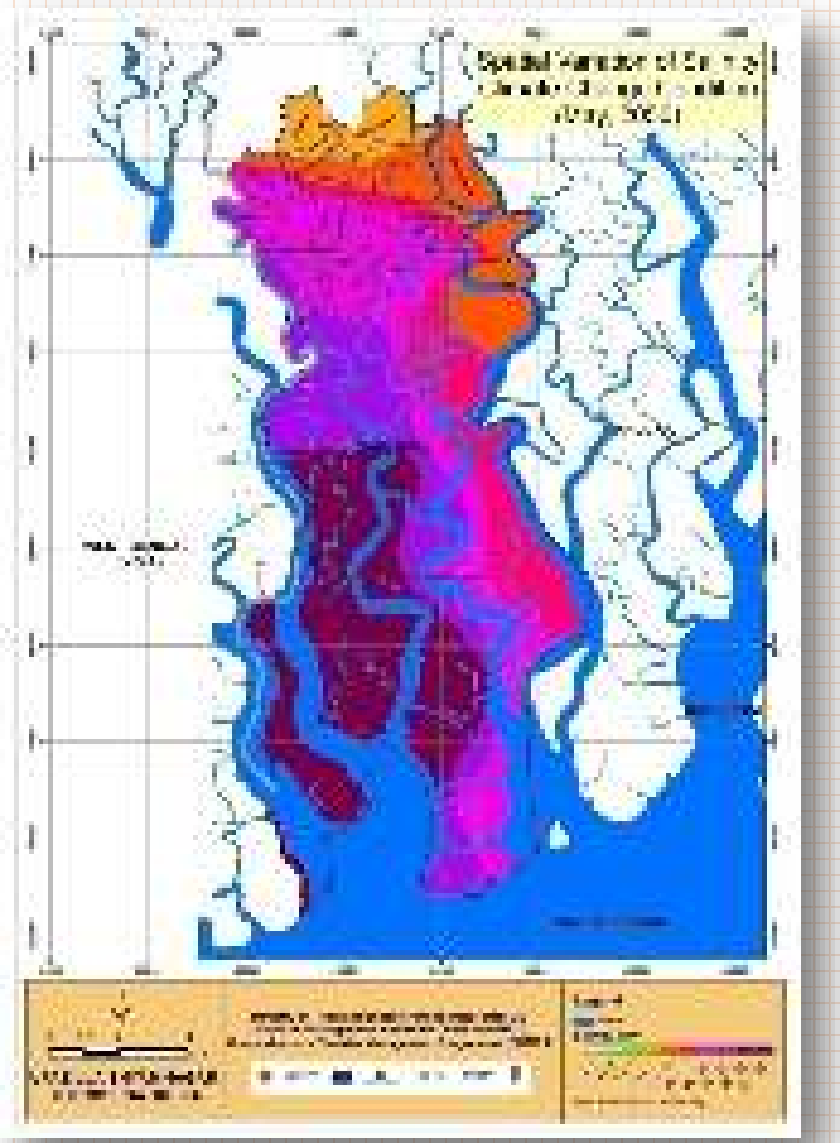
Climate Change Condition



District: Gopalganj

SALINITY DISTRIBUTION





Sub-district: Shyamnagar; District: Satkhira

BENEFIT OF SALINITY DISTRIBUTION MAPS

The salinity distribution maps are useful for

- to find the water availability in different months for agriculture, drinking purpose, industrial and other household requirement
- Adaptation in fisheries sector and crop planning can also be benefitted from salinity zoning maps
- to find the effect of climate change on the coastal ecosystem as well as on bio-diversity

DISTRICTS FOR THE FLOOD EVENT IN 1988 AND 2007

Sl. No.	Districts	Sl. No.	Districts	Sl. No.	Districts
1	Barhmanbaria	11	Tangail	21	Sylhet
2	Dhaka	12	Manikganj	22	Habiganj
3	Gopalganj	13	Rajbari	23	Moulovibazar
4	Shariatpur	14	Gaibandha	24	Chandpur
5	Madaripur	15	Kurigram	25	Rajshahi
6	Faridpur	16	Sunamganj	26	Pabna
7	Jamalpur	17	Sirajganj		
8	Kishorganj	18	Rangpur		
9	Netrokona	19	Nilphamari		
10	Munshiganj	20	Lalmonirhat		

DISTRICTS CONSIDERING CC

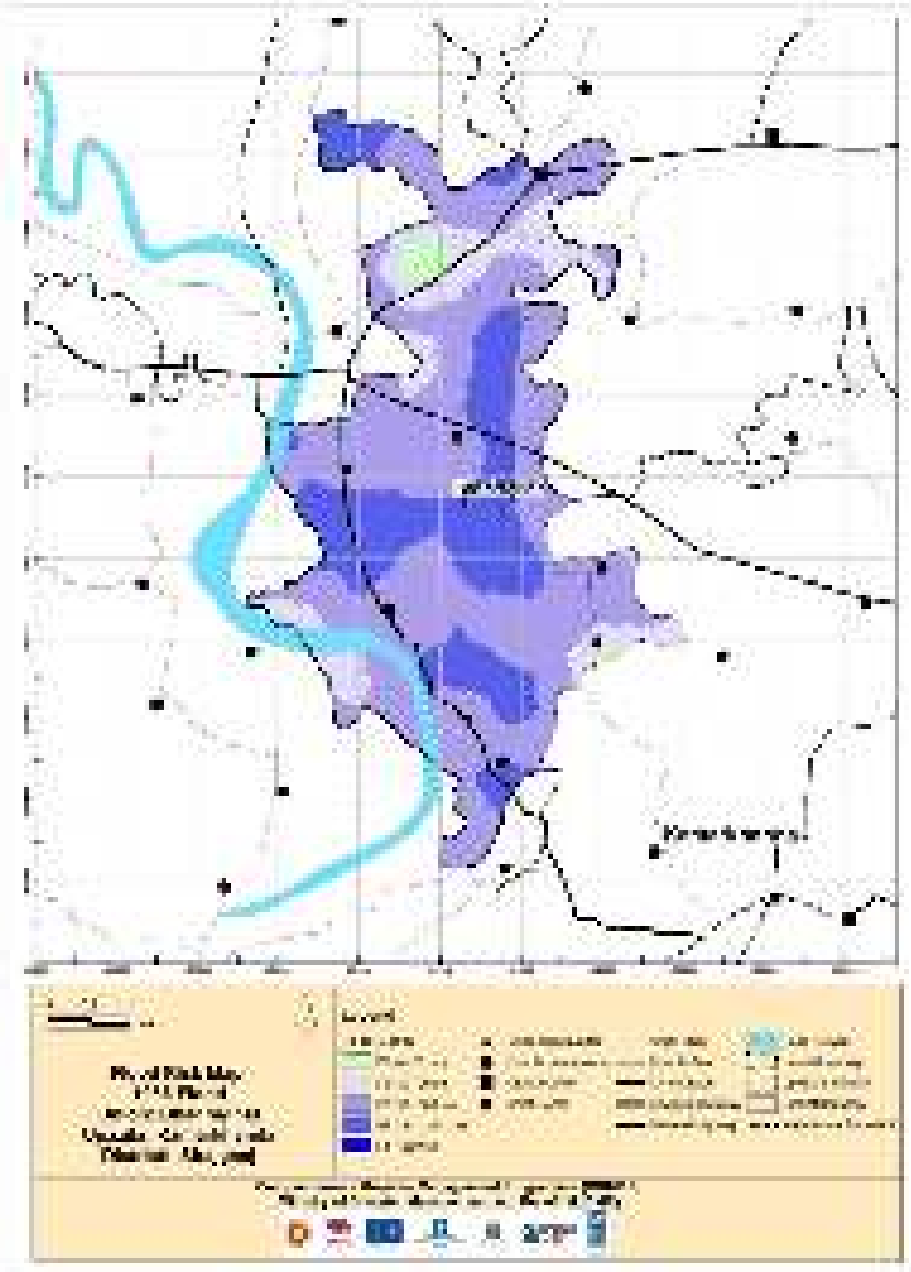
Sl. No.	Districts	Sl. No.	Districts	Sl. No.	Districts
1	Barhmanbaria	13	Rajbari	25	Moulovibazar
2	Dhaka	14	Gaibandha	26	Chandpur
3	Gopalganj	15	Kurigram	27	Pirojpur
4	Shariatpur	16	Sunamganj	28	Barisal
5	Madaripur	17	Sirajganj	29	Bhola
6	Faridpur	18	Khulna	30	Jessore
7	Jamalpur	19	Sathkhira	31	Bagerhat
8	Kishorganj	20	Rangpur	32	Laxmipur
9	Netrokona	21	Nilphamari	33	Pabna
10	Munshiganj	22	Lalmonirhat	34	Rajshahi
11	Tangail	23	Sylhet		
12	Manikganj	24	Habiganj		

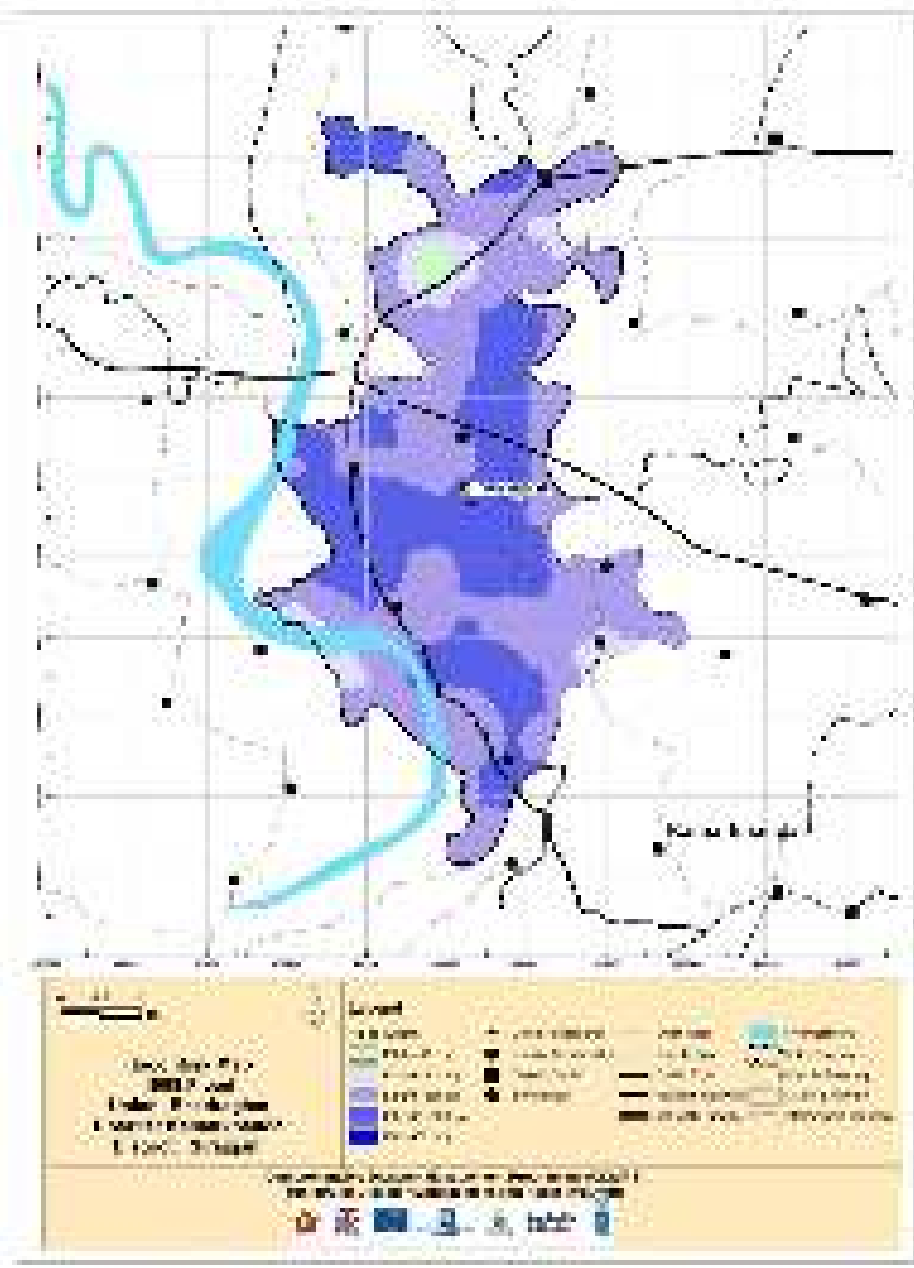
FLOOD INUNDATION DEPTH MAPS

The flood depths are classified in accordance with the NWMP guidelines.

- **F_0 = 0-30 cm**
- **F_1 = 30-90 cm**
- **F_2 = 90-180 cm**
- **F_3 = 180-360 cm**
- **F_4 > 360 cm**

The flood levels are the result of interpolation of monsoon water level of model grids surrounded with the rivers and channels in the locations of interest.





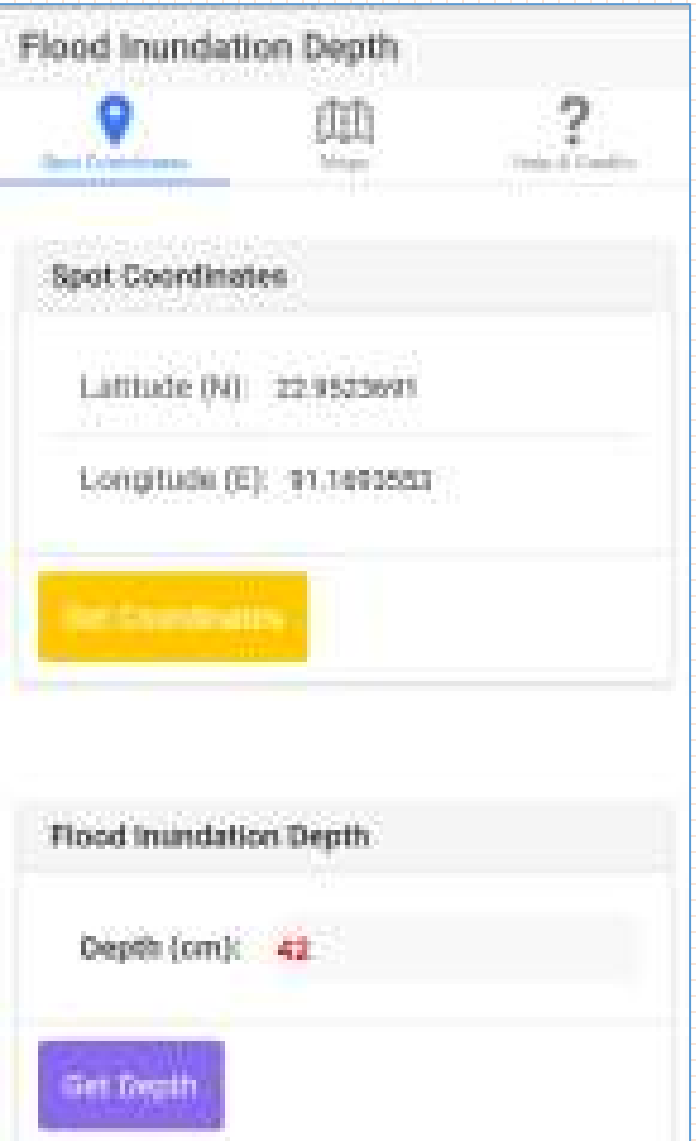
BENEFIT OF FLOOD INUNDATION DEPTH MAPS

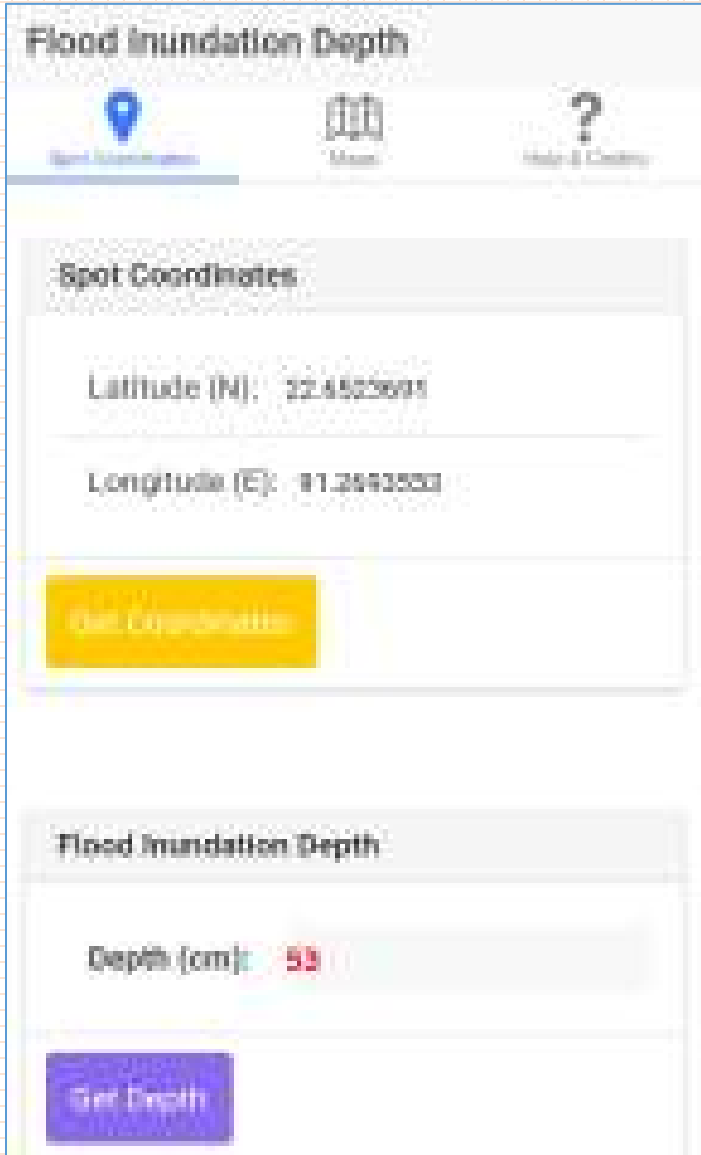
The flood risk maps are useful for

- assessing community risk
- examine the potential physical impacts of climate change
- assess the associated damages and losses in key economic sectors, on vulnerable populations, and in the overall economy
- it can be instrumental for awareness building of local communities and assessment of associated risks
- enable to planner to find different elements at risk like road, homestead and crop fields

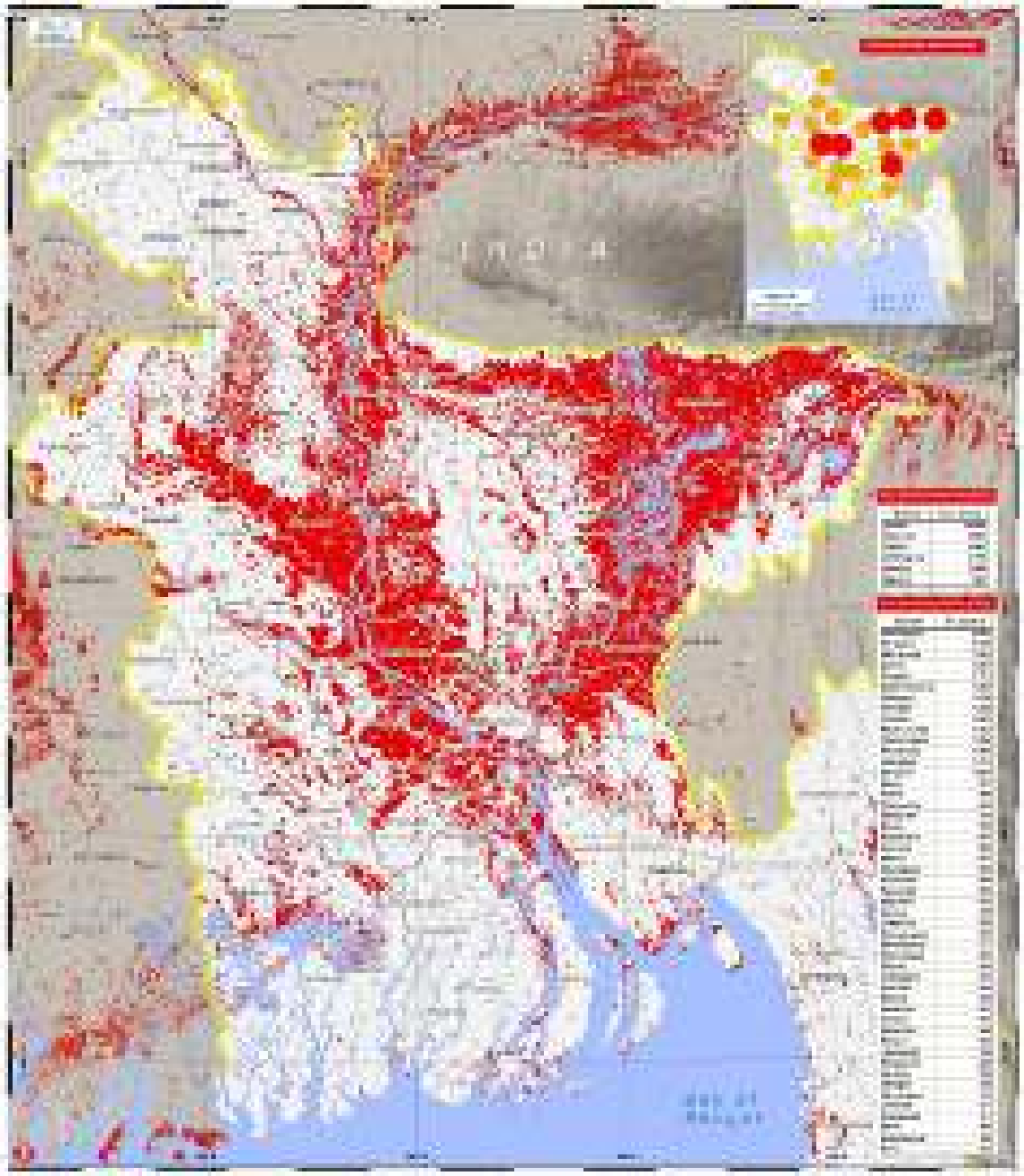
Location based Service

- GPS enabled Smart Phone to identify on the spot Flood Inundation Depth.
- System Requirement (Open Source Software/Technology)
- Smart Phone with GPS Module

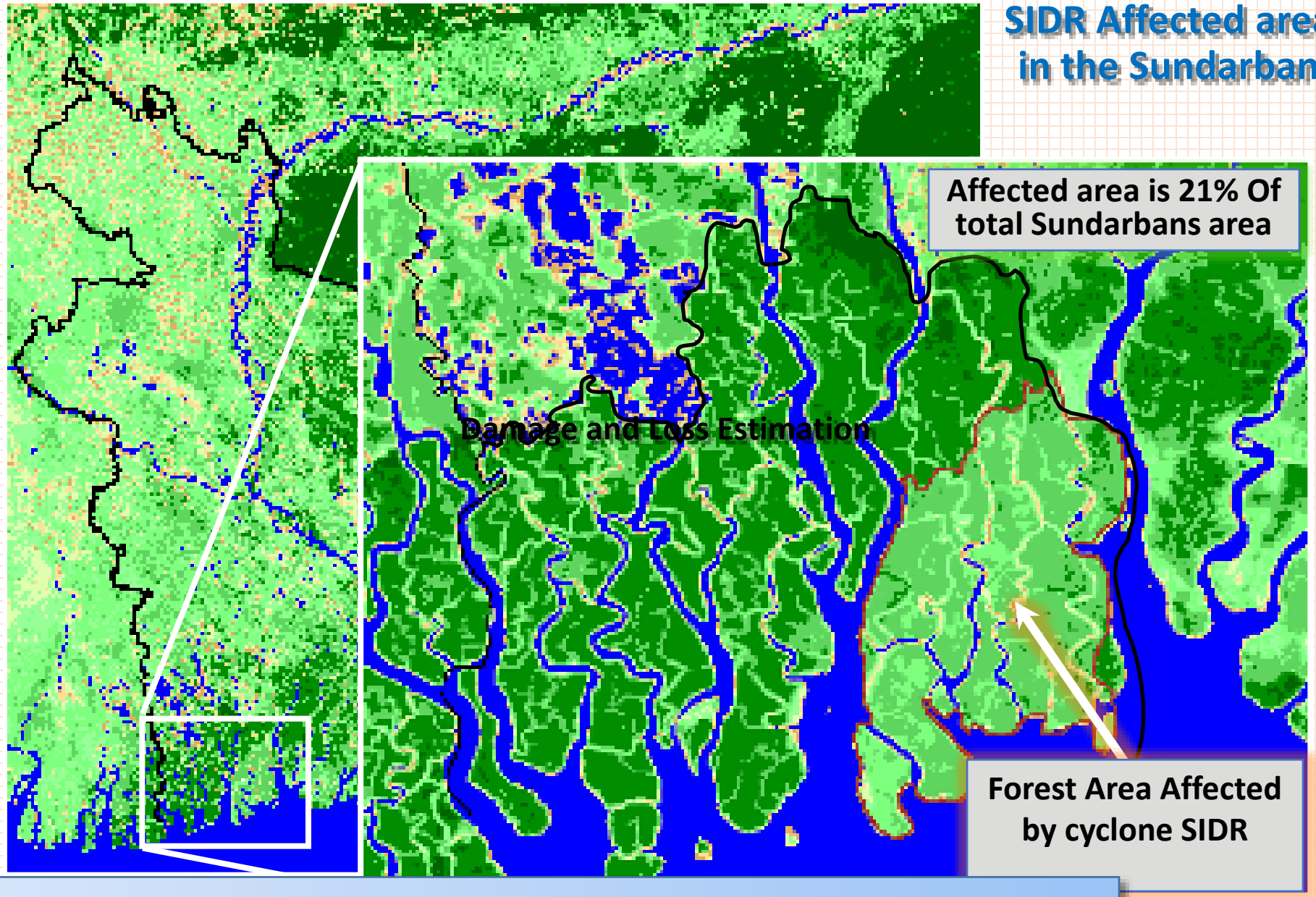




Flood Extent Map from Satellite Image (Flood 2007)

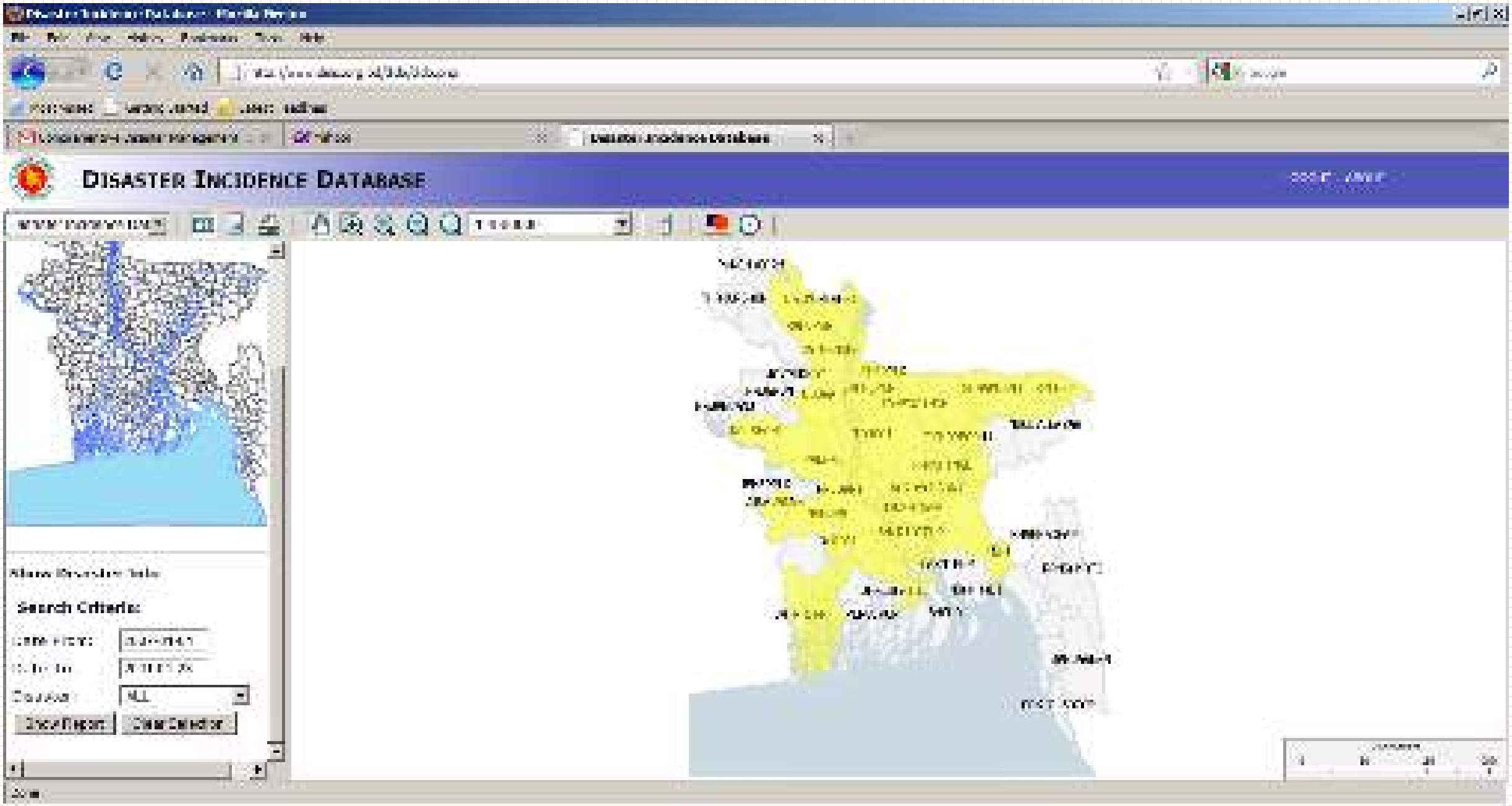


Damage and Loss Estimation

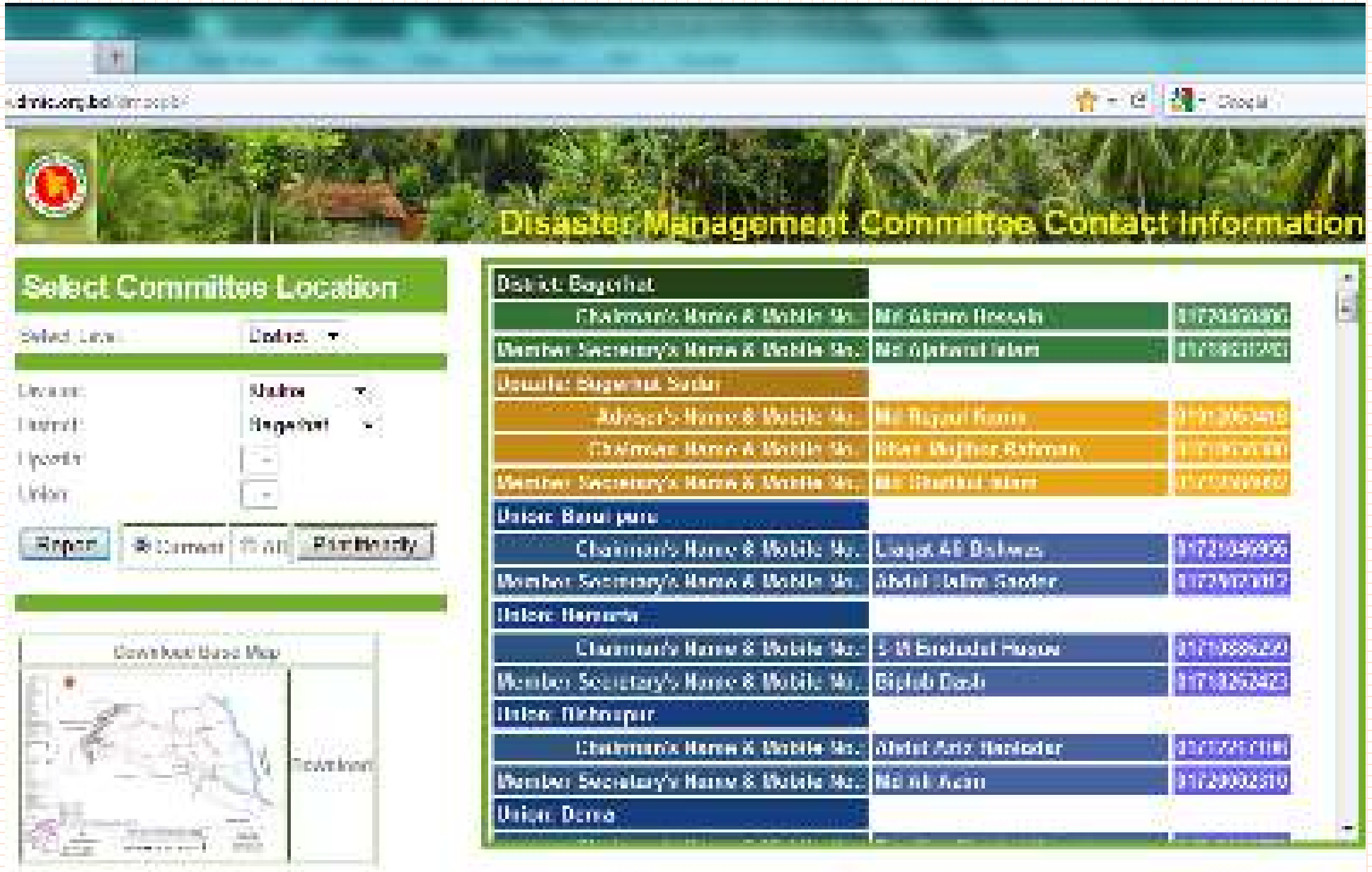


Disaster Incidence Database (DIDB)

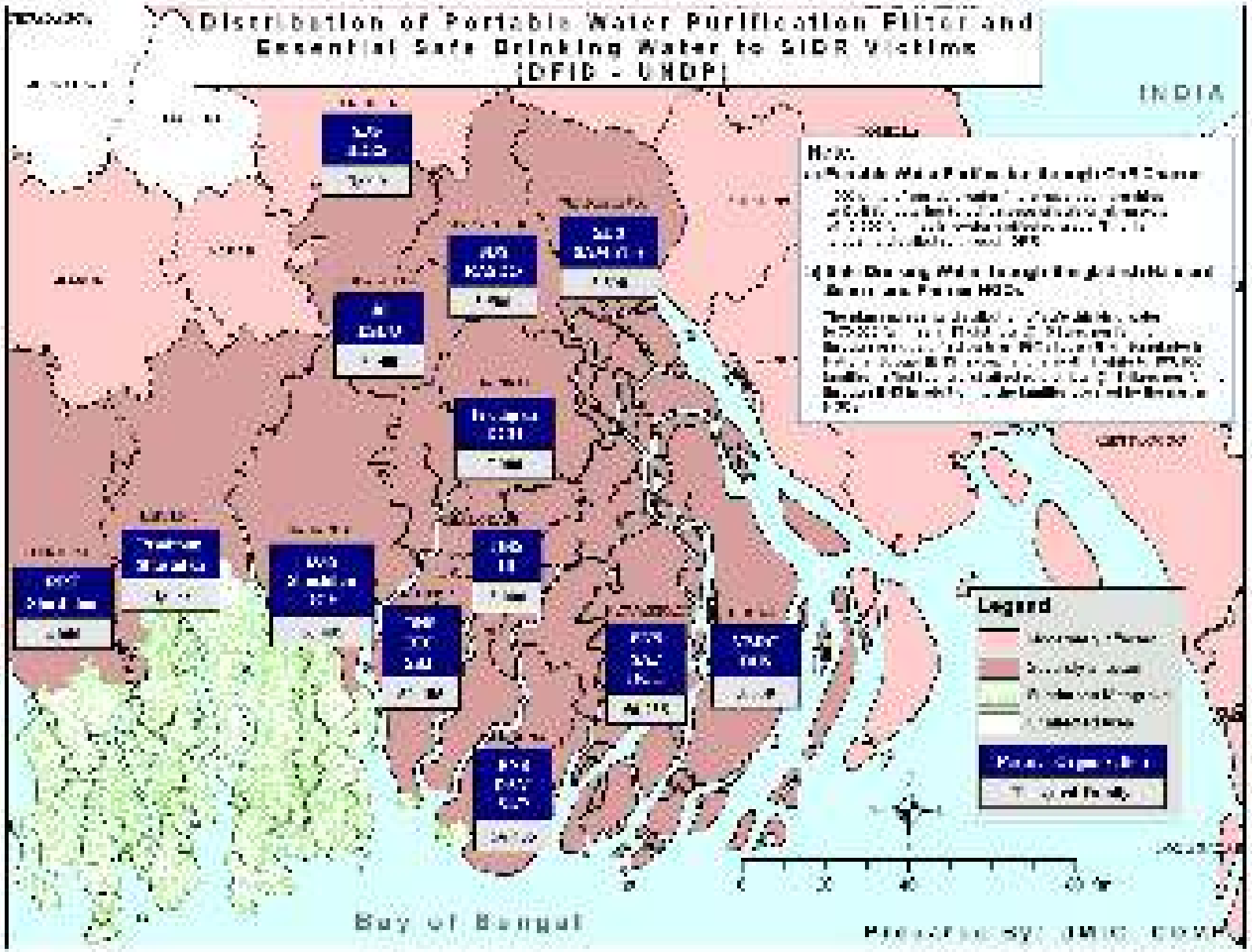
Disaster Incidence Database (DIDB)



Disaster Management Committee Contact Information



3W Map


Distribution of Portable Water Purification Filter and
Essential Safe Drinking Water to SIDR Victims
(DFID - UNDP)
INDIA
Legend
Bay of Bengal

Thanks