

Memorandum

Landslides and Flood Losses - 2012



Submitted by
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Government of Kerala

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Chapter 1 – Situation Assessment

1.1 Introduction

Indian Meteorological Department declared the onset of monsoon of 2012 on 5th June over Kerala. IMD in its first stage forecast of the South-West monsoon issued on 26th April predicted 47% probability of the monsoon rainfall to be normal (96 to 104 % of long period average). In its press release dated 27 July 2012, IMD reported that Kerala as a whole had a rainfall deficit of 39% from its long period average for the period of 1 June - 25 July.

As the Government was preparing to tackle a state-wide drought condition, parts of the state were lashed by heavy rainfall from 7 August 2012. This resulted in landslides and floods in several districts of the State and consequently heavy loss to life and property. As the IMD's predictions were for a weak monsoon landslides and floods were not anticipated by the State Government and hence its resources were stretched to their limits.

As the State Governments machinery could not cope with the disastrous situation the National Disaster Response Force and the Indian Navy was pressed into service. Thus the events that occurred in Kerala since 7 August 2012 qualifies to be **disasters** as they *exceeded the ability of the 'affected people (the State Government)' to cope using their own resources*. This document provides a detailed report of the damages that occurred to life and property in the State due to landslides and floods during the South West Monsoon season of 2012.

1.2 Landslides and floods

Landslides were reported from six districts namely Kannur, Kozhikode, Palakkad, Ernakulam, Idukki and Kottayam. Flood situation prevailed in Iritty town in Kannur district as the region was experienced a >100 year return interval rainfall. As a consequence, Pazahsshi dam in Iritty town overflow aggravating the disastrous situation. Figure 1 shows the photographs depicting damages due to landslides and floods in Kerala, 2012.

- **Kannur:** Two landslides were reported from Karikottakiri and Murikkan Kara in Ayyankunnu Village, Thalasherry Taluk on 6 and 7 August. On the days, the region experienced a >100 year return interval rainfall which resulted in the flooding of Iritty township and the overflowing of Pazahsshi dam. One fatality was reported. On 26 August a landslide was reported from Thirumeni village, Thalasherry Taluk which damaged the arterial road of the village.
- **Kozhikode:** Over 35 minor and major debris flows were reported from Pulloorampara-Anakkampoyil region on 6 August 2012. Acres of crop land perished and eight fatalities were reported.
- **Palakkad:** A debris flow occurred at 100 acre, Ambalappara, Kottappadam Panchayath within the Silent Valley National Park Buffer Zone. The event was reported on 22 August as the region is only accessible by foot and is an abode of forest dwelling tribal communities. The actual date of occurrence is unknown. The hill which was affected is the origin of Vaniyampara River and it houses numerous medicinal plants thus resulting in loss to biodiversity.
- **Ernakulam:** A major debris flow occurred in Kadavoor village of Kothamangalam Taluk on 17 August 2012. Six fatalities were reported, in addition to significant loss to property.



- **Idukki:** A major landslide occurred in Kaduvappara, Peerumedu Taluk on 14 August 2012, 4pm. Two people were injured in the event and acres of crop loss were reported.
- **Kottayam:** Two minor debris flows were reported from Thalappalam and Tikoy villages of Meenachil Taluk. Few acres of crop land were damaged and an arterial road was blocked in one of the debris flows.

Figure 2 shows the locations of the landslides. These landslides were a consequence of the heavy rainfall that Kerala received from 1 August 2012.

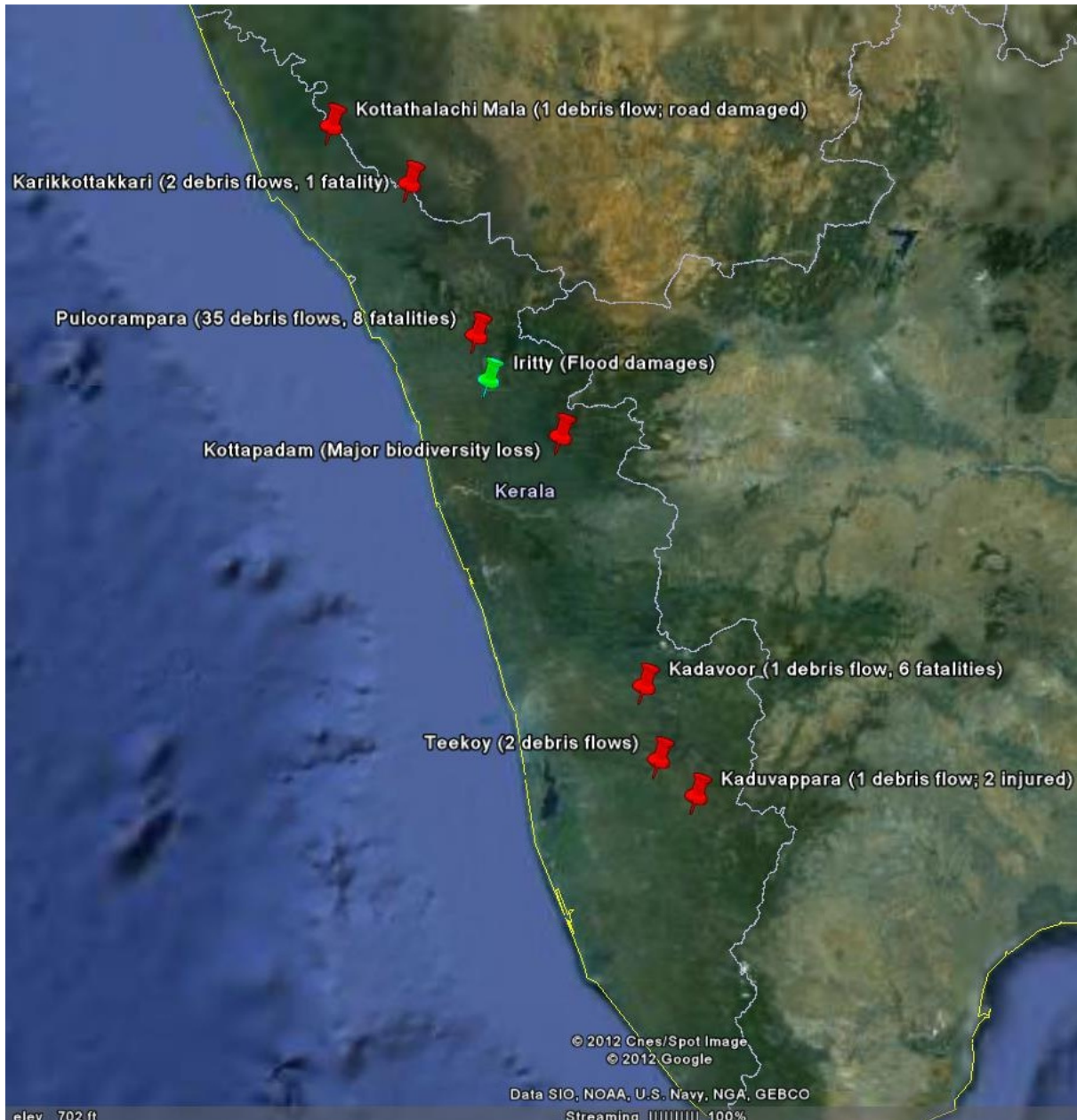


Figure 2: Location map of the disasters (Image Courtesy: Google Earth)

1.3 Rainfall

Figure 3 shows the comparison of actual and expected (normal) rainfall for the current and the preceding 6 years as per IMD data. From the figure it is evident that the state as a whole is still facing a rainfall deficit. The intra-state variability of rainfall in Kerala is very high; instantaneous rainfall at 1000 m above mean sea level can be 150% higher than at 40 m above MSL. Thus although the State has an overall rainfall deficit, parts of the high lands and scarp faces, received significant rainfall from 1 August 2012 onwards.

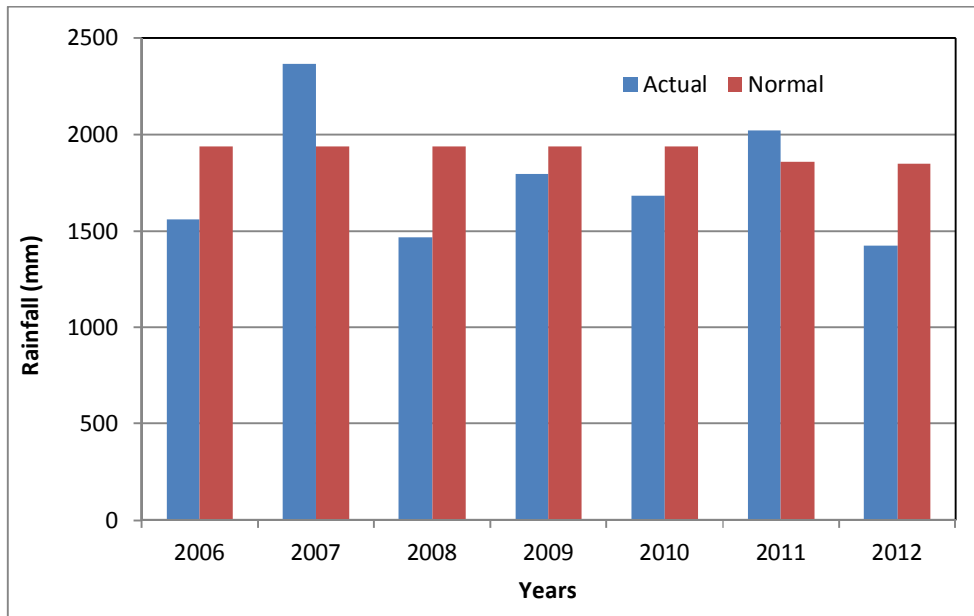


Figure 3: Performance of South-West Monsoon from 1 June to 7 September – 2006 to 2012
(Data source: IMD)

Figure 4 shows the INSAT pictures of 7 August and 17 August, the two days on which the landslides which caused fatalities occurred. The thick clouds covering the entire state indicate the intensification of South West Monsoon and this intensification of monsoon activity was confirmed by IMD.

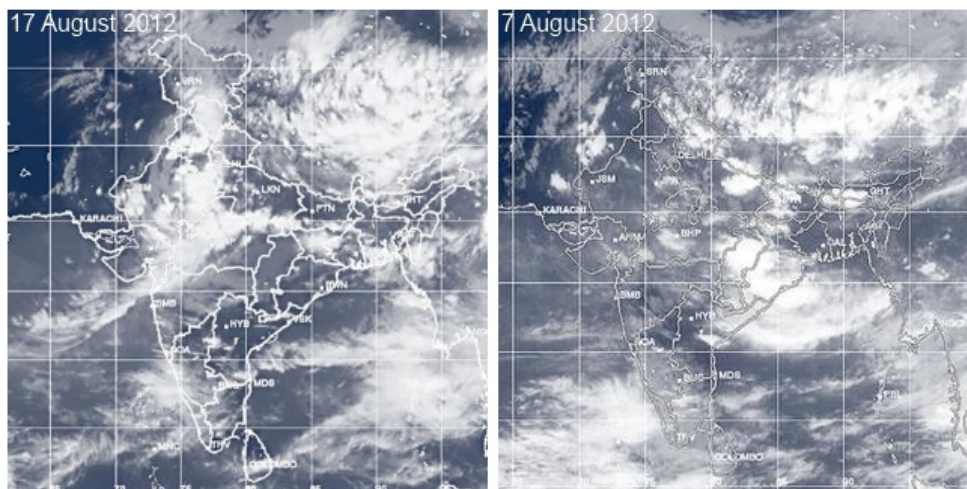


Figure 4: INSAT pictures of 17 August and 7 August 2012 (Source: IMD)

Table 1 compiles the rainfall received on the day and 5 days prior to the events at the rain gauges of IMD that are in close proximity to the locations where landslides that caused fatalities occurred. It was evident from the available rainfall figures that the monsoon rainfall had saturated the soil column of the region. Further, field investigations by scientists from Centre for Earth Science Studies and HVRA Cell confirmed that the debris flows were a consequence of the increase in pore water pressure as a consequence of the continuous and intense rainfall.

Table 1: Daily rainfall (mm) for the preceding five days and the day of the event (Source: IMD)

Date	Location: Pulloorampara		
	Vadakara	Quilandy	Vythiri (Wayanad)
02.08.2012	7.0	0.0	3.8
03.08.2012			
04.08.2012	0.0	1.4	23.6
05.08.2012	3.0	0.0	-
06.08.2012	0.0	2.0	114.6
07.08.2012	65.0	17.0	232.8
	Location: Kadavoor		
	Thodupuzha (Idukki)		
12.08.2012	17.5		
13.08.2012	3.4		
14.08.2012	0.0		
15.08.2012	2.0		
16.08.2012	46.5		
17.08.2012	114.0		

These events caused significant damage to life and property, the details of which is given in the subsequent chapters.

Chapter 2 - Losses

2.1 Human Fatalities

In the heavy rain and landslides that hit the State, 16 lives were lost and 7 were left injured. Table 2 shows the district wise human fatalities and injuries reported.

Table 2: District wise human fatalities and injuries (Source: District Administration Reports)

District	Fatalities	Injuries
Kannur	1	0
Kozhikode	8	4
Palakkad	0	0
Ernakulam	6	1
Idukki	0	1
Kottayam	0	0

2.2 Houses damages

A large number of houses were completely or severely damaged. Affected people were accommodated in relief camps. The actual loss to housing sector due to this is inestimable. However the loss estimated as per norms is Rs. 6,18,28,600 (Rupees Six Crore Eighteen lakhs Twenty Eight Thousand Six Hundred only). District wise details of number of houses damaged (fully and partially) with estimated loss is given in Table 3:

Table 3: District wise house damage estimates (Source: District Administration Reports)

District	Fully damaged pucca houses	Severely damaged pucca houses	Total No. of houses Damaged	Estimated Loss
Kozhikode	24	28	52	3,80,00,000
Kannur	50	600	650	2,00,00,000
Wayanad	3	21	24	10,28,600
Ernakulam	10	3	13	28,00,000
Total	87	652	739	6,18,28,600

2.3 Agriculture damages

The landslides caused severe damages to crops in the affected areas. Rivers were in-spate and it breached banks at many places, inundating low-lying areas resulting in crop damage, apart from that caused by the landslides. The details of district wise perennial crop losses are given in Table 4:

Table 4: District wise agricultural damages (Source: District Administration Reports)

District	Damaged extent (hec)	Estimated loss (Rs.)
Kannur	150.2	27,00,00,000
Kozhikode	300	83,10,00,000
Wayanad	26.5	7,34,05,000
Ernakulam	34	9,41,80,000
Kottayam	20.1	5,56,77,000
Idukki	10.2	2,77,00,000
Total	541	135,22,39,000

2.4 Loss of land due to landslides and flood

Cultivable land in Kerala is a scarce and very valuable resource. The loss of cultivable land due to landslides and floods in the month of August 2012 was substantially high as illustrated in

Table 4. Much of the land area will not be useful for agriculture or human habitation for a long period. Hence, the State Government has decided to buy new land at market rate (or near market rate) and construct houses for rehabilitating the affected families and those living within 100 m buffer of the landslide paths. Table 5 shows the cost for buying land and rehabilitating the affected and those living within 100 m buffer of the landslide paths.

Table 5: Cost for buying land and rehabilitating the affected families and those living within 100 m buffer of the landslide paths (Source: District Administration Reports)

District	Land required (hec)	Cost of Land (Rs.)	Cost of Infrastructure (Rs.)
Kannur	100.2	2,80,00,000	6,30,00,000
Kozhikode	300	20,00,00,000	1,50,00,000
Wayanad	26.5	5,30,00,000	2,28,70,000
Ernakulam	34	1,00,00,000	90,00,000
Kottayam	20.1	30,00,000	34,00,000
Idukki	10.2	20,00,000	17,25,373
Total	491	29,60,00,000	11,49,95,373
Grand total			41,09,95,373

Chapter 3 – Relief and Recovery

3.1 Relief Camps and Medical Care

Nine relief camps were opened in the 4 districts during the period accommodating around 956 people including women and children. Details of camps are shown in Table 6:

Table 6: District wise cost of relief camps (Source: District Administration Reports)

District	No. of Camps	Cost (Rs.)
Kannur	5	2,09,426
Kozhikode	2	5,00,000
Ernakulam	1	10,00,000
Wayanad	1	5,00,000
Total	9	22,09,426

3.2 De-silting of agricultural land

Kannur district which faced heavy floods incurred losses due to siltation of agricultural land. Table 7 shows the area affected and the cost incurred for de-silting the agricultural land area.

Table 7: District wise cost of de-silting of agricultural land (Source: District Administration Reports)

District	Area (hec)	Cost (Rs.)
Kannur	50	2,00,00,000
Total		2,00,00,000

3.3 Debris Clearance – Public area

The events listed in Section 1.2 caused extensive damage to road network. Table 8 shows the length of road network affected by the events and the cost incurred in removing debris that accumulated atop these roads and in public areas such as parks, panchayath office compound, village office compound etc.

Table 8: District wise cost of debris clearance from public area (Source: District Administration Reports)

District	Length (km)	Cost (Rs.)
Kannur	60 km & 2 hec land	4,50,00,000
Kozhikode	40	8,00,00,000
Ernakulam	12	10,00,000
Total		1,26,00,000

3.4 Debris Clearance – Agricultural land

As detailed in Section 2.3, Five hundred and forty one hectares of land was damaged due to the events listed in Section 1.2. As can be seen from Figure 1, debris was accumulated over the affected area (mainly agricultural land); earth removers and manual labour was used for the removal of the same. Table 9 shows the area affected and the cost incurred for debris clearance from the affected agricultural land area.

Table 9: District wise cost of debris clearance from agricultural lands (Source: District Administration Reports)

District	Area (hec)	Cost (Rs.)
Kannur	100.2	97,00,000
Kozhikode	300	52,00,000
Wayanad	26.5	17,00,000

Ernakulam	34	10,00,000
Kottayam	20.1	2,00,000
Idukki	10.2	3,26,566
Total		181,26,566

3.5 Draining of flood water

Severe flooding conditions prevailed in Iritty town as can be seen from Figure 1. Flood water draining using pump sets was required at many locations in Iritty town and the downstream areas of Pazhassi dam. Table 10 shows the cost incurred for flood water draining.

Table 10: District wise cost of draining flood water (Source: District Administration Reports)

District	Number of pump sets operated	Cost (Rs.)
Kannur	20 for 2 days	8,00,000
Wayanad	2 for 2 days	1,00,000
Total		9,00,000

3.6 Funeral and burial of the dead bodies

Fifteen individuals perished in the landslides and floods in the state. Table 11 shows the cost incurred for the funeral and burial of the dead bodies.

Table 11: District wise cost of funeral and burial of dead bodies (Source: District Administration Reports)

District	Fatalities	Cost (Rs.)
Kannur	1	6000
Kozhikode	8	50,000
Ernakulam	6	32,000
Total		88,000

3.7 Search and Rescue

As the State's machinery was not sufficient to cope with the situation, central forces such as National Disaster Response Force (NDRF) and the Indian Navy had to be pressed into service, especially in Kannur district. The Fire and Rescue Services and the Kerala Police were involved in the search and rescue operations in the affected area. Table 12 shows the cost incurred for search and rescue in the affected area.

Table 12: Cost (in Rs.) incurred for seeking services from NDRF and Indian Navy & other search and rescue measures (Source: District Administration Reports)

Force	Amount
Indian Navy (Kannur)	80,000
NDRF (Kannur)	70,000
Cost of search and rescue measures	25,00,000
Evacuation of people	10,00,000
Total	36,50,000

3.8 Repair/restoration (of immediate nature) of damaged infrastructure

Losses were incurred to roads, irrigation canals and community owned open wells. A total of 112 km roads, 100 km canals and 70 open wells were damaged. Most of these roads being the only network between villages and neighbouring townships they had to be restored to motor-able condition. The breach of canals resulted in flooding of several localities and hence the bunds had to be restored and reinforced. Open wells are the only source of drinking water in many of the rural hilly regions of the state and hence, those wells of which the walls collapsed and got silted

had to be restored with immediate effect. Table 13 shows the length of roads, the length of canals and the number of open wells that had to be repaired in each district.

Table 13: Cost incurred for immediate restoration of infrastructure
(Source: District Administration Reports)

District	Length of road (km)	Cost (Rs.)	Length of canal/electric line (km)	Cost (Rs.)	Number of open wells	Cost (Rs.)
Kannur	60	11,00,00,000	10 (canal); 17 (electric)	2,50,00,000	35	1,05,000
Kozhikode	40	7,50,00,000	6 (electric)	25,00,000	21	63,000
Ernakulam	12	30,00,000	-	-	14	42,000
Total	112	18,80,00,000	10 canal; 13 electric	2,75,00,000	70	2,10,000
Grand total						21,57,10,000

Abstract

MAJOR LOSS AS PER CENTRAL NORMS & ESTIMATED LOSS DUE TO LANDSLIDES AND FLOODS IN AUGUST 2012			
Code No.	Item	Estimated Loss (lakhs)	Loss as per CRF norms (lakhs)
1	2	3	4
1	Gratuitous Relief		
a	Ex-gratia payment to families of deceased persons (15 people)	22.5	22.5
b	Ex-gratia payment for loss of a limb or eyes (1 individual)	0.62	0.62
c.i	Grievous injury requiring hospitalization for more than a week (5 individuals)	0.465	0.465
c.ii	Grievous injury requiring hospitalization for less than a week	NA	NA
d	Clothing and Utensils	NA	NA
e	Gratuitous Relief for families in dire need (Free Ration)	NA	NA
2	Search and Rescue		
a	Services of Indian Navy	0.8	0.8
b	Services of NDRF	0.7	0.7
c	Cost of search and rescue	25	25
d	Cost of evacuation	10	10
3	Relief Measures		
a	Provision for temporary accommodation, food, clothing, medical care etc. for people affected/evacuated and sheltered in relief camps	22.09426	22.09426
b	Air dropping	NA	NA
c	Provision of emergency supply of drinking water in rural areas and urban areas	NA	NA
4	Clearance of affected areas		
a	Clearance of debris in public areas	126	126
b	Draining of flood waters in affected areas	9.0	9.0
c	Disposal of dead bodies	0.88	0.88
5	Agriculture		
i	Assistance to small and marginal farmers		
A	Assistance for land and other loss		
a	De-silting of agricultural land (their thickness of sand/silt deposit is >3 inches, to be certified by the	200	4.05

	competent authority of the State Government)		
b	Removal of debris on agricultural land in hilly areas	181.26566	39.7710
c	De-silting/restoration/repair of fish farms	NA	NA
d	Loss of substantial portion of land caused by landslide/avalanche/change of course of rivers	4109.95373	122.75
B	Input subsidy (where crop loss is 50% and above)		
a	For agricultural crops, horticulture crops and annual plantation crops	NA	NA
b	Perennial crops	135.2239	43.28
c	Sericulture	NA	NA
ii	Input subsidy to farmers other than small & marginal farmers	NA	NA
6	Animal Husbandry - Assistance to small and marginal farmers/agricultural labourers		
i	Replacement of milch animals, draught animals or animals used for haulage	NA	NA
ii	Provision of fodder/feed concentrate in cattle camps	NA	NA
iii	Water Supply in cattle camp	NA	NA
iv	Additional cost of Medicines and Vaccines	NA	NA
v	Transport of fodder to cattle outside cattle camps	NA	NA
7	Fishery		
i	Assistance to Fishermen for repair/replacement of boats, net – damaged or lost	NA	NA
ii	Input subsidy for fish seed farm	NA	NA
8	Handicrafts/handloom - Assistance to artisans		
i	For replacement of damaged tools/equipment	NA	NA
ii	For loss of raw material/goods in process/finished goods	NA	NA
9	Housing		
a	Fully damaged/Destroyed houses		
i	Pucca Houses	256.45	30.45
ii	Kutchra Houses	NA	NA
b	Severely Damaged Houses		
i	Pucca Houses	361.836	41.076
ii	Kutchra Houses	NA	NA
c	Partially damaged houses - pucca/kutchra (Other than huts)	NA	NA

d	Damaged/Destroyed huts	NA	NA
e	Cattle shed attached with house	NA	NA
10	Infrastructure		
	Repair/restoration (of immediate nature) of damaged infrastructure		
	i) Road & bridges	1880	1880
	ii) Drinking water supply works	NA	NA
	iii) Irrigation	275	275
	iv) Power		
	v) Schools	NA	NA
	vi) Primary health centres	NA	NA
	vii) Community assets owned by panchayaths	2.1	2.1
11	Procurement	NA	NA
	Total	7619.889	2656.536
Estimated loss in real terms: Rs. 7619.889 lakhs (Rs. 76.19889 crores)			
Estimated loss as per CRF Norms: Rs. 2656.536 lakhs (Rs. 26.56536 crores)			