NEPAL FLOOD 2017

Post Flood Recovery Needs Assessment

GOVERNMENT OF NEPAL

NATIONAL PLANNING COMMISSION

KATHMANDU

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NATIONAL PLANNING COMMISSION

KATHMANDU
NEPAL

Preface

The 2017 monsoon brought excessive rainfall within a compressed calendar, resulting in flash floods across a wide swathe of Nepal's plains. The impact has been severe in 18 districts, with extensive loss of life and property. Successive disasters have demonstrated Nepal's high vulnerability to natural hazards and they underscore the need for better preparedness and plans for more resilient recoveries.

The Post Flood Recovery Needs Assessment (PFRNA) presents an objective basis for recovery planning as well as measures for reducing future risks. There are pockets of acute poverty and vulnerability in the Terai-Madhesh. The Recovery Strategy presents a roadmap through which the Government of Nepal aims to undertake the ambitious task of recovery in concert with the private sector, development partners and non-governmental alliances.

The task ahead is to restore not only lost assets, but to rebuild lives and livelihoods. The Assessment reflects the spirit of the recently enacted Disaster Risk Management Act, which provides an opportunity for all stakeholders to band together in pursuit of a more resilient Nepal through pre-disaster preparedness and post-disaster response. This is also a clear signal of our national commitment to the Sendai Framework, the global compact for disaster risk reduction.

We take this PFRNA as a living document that will be revised as improved data on damage and needs become available. Nepal is committed to achieving the Sustainable Development Goals, and we recognize that rebuilding livelihoods and infrastructure is an essential step towards achieving these goals.

I take this opportunity to thank all the government officials, particularly at NPC and the line ministries, for their contributions. This Assessment was done within a short time period and in midst of a hectic festival season. I am particularly grateful to the United Nations Development Programme and the World Bank for their professional engagement and devotion to helping NPC with the preparation of this Assessment in a rigorous and credible manner.

Swarnim Waglé
Vice-Chairman
National Planning Commission

WORLD BANK GROUP

UNITED NATIONS

Foreword

Nepal has faced increasing severity and frequency of floods over last few years. As evident from the massive flood impacts this year and a number of other similar events in previous years, the Nepal's exposure to floods will continue to be high and be a serious impediment to its progress towards development goals. This situation underscores the need to develop a long-term recovery and resilience framework which not only helps communities to bounce back from the impact of floods, but also helps them build resilience to future events. While it is difficult to prevent floods in Nepal entirely, careful attention to recovery, preparedness and mitigation measures can certainly help reduce their impact and protect lives, livelihood, and assets. The Nepal Post-Flood Recovery Assessment (PFRNA) charts a resilience-based approach to recovery, which would help communities recover on a sustainable basis. The flood recovery programme should draw upon the experiences and lessons of the Nepal earthquake recovery programme, and enhance the national implementation capacity.

The UN system and the World Bank have been assisting the Government of Nepal to enhance its capacities in disaster risk reduction and recovery. We commend the National Planning Commission for efficiently conducting the Assessment with the participation of various line ministries and also integrating the findings from the Initial Rapid Assessment (IRA) led by the Ministry of Home Affairs (MoHA).

Nepal has expressed its strong commitment to the Agenda 2030 and the Sendai Framework for Disaster Risk Reduction, of which post-disaster recovery is an important pillar. The present Assessment is a welcome step towards implementing the Sendai Framework on the ground, and it offers a unique opportunity to highlight the link between recovery, resilience and long term development embodies by the Sustainable Development Goals. We sincerely hope that the Government of Nepal will follow the Assessment findings and implement a comprehensive recovery programme in the Terai region.

We remain committed to continue our collaboration with the Government of Nepal.

11/16/2017

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Acknowledgements

The Post-Flood Recovery Needs Assessment (PFRNA) is prepared by the National Planning Commission (NPC) under the leadership of the Vice Chairman, Dr. Swarnim Waglé, with the support of all Members of the Commission.

The NPC Secretary Bishnu Prasad Lamsal and Joint Secretary Tulsi Prasad Gautam coordinated the Assessment, aided by a core team comprising of Shiva Ranjan Poudyal, Rabindra Paudyal, Devraj Joshi and the line ministry focal points in NPC. We thank the officials from all participating ministries for their contribution to the PFRNA process. For strategic inputs, the NPC is also grateful to Dr. Suman Kumar Karna, Project Chief of the newly created unit for post-flood recovery at the National Reconstruction Authority.

The Assessment benefited immensely from the technical assistance and written inputs provided by a joint United Nations and World Bank team led by Seeta Giri and comprising of Ojeswee Pande, Shairi Mathur, Mohita Joshi, and Hemang Karelia. The NPC is particularly grateful to Dr. Krishna Vatsa, UNDP Recovery Advisor, for his expert advice and efforts to enhance the overall quality of the Assessment.

A list of contributors to the PFRNA report is included in Annex 1. To all of them, NPC expresses its gratitude.

Photo by: Prakash Chandra Timilsena

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Photo by: Angad Dhakal/Kantipur

Executive Summary

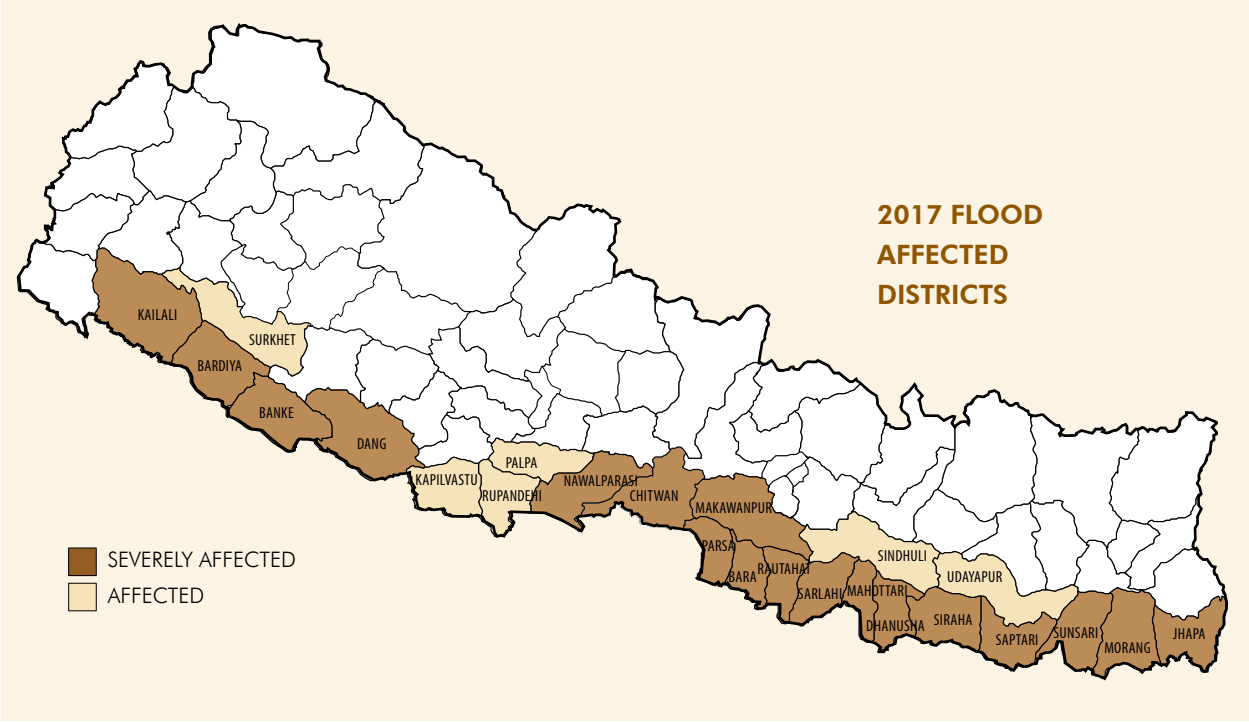
Context

Nepal experienced incessant rainfall from August 11 to 14, 2017, resulting in widespread floods across 35 of the country's 77 districts.[1] Several districts experienced the heaviest rainfall in over 60 years.[2] This led to the inundation of about 80 percent of the land in substantial parts of the Terai region.[3]

Floods have historically resulted from a combination of the following natural factors in Nepal: continuous rainfall and cloudbursts, snowmelt and rainfall, glacial lake outburst floods and bishyari (breaking of dams caused by landslides falling directly into rivers).[4] This year's heavy rains were a result of the monsoon trough, an elongated area of low pressure that formed parallel to the foothills of the Himalayas; presence of low-pressure and the entry of moisture from the Bay of Bengal that released significant rains on the southern parts of the Chure range and the mid-hills. Shifting of the monsoon trough closer and away from Nepal is a common phenomenon. However, this year it extended from the east to the west of the country, causing heavy rains.

The monsoon is both a productive and hazardous resource in Nepal. When it brings the right amount of rain, agriculture productivity soars; when there is excess, it causes tremendous loss of life and property. During monsoon cloudbursts,

MAP 1: FLOOD-AFFECTED DISTRICTS



[1] The total number of districts until recently stood at 75. Although Nawalparasi and Rukum have now been split into two, we treat Nawalparasi as a single district in this report.

[2] In 2017, the Department of Hydrology and Meteorology (DHM) also recorded the highest ever mean rainfall of 1,800 mm, substantially exceeding the average of 1,200 mm in the recent past.

[3] Nepal Red Cross Society, IRA Compilation Report, 20 August 2017.

[4] Dixit, Ajay (2003). "Floods and Vulnerability: Need to Rethink Flood Management". *Natural Hazards*.

landslides and flash floods occur in the mountains. In the southern plains, the same water breaches river banks and inundates swathes of land. The impact is aggravated by rapid urbanization in the Terai: physical construction along the embankments have interfered with the existing patterns of surface water flow and caused drainage congestion. With local hydrology changed, there has been flooding even in regions with no past experience of such calamities.[5]

The booming construction industry has also driven up the demand for sand and gravel, usually mined from upstream river beds in the dry season. During the monsoon, the loosened sediments are transported downstream, which elevate the beds of river, causing them to meander and flood.[6]

The 2017 flood spanned the entire breadth of the country. A total of 35 districts were affected of which 18 of them severely (see Figure 1). More than 190,000 houses were destroyed or partially damaged, displacing tens of thousands of people and rendering many homeless. Household assets and food grains were damaged and the affected communities faced shortage of food, water and non-food items. Many suffered infections from contaminated water.

In comparison to the past floods in 2001 and 2008, which killed 1,673 people, the 2017 floods saw reduced mortality and injuries. The number of people who died in the 18 most affected districts was 134 of which 44 were female. The districts where most of the deaths occurred are as follows: Rautahat, Morang, Jhapa and Sarlahi.[7] The number of recorded injuries caused by the floods this year was only 22. In the severely affected 18 districts, the floods affected a total of around 1.7 million people (866,993 male and 821,480 female).[8]

TABLE 0.1: NUMBER OF DEATHS, INJURIES AND AFFECTED POPULATION IN 18 SEVERELY AFFECTED DISTRICTS

District	Affecte Population		
	Male	Female	Total
Banke	25,705.00	26,732.00	52,437.00
Bara	6,306.00	7,257.00	13,563.00
Bardiya	66,015.00	68,789.00	134,804.00
Chitwan	10,820.00	11,490.00	22,310.00
Dang	2,089.00	2,131.00	4,220.00
Dhanusha	34,140.00	34,830.00	68,970.00
Jhapa	12,228.00	12,752.00	24,980.00
Kailali	7,640.00	7,795.00	15,435.00
Mahottari	100,567.00	99,433.00	200,000.00
Makwanpur	5,485.00	5,595.00	11,080.00
Morang	11,523.00	12,054.00	23,577.00
Nawalparasi	3,193.00	3,257.00	6,450.00
Parsa	19,835.00	20,235.00	40,070.00
Rautahat	131,910.57	134,575.43	266,486.00
Saptari	353,279.00	295,666.00	648,945.00
Sarlahi	10,195.00	11,445.00	21,640.00
Siraha	28,858.00	29,442.00	58,300.00
Sunsari	37,205.00	38,002.00	75,207.00
Total	**866,993.57**	**821,480.43**	**1688,474.00**

District	Death		Injured	
	Male	Female	Male	Female
Banke	3	5	0	0
Bara	2	1	1	0
Bardiya	3	1	4	2
Chitwan	3	2	0	0
Dang	5	2	2	1
Dhanusha	3	0	0	1
Jhapa	11	5	0	0
Kailali	0	1	0	0
Mahottari	6	3	0	0
Makwanpur	4	3	2	2
Morang	11	5	1	0
Nawalparasi	2	0	0	0
Parsa	5	1	0	0
Rautahat	13	5	0	2
Saptari	4	0	0	0
Sarlahi	11	2	0	0
Siraha	0	0	0	0
Sunsari	4	8	3	1
Total	**90**	**44**	**13**	**9**

Source: MOHA, Initial Rapid Assessment, 20 August 2017

[5] Dixit et al. (2013). "Flood Disaster Impacts and Responses in Nepal Terai's Marginalized Basins."
[6] Gill, Peter and Bhola Paswan (2017). "Flood devastate Nepal's Southern Plains." *The Diplomat.*
[7] MoHA, August 2017
[8] Nepal Red Cross Society, 2017

Emergency Response

Immediately following the floods, the Government of Nepal activated the Humanitarian Cluster System, resulting in efficient coordination and immediate response to the needs emerging in the affected communities. The government mobilized 27,000 security personnel and civil servants to support relief efforts. It undertook more than 100 helicopter flights to rescue the stranded and injured and deliver aid. The government mobilized its emergency stockpile to meet the needs and allocated over USD 11.5 million toward first-phase relief activities.[9] A cash-based distribution was also launched with NPR 70 per person per day for the severely affected people for 30 days.

Other responses included immediate humanitarian assistance from the UN System, IFRC, Red Cross, non-governmental groups and development partners. The UN's Central Emergency Response Fund allocated USD 4.8 million to flood response efforts in Nepal. Donors provided additional support to relief operations. National Red Cross societies from Australia, Bulgaria, Japan, and Korea provided funding to the IFRC. ECHO, Italy, and Canada also contributed resources. Additional contributions, including from the Governments of France and Australia, exceeded USD1.75 million.

The affected people tried to cope with the situation. Many families were evacuated from their homes and moved to community centers. As houses were damaged on a large scale, households faced a pressing need for emergency shelter, for which schools were used extensively. The displaced population and a portion of the affected also needed basic household items, as these were lost or damaged. Local administration, UN Agencies and NGOs distributed tarpaulins, blankets and other relief items.

In many areas, the families also coped with disrupted water supplies and poor sanitation facilities. Providing for safe drinking water and household toilets were among the most important priorities. As standing crops, seed stock, farm tools were badly affected, households needed immediate support for resuming agriculture. Food and income are the core challenges at the household level, and any assistance towards meeting these needs would help revive the economy.

Assessment Objectives and Methodology

The objective of the Assessment is to estimate the impact of the 2017 floods that affected the Terai region and to identify medium-term recovery needs. The Assessment of disaster effects and recovery needs is led by the National Planning Commission (NPC) in close coordination with the Ministry of Home Affairs (MOHA) and other line ministries. A core team of NPC and focal points from the respective line ministries undertook the Assessment under the leadership of the Vice Chair of the National Planning Commission. The World Bank and UNDP provided technical assistance.

The Assessment covers 18 most affected districts and nine sectors based on the disaster effects data reported by the ministries. The Initial Rapid Assessment (IRA) was undertaken from 14 to 20 August 2017 under the leadership of MoHA; sector specific assessments were done by the line ministries.

The nine most affected sectors are grouped as follows:

- Social Sector: i) Housing; ii) Health; and iii) Education
- Productive Sector: i) Agriculture; ii) Livestock; and iii) Irrigation
- Infrastructure Sector: i) Transport; ii) Water and Sanitation; and iii) Energy

With data collected through field offices, sector teams evaluated disaster effects and impacts in each sector to determine overall recovery needs. The ministries presented the cost estimates of these recovery needs. The total cost of recovery, which includes the cost of reconstruction of destroyed assets, was calculated by aggregating the cost of recovery needs of all sectors including risk reduction measures.

An overarching strategy has been prepared for the recovery programme covering all sectors. In view of poverty and vulnerability that characterizes the life of people in the Terai region, a Resilience Framework has also been developed. The framework presents a long-term approach to reducing risks and vulnerabilities in this risk-prone region.

[9] UN SitRep, 13 September 2017

Development Impact

The total damage caused by the floods is NPR 60,716.6 (USD 584.7) million, which almost amounts to 3 percent of Nepal's GDP. The household sector accounts for the largest share of damages as many homes and standing crops were damaged. Income losses were not significant, and much of the costs were incurred by private housing stock. This will, therefore, have a low level of direct impact on the annual output of the national economy. As the cost of recovery will be phased over two to three years, the fiscal burden placed by the recovery programme is manageable. We expect the government's regular investments to fund the social and public components of the recovery, resulting in renewal of housing stock and the region to be more resilient to future floods.

The floods will, however, have a larger impact on the local economy as a result of extensive damage to rural infrastructure in the Terai region. If not supported through recovery and reconstruction, the frequent occurrence of floods will increase regional disparity in Nepal. The difference in income and access to basic services will widen between people living in the Terai and other parts of the country. Some of the affected districts are already among those scoring the lowest on the Human Development Index (HDI).

In Nepal, the percentage of population living below the poverty line is higher in the Terai region than in the hills. The economy in the Terai is much less diversified, and more than 70 percent of the people depend on subsistence farming. Further, households in the region are larger in size with smaller landholdings. A slow rate of growth in the agriculture sector has not helped people rise above the poverty level, fueling an epic scale of temporary out-migration over the past decade. At the household level, food insecurity and poor nutrition are major concerns. Damage to houses and destruction of standing crops will pose serious problems for these households.

Damages and Recovery Needs

DISASTER EFFECTS

Based on the assessment of nine sectors, the total damage and losses caused by the floods have been estimated at NPR 60,716.6 (USD 584.7 million). It does not include personal household losses. While most of the important assets in the public and private sector have been included, the damage to small-scale community infrastructure has not been costed.

RECOVERY NEEDS[10]

The total recovery need is estimated at NPR 73,224.8 (USD 705.1) million. Although the cost of the recovery appears to be high, a care-

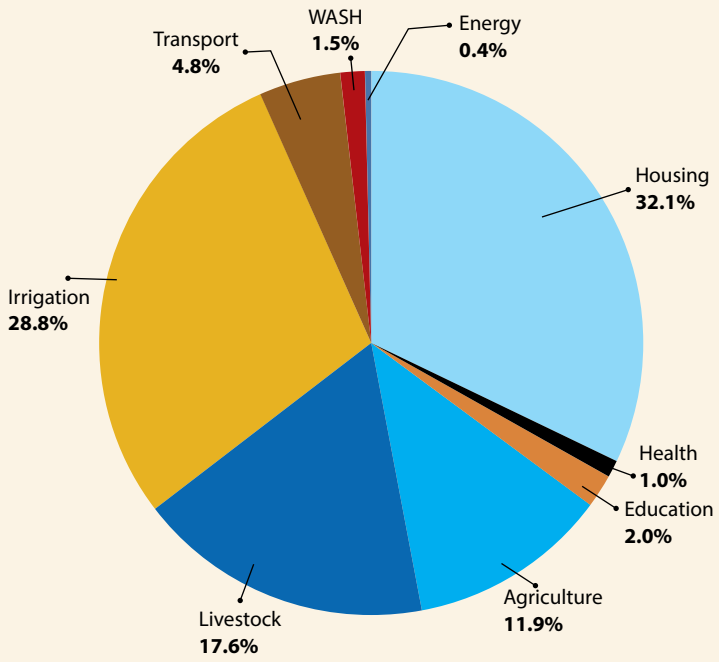
TABLE 0.2. SUMMARY OF DISASTER EFFECTS*

Sectors	Damages Total (NPR million)	Total (USD million)
Social Sectors		
Housing	19,512.7	187.9
Health	620	6
Education	1,193.8	11.5
Productive Sectors		
Agriculture	7,213.8	69.5
Livestock	10,670.4	102.7
Irrigation	17,460.1	168.1
Infrastructure Sectors		
Transport	2,937.8	28.3
Water and Sanitation	887.7	8.5
Energy	220.3	2.12
Total	**60,716.6**	**584.7**

Source: Line ministries
**Represent the priority sectors where damages and recovery needs are reported*
Note: Conversion rate of USD 1 = NPR 103.85

[10] Recovery needs are determined by four components: (i) the reconstruction of damaged infrastructure and physical assets; (ii) the resumption of production, service delivery and access to goods and services; (iii) the restoration of governance and decision-making processes; and (iv) the reduction of risks.

FIGURE 1. DISASTER EFFECTS ACROSS SECTORS



ful planning of the recovery programme would ensure that the recovery programme is fiscally prudent.

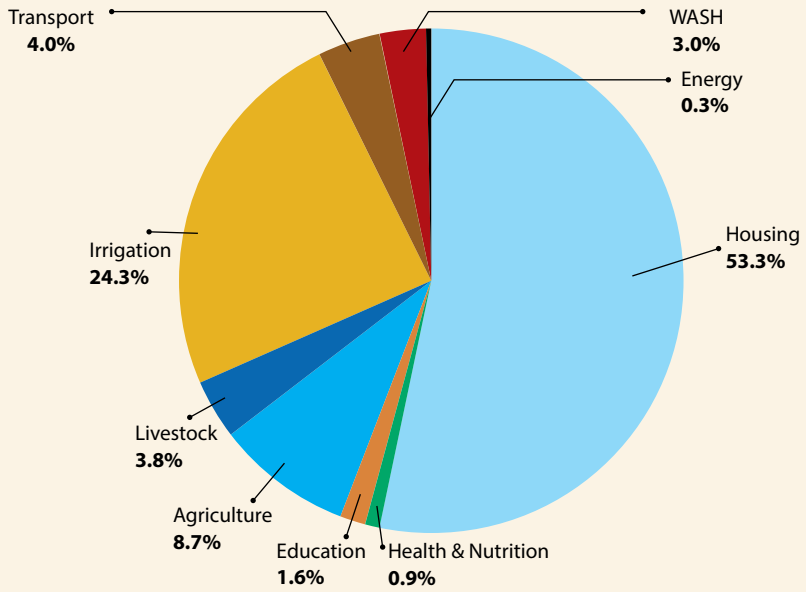
Recovery is not just a government responsibility. It is important that the programme becomes a collective effort of all stakeholders, the most important ally being the households themselves. Resources are also expected from development partners, NGOs and the private sector. A recovery programme with an earmarked budget is a clear demonstration of the government's commitment to the peoples' recovery. A recovery programme based on a systematic assessment of

TABLE 0.3. SUMMARY OF TOTAL RECOVERY NEEDS

Sectors	Total Needs (NPR million)	Total Needs (USD million)	Share of Recovery Needs by Sector (%)
Social Sectors			
Housing	39,025.5	375.8	53.3
Health & Nutrition	680	6.5	0.9
Education	1193.8	11.5	1.6
Productive Sectors			
Agriculture	6,394.8	61.6	8.7
Livestock	2,792.4	26.9	3.8
Irrigation	17,789.2	168.1	24.3
Infrastructure Sector			
Transport	2,937.8	28.3	4.0
Water and Sanitation	2,169	20.9	3.0
Energy	242.3	2.33	0.3
Total	**73,244.8**	**705.1**	**100**

Source: Line ministries

FIGURE 2. RECOVERY NEEDS ACROSS SECTORS



damages and recovery would inspire confidence both in the intention and competence of the Nepali state.

The following chapter presents a detailed analysis of disaster effects and recovery needs. This is followed by the Recovery Strategy to be implemented in the immediate, medium and long-term within a span of three years. Part II of this report proposes the resilience framework to address the underlying vulnerabilities and risks that exist in the Terai region. A comprehensive recovery approach that helps the most affected and vulnerable recover from the recent floods is crucial to ensuring that Nepal remains on track to achieving the Sustainable Development Goals (SDGs).

PART I

DISASTER EFFECTS AND RECOVERY NEEDS

Photo by: Prakash Chandra Timilisena/ Kantipur

SOCIAL SECTOR

Photo by: Seeta Giri/UNDP Nepal

I. Housing and Human Settlements

The 2017 floods completely destroyed 41,626 houses and partially damaged 150,510 houses. The district of Rautahat reported 16,145 houses as fully destroyed, the highest among all the 18 severely affected districts. According to the Annual Household Survey 2014-15, more than 85 percent of people live in their own homes. In rural areas, this share is about 95 percent. The house is considered an independent free-standing structure, which includes one or more rooms or space, usually enclosed by walls that extend from the foundation to the roof. In the Terai region, houses are designed and constructed primarily for residential purposes; however, these are also used for agricultural and commercial ends.

The size of the houses varies according to the economic clout of families. About 20 percent of households live in 1 or 2 rooms; about two-thirds of the families have 3 to 6 rooms. Rural houses in Nepal are mainly constructed with wooden pillars buttressed on mud bonded foundations. The roof material ranges from tiles or straw/thatch to galvanized/corrugated iron sheets. Concrete roofing is also becoming popular, with almost one fourth of all houses having such roofs.

Floods affect mud or brick houses much more than concrete houses. However, the damage to the houses would depend upon the level and duration of inundation. While MoHA has conducted a preliminary survey of partially and completely damaged houses, the criteria underlying the classification of damages need to be made clearer. A detailed technical survey will need to be commissioned and completed before the next monsoon.

1.1. Disaster Effects

According to the Department of Urban Development and Building Construction (DUDBC) and the government's flagship housing project for low-income families (Janata Aawas), the minimum size of a decent shelter is taken as 324 sq. feet. Approximately 30 percent of the construction cost is apportioned for repair and retrofitting of partially damaged houses. The average cost of construction in the Terai region is taken as NPR 694 per sq. ft. Based on this methodology and data on the total number of fully destroyed and partially damaged houses, the total damages incurred by the housing sector is estimated at NPR. 19,512.7 (USD 187.9) million.

TABLE 1.1: SUMMARY OF DAMAGES

	Disaster Effects	
	Number	Damages
Fully Destroyed	41,626	9,359.9
Partially Damaged	150,510	10,152.8
Total (NPR million)		**19,512.7**
Total (USD million)		**187.9**

1.2. Recovery Needs

On September 18, 2017, the Cabinet decided to entrust post-floods housing construction to the National Reconstruction Authority (NRA) along with the DUDBC. The government assigned NRA and DUDBC to come up with appropriate housing designs in six months addressing the flood affected districts with required budget and allocate necessary technical workforce to be presented to the District Disaster Relief Committee (DDRC).[11]

A detailed survey of all damaged houses now is all the more essential. Damaged houses will be reconstructed through an owner-driven process. The government will provide some assistance (not on a replacement basis) to act as a catalyst for the process of reconstruction. With the increasing impact of climate change, floods are likely to occur frequently in Nepal. There will always be housing damage on a significant scale. Thus, the government policy regarding recovery assistance for housing damage will be guided by considerations for fiscal sustainability. While NRA is entrusted with the responsibility of reconstruction in flood-affected areas as well, the assistance for reconstruction will be similar, but not identical, to the earthquake recovery programme.

[11] MoHA (2017) at http://drrportal.gov.np/uploads/document/1100.pdf

Photo by: Seeta Giri/UNDP Nepal

The total housing recovery cost is estimated at NPR. 39,025.5 (USD 375.8) million. This includes the damage and costs for improved specifications for disaster resilient homes. The existing practice for low-income housing (Janata Aawas) uses a benchmark space requirement of 324 sq. feet. The approved cost for a modest housing structure with improved specifications stands at NPR 1,388 per sq. ft. Based on the size of houses, approximately 30 percent of the reconstruction cost is taken as recovery cost for partially damaged houses. Using this assumption, the cost of reconstruction with improved specifications per house is estimated at NPR 449,712 and recovery needs for partially damaged house is NPR 134,913.6.

TABLE 1.2: SUMMARY OF RECOVERY NEEDS

	Number	Recovery Needs
Fully Destroyed	41,626	18,719.7
Partially Damaged	150,510	20,305.8
Total (NPR million)		**39,025.5**
Total (USD million)		**375.8**

A thorough assessment of the magnitude and severity of damage to houses will need to be undertaken to categorize and enlist beneficiaries for housing reconstruction. A two-year housing reconstruction programme could be developed for people whose houses are completely damaged. The government would provide assistance by organizing the services of engineers, masons, and building materials for reconstruction, as it is being done for the earthquake-affected population. It would seek the assistance of relevant NGOs for providing such assistance. The total assistance would be released to the affected people in two tranches, linked to the progress of house reconstruction. Lessons learned from the post-earthquake housing reconstruction will be incorporated during implementation to avoid delays in reconstruction.

The quality of housing is an important indicator of vulnerability. People tend to be less vulnerable if the houses are safely located and properly built. The objective of housing reconstruction is to help people improve their living space and reduce vulnerability. Along with the design and construction of the houses, the sites become important. Houses should not be in low-lying areas. Similarly, houses should not be constructed on river beds, or close to river channels. In some villages, small walls or other flood protection structures could be established to protect houses against floods.

House-owners should raise the plinth of houses so that the water does not enter their houses during floods. In addition, house-owners should also include earthquake-resistant features such as concrete foundation, bands at the plinth, corner and roof levels to reinforce their houses since the Terai region also has a high level of seismic risks. Risk reduction should be an important feature of the process of reconstruction. This process should take into consideration the needs of the more vulnerable groups such as elderly people, widows, women-headed households and people with disabilities. Many of these groups would find it difficult to contribute to the reconstruction of their own house.

II. Health and Nutrition

The Ministry of Health (MoH) has developed a central Rapid Response Team (RRT), Regional RRT and District RRT under the leadership of the Epidemiology and Disease Control Division (EDCD), Regional Health Directorate and District Health Office/District Public Health Office respectively. In some districts, community RRTs were formed based on vulnerability and needs. During the 2015 earthquake, this institution played an important role in delivering the health sector response. In the recent floods, response from the central level was immediate and effective both to build local capacity and support for the local response. MoH formed five RRTs and deployed them in the affected districts on 14 August 2017.

In 2013, as part of disaster preparedness, the Ministry of Health (MoH) set up a Health Emergency Operation Center (HEOC) in its premises with support from the World Health Organization and other development partners. Its purpose has been to serve as a central command and control facility for effective administration of emergency preparedness and disaster management in any emergency related to health. The HEOC Steering committee is chaired by the Secretary of Health and the Technical committee chaired by Chief of Curative Service Division (CSD). These committees are operational and active. A disaster management committee is formed under the Department of Health Services (DoHS) for the overall management of health hazard and vulnerabilities of flood and landslide affected population.

The following were some of the important activities organized by the RRTs:

1. Health camps in more than 15 districts, catering to 50,770 beneficiaries;
2. Dissemination of health awareness messages through print and audio-visual media;
3. Coordination with other sectors for activities related to nutrition and sanitation and distribution of emergency items such as dignity kits.

To document and disseminate health sector response to the floods, 20 situation reports were published by the Disaster Management Section under EDCD from 14 August to 16 September 2017. In addition, a hotline was established at the EDCD to facilitate response to the affected, with dedicated staff assigned to attend to calls throughout the day. The EDCD also coordinated with relevant agencies to address issues raised by the callers.

2.1. Disaster Effects

A total of 99 health facilities were damaged of which 5 were fully destroyed and 94 partially damaged in Banke, Dhanusha, Jhapa, Mahottari, Morang, Parsa, Rautahat, Saptari and Sarlahi districts. The damage included losses of essential drugs, equipment and non-consumables. Total monetary value of damages incurred by the health sector to the floods was estimated at NPR 620 (USD 6) million.

TABLE 2.1: SUMMARY OF DAMAGES

	Disaster Effects	
	Number	Damages
Health Facilities fully destroyed	5	150
Health Facilities partially damaged	94	470
Total (NPR million)		**620**
Total (USD million)		**6**

2.2. Recovery Needs

TABLE 2.2: SUMMARY OF RECOVERY NEEDS

Health sub-sector	Financial Year			Total
	2017-18	2018-19	2019-20	
Recovery activities				
Planning of reconstruction	10			10
Replenishment of stocks	15			15
Training and quality control	10	10	10	30
Reconstruction activities				
Reconstruction of facilities	50	50	50	150
Repair of facilities	470			470
Long term needs (resilience)		3	2	5
Total (NPR million)	**555**	**63**	**62**	**680**
Total (USD million)				**6.5**

The Department of Health Services will further assess the losses in greater detail. They will replenish the lost stock of medicines and consumables and damaged equipment and rebuild dam-

Photo by: Seeta Giri/UNDP Nepal

aged health facilities and maintain the ones that are partially damaged. Immediate repair and maintenance of partially damaged facilities will be completed in the first year while reconstruction of the fully destroyed facilities will follow in the next two years. Reconstruction will focus on constructing flood resilient structures.

Regular monitoring and evaluation will need to be conducted for recovery efforts by the MoH. A dedicated fund for post-floods medical care and treatment need to be established for the population who still require medical assistance. According to a recent UN report, there are districts which require supplementary food for management of moderate acute malnutrition (MAM) in children and nutrition supplementation for pregnant and lactating women. This will be exacerbated in post flood conditions. There is already a major shortfall of therapeutic food to treat 15,000 cases of severe acute malnutrition (SAM). To verify this, the MoH will conduct a post flood surveillance to understand medical and nutrition need for all flood affected districts to gather evidence for enhanced support. MoH will liaise with relevant partners for support in this arena.

LONG-TERM NEEDS

The Ministry of Health has proposed the following activities that are needed and should be tested in future floods:

- An incident management system, with Standard Operating Procedures (SOPs), defining roles and responsibilities of all central bodies, institutions and sub-national governments;
- Emergency preparedness plans to be developed by every sub-national health facilities in consultation and support from MOH;
- Provision of emergency funds to ensure effective team mobilization and initiation of first responses and recovery activities;
- Provision/allocation of means of transportation for rapid movement of manpower and materials from Kathmandu and provincial headquarters to the affected areas;
- Medical warehouses at the local level to be re-organized and properly managed ensuring availability at all times of life saving essential drugs and provisions;
- Close coordination between WASH and Health clusters, especially for distribution of WASH items;
- Assessment forms, including for syndromic diseases, to be readily available;
- Vulnerable groups (children, pregnant women, elderly people, malnourished people and people who are ill or immune-compromised) to be prioritized during response/recovery interventions;
- Additional capacity to deal with water and vector borne diseases.

III. Education

Education is one of the most important social sectors in Nepal, with the Ministry of Education (MoE) being the largest ministry of the government. It consists of pre-primary (ECED), school, technical and vocational education and training (TVET) and higher education subsectors.

The Government of Nepal has paid considerable attention to school safety. It has retrofitted 160 school buildings, none of which experienced damage due to the 2015 earthquake. The school safety programme will need to be expanded to the Terai region. Students should be sensitized about floods and landslides. Disaster risk management awareness should be made part of the school curriculum.

Flood-related damages include buildings, teaching materials including text books, classrooms, toilet facilities and drinking water facilities. The net value of total damages to the education sector is estimated at NPR 1,193.8 (USD11.5) million at pre-disaster prices. The following is the summary estimates of the disaster effects in the education sector.

3.1. Disaster Effects

TABLE 3.1: SUMMARY OF DAMAGES

	Disaster Effects
	Damages
Text Books	47.8
Materials	16.6
School Buildings	538.9
Class Rooms	189.9
Toilet Facilities	97
Drinking Water	162.6
Walls	141
Total (NPR million)	**1,193.8**
Total (USD million)	**11.5**

TABLE 3.2: SUMMARY OF RECOVERY NEEDS

	Financial Year		
	2017-18	2018-19	Total
Recovery activities			
Textbooks	47.8		47.8
Materials	16.6		16.6
Reconstruction activities			
Schools Buildings	269.4	269.4	538.9
Classrooms	94.9	94.9	189.9
Toilet	48.5	48.5	97
Drinking water	81.3	81.3	162.6
Walls	70.5	70.5	141
Total (NPR million)	**629.1**	**564.7**	**1,193.8**
Total (USD million)	**6.06**	**5.44**	**11.5**

3.2. Recovery Needs

All schools need to be repaired or reconstructed immediately through a special unit at MoE. It has gained substantial experience and lessons from the school reconstruction programme under the Earthquake Recovery and will ensure these lessons are applied for the post-flood reconstruction. In cases where some of the schools or classrooms are damaged beyond repair, MOE proposes to provide temporary space to resume classes. MoE plans to undertake a detailed structural assessment of all damaged school buildings, and prepare estimates for their repairs and reconstruction on the existing sites or in a safer location as appropriate. The Ministry will prepare detailed design of school buildings, which will include hazard-resistant features.

In addition, it is recommended that resources be allocated for purchasing textbooks and other educational materials for those students who have lost them in the floods and families are unable to support these. Replacing equipment and furniture are some of the other recovery needs that MoE will pursue through immediate procurement. Apart from reconstruction of educa-

Photo by: Samir Jung Thapa/UNICEF

tional infrastructure, the Ministry will sensitize teachers and children about floods, landslides and earthquakes and related preparedness. The teachers and students will be made aware of mitigation measures for such disasters with its inclusion in the school curriculum.

The recovery programme is planned to be implemented over a period of two years. During the first six months the partially damaged schools will be repaired, and school services will be resumed as soon as possible. In the period beyond six months, the Ministry will focus on reconstruction of all the schools and classrooms damaged completely by floods.

PRODUCTIVE SECTOR

IV. Agriculture

Monsoons determine a large share of agricultural productivity in Nepal. During June and July this year, the country faced prolonged drought in the Terai which affected regular transplanting of paddy in major production clusters. The drought was followed by severe flooding and water logging, which affected agricultural production and livelihoods of thousands of farmers. Most of them live on subsistence. In recent times, there is an increasing trend towards growing cash crops such as sugarcane, oilseeds, tobacco and potatoes. Nevertheless, rice continues to be the most important crop of the region, and its production contributes directly to the income and consumption of farmers.

4.1. Disaster Effects

The agriculture sector faced substantial damages from the floods this year. The total damage has been estimated at NPR 7,213 (USD 69.5) million. The unit price calculated for damage estimation differs based on commodity. The Ministry of Agriculture Development (MoAD) has established the cost of paddy grain at NPR 20/kg; vegetables at NPR 27/kg; fish at NPR 110/kg and corn at NPR 18/kg. The total damage was determined based on these established unit prices.

TABLE 4.1: SUMMARY OF DAMAGES

	Disaster Effects	
	Areas Affected (HA)	Damage
Paddy	126,282	1,727.6
Vegetables	8,950	1,286.8
Fish	4,260	1,549.2
Corn	2,567	133.5
Pulse	1,725	110
Other crops (banana, sugarcane, turmeric, almonds etc.)	940	1041.8
Other MoAD assets (offices, godowns, seed banks, equipment etc.)		1,365
Total (NPR million)		**7,213.8**
Total (USD million)		**69.5**

TABLE 4.2: SUMMARY OF RECOVERY NEEDS

	Financial Year			Total
	2017-18	2018-19	2019-20	
Recovery Activities				
Supply of agriculture inputs	2741.6			2741.6
Supply of fishery inputs	579.9			579.9
Reconstruction Activities				
Replacement of agriculture inputs/tools/ machineries	698.3			698.3
Reconstruction of agricultural infrastructures	731.6	548.7	548.7	1,829
Reconstruction of damaged assets		546		546
Total (NPR million)	**4750.8**	**1,094.7**	**548.7**	**6,394.8**
Total (USD million)	**45.7**	**10.5**	**5.3**	**61.6**

4.2. Recovery Needs

The total recovery need for the agriculture sector has been estimated at NPR 6,394.8 (USD 61.6) million. The following needs have been included in the above estimated recovery plan of the sector:

- Supply of agriculture inputs and fishery inputs in the short term;
- Replacement of agriculture inputs and tools (including hermetic bags, cocoon bags, seed bins for storage purpose and pump sets for irrigation purpose) considered as short-term needs;
- Some reconstruction activities such as market sheds, small irrigation projects etc. that are needed urgently are addressed this year as medium term; and,
- Reconstruction of damaged assets will be addressed in the next two years as long term.

Similar to the post-earthquake housing reconstruction system, it is recommended that the flood affected families receive direct transfer of cash assistance through bank accounts. In addition to cash, the affected farmers should be provided with agricultural seeds, fertilizers and pesticides. A detailed database of all the farmers

Photo by: Seeta Giri/UNDP Nepal

assisted after the floods should be prepared for monitoring of assistance and impact.

As agriculture is becoming more risk-prone, farmers will need to be encouraged to diversify their agricultural practices. Alternative cash crops should be promoted in the region. Furthermore, interested farmers may also be encouraged to engage in non-farm activities for supplementing their income. When agriculture is the sole source of income, livelihoods are fraught with serious risks, given the fluctuating patterns of rainfall and weather conditions.

The Government of Nepal has launched crop and livestock insurance schemes. These will be promoted in the flood prone region to minimize financial risks for the farmers. With more farmers joining the insurance scheme, agriculture and cattle insurance would become more viable. Encouraging insurance among the farmers is an important means of reducing risks in the agriculture sector.

In Nepal, especially in the rural areas, agriculture has been feminized. Many women-headed households are engaged in agriculture. These women farmers need to be supported through better agriculture extension services including labour saving equipment. A targeted package of assistance should be implemented for women farmers.

Photo by: Gajendra Shrestha/World Bank

V. Livestock

The livestock sector contributes significantly to the national economy. Agriculture accounts for nearly 30 percent of national GDP to which the livestock sector contributes about one third. It can be said that it is the backbone of the rural economy. Up to 80 percent of the rural people are still engaged in livestock farming, thus generating rural employment. Earlier, the livestock sector was perceived only as a means of livelihoods of poor farmers but over the past few years, it has become much more lucrative.

Occasionally, natural disasters have hindered the growth of the livestock sector. This year's monsoon-triggered floods claimed a huge number of livestock in the Terai districts. This resulted in severe diminution in production. After the floods, the Ministry of Livestock Development (MoLD) released NPR 5 million to 21 districts for disposal of carcasses, procurement of feed, disinfectants and temporary shelter for cattle.

5.1. Disaster Effects

The details of direct damage and indirect loss of livestock are presented in the table below. The damage and loss for the livestock sector has been calculated based on the data collected by MoLD. This sector has been severely affected as is evident from the damage and loss of poultry, cattle and fisheries. The total monetary value of damage and loss due to the flood is estimated at NPR 10,670.4 (USD 102.7) million. It was noticed that most damage was caused to pens and cow sheds (22 percent of total damage cost) while poultry farming incurred the damage cost of up to 30 percent of the total.

5.2. Recovery Needs

The total recovery needs in the livestock sector is estimated at NPR 2,792.45 (USD 26.9) million. The Ministry of Livestock Development is the main government agency responsible for this sector. The fund for immediate recovery activities will be disbursed during the first year. Reconstruction of farm animal sheds and replacement will be undertaken in the next two years.

The total recovery cost for the livestock sector has been estimated at NPR 2,784.4 (USD 26.9) million. The sector has identified the following activities as priorities:

Proposed short term recovery activities include

- Feed and forage management;
- Medicine supply and vaccines;
- Animal health camp;
- Temporary shed, tent and tarpaulin;
- Restocking of livestock and poultry;
- Mass vaccination for communicable diseases;
- Vaccine supply, stockpiling of logistics.

Long term recovery activities include

- Support for construction of improved sheds (flood resistant design);
- Rehabilitation of the affected subsistence based farming;
- Rehabilitation of commercial livestock industry;
- Arrangement of soft loan and insurance for affected farmers;
- Packaged programs to revive livestock businesses;
- Contingency plan for disaster management for relief and rescue in the livestock sector.

TABLE 5.1: SUMMARY OF DAMAGE AND LOSS

	Disaster Effects			
	Number	Damages	Losses	Total
Poultry	812,850	406.4	914	1,320.4
Cattle and other animals	9,429	212.2	7,296	7,508.2
Pen and cowshed	74,335	557.6	0	557.6
Farm feeds		4.2	0	4.2
Straw forage		1,280		1,280
Total (NPR million)		**2,460.4**	**8,210**	**10,670.4**
Total (USD million)		**23.7**	**79**	**102.7**

TABLE 5.2: SUMMARY OF RECOVERY NEEDS

		Financial Year			
		2017-18	2018-19	2019-20	Total
A	*Recovery Activities*				
1	Shelter for affected livestock	8	0		8
2	Feed and forages	1,010	0		1,010
3	Animal health management	15.1	0		15.1
4	Information and communications	3.2	0		3.2
5	Medicines and vaccines	0	48.7	48.7	97.5
6	Equipment and other supplies	0	48.7	48.7	97.5
7	Restocking of cattle/buffalo	0	500		500
8	Restocking of goat	0	300		300
9	Restocking of pig	0	75		75
10	Restocking of poultry	0	40		40
11	Replacement of cattle feed	0	50		50
12	Replacement of goat feed	0	30		30
13	Replacement of pig feed	0	12.5		12.5
14	Replacement of poultry feed	0	7.5		7.5
15	Contingency costs (costs for transportation, monitoring, etc.)	30	26.8	26.8	83.6
B	*Reconstruction Activities*				
1	Construction of cattle/buffalo shed	50	200		250
2	Construction of goat shed	50	100		150
3	Construction of pig shed	18.8	18.7		37.5
4	Construction of poultry coop	0	25		25
	Total (NPR million)	**1,185.1**	**1,482.9**	**124.2**	**2,792.4**
	Total (USD million)				**26.9**

VI. Irrigation

The Government of Nepal has invested a huge amount of resources for irrigated agriculture development and water induced disaster management. Nepal's vision is to initiate and retain demand-driven models and assured participation of users at every stage in the government operated irrigation schemes. The Ministry of Irrigation is responsible for construction, rehabilitation, maintenance and management of irrigation systems as well as the protection of human settlements, pasture and cultivable land and existing development of infrastructure and monuments from water induced disasters.

In the recent past, erratic and high intensity rainfall has frequently been observed due to the impact of climate change. There is loss of human lives and devastation to infrastructure such as irrigation schemes due to unpredicted heavy rainfall. A total of 961 government managed irrigation schemes and river training infrastructures were affected to various degree by the floods. Thus, many farmers have been deprived of irrigation services. Data were collected throughout the flood affected regions to assess the damages and losses. The irrigation sector damage has been estimated at NPR 17,460 (USD 168.1) million.

6.1. Disaster Effects

TABLE 6.1: SUMMARY OF DAMAGE

Subsector	Disaster Effects	
	Number	Damages
Irrigation schemes	961	5,491.7
Damage to River Training Infrastructures		11,968.4
Total (NPR million)		**17,460.1**
Total (USD million)		**168.1**

6.2. Recovery Needs

The total recovery needs is estimated at NPR 17,789.2 (USD 174.4) million. The damaged irrigation and river training infrastructure need to be recovered as early as possible. Due to financial and technical constraints, all the damaged infrastructures cannot be rehabilitated within the first year.

Infrastructure that is minimally damaged will be reconstructed and rehabilitated during the first fiscal year. Infrastructure that is not severely damaged, but has disrupted irrigation significantly will be rehabilitated and reconstructed within two fiscal years. Those infrastructure which are

TABLE 6.2: SUMMARY OF RECOVERY NEEDS

	Financial Year			Total
	2017-18	2018-19	2019-20	
Recovery Activities				
Inventory and design	62.1	63.1	39.3	164.5
Retrofitting guidelines	62.1	63.1	39.3	164.5
Reconstruction Activities				
Reconstruction of irrigation systems	3615	1519.3	357.3	5491.6
Re/construction of River Training Infrastructures	3,599.6	4,791.9	3,576.9	11,968.4
Total (NPR million)	**7,338.9**	**6,437.4**	**4,012.9**	**17,789.2**
Total (USD million)	**71.9**	**63.1**	**39.3**	**174.4**

severely damaged, that need major reconstruction, will be rehabilitated within three fiscal years.

Reconstruction and rehabilitation of damaged infrastructure are only the means for recovery of the livelihoods of the distressed flood affected people. For reconstruction and rehabilitation activities, the people need financial as well as technical support because most of their valuable assets have already been destroyed or damaged. After recovery, the flood affected communities will be able to irrigate their lands and settlements and agricultural land will be protected from future floods and landslides.

The MoI and its provincial offices will be directly involved in the implementation of the damaged infrastructure. The survey, design, estimate and approval of the projects will be based on engineering norms. The beneficiary communities will be encouraged to actively participate in the reconstruction activities.

INFRASTRUCTURE SECTOR

Photo by: Angad Dhakal/Kantipur

VII. Transport

As floods submerged parts of the Terai, damage to roads and bridges has been extensive. The Department of Roads has conducted an evaluation of the damage and provided details of repairs and reconstruction. The existing data need improvement through a detailed survey, with the technical survey including the names of roads damaged by floods in each district, the length of roads damaged, the nature of the damage, the unit cost of road repairs and reconstruction, and the total cost of repairs and reconstruction for each damaged road. Without a detailed survey, the process of reconstruction would be difficult to commence.

The extent of damage would depend upon the number of days the roads were submerged. If the submergence is for a limited period, repairs would be sufficient. However, if the submergence has been for a longer period, the roads need to be paved again.

The Strategic Road Network (SRN) links important cities and towns, commercial centers, main international border crossings in most of the districts. Local roads are also extremely important for linking small towns and villages, and provide mobility for the people living in remote areas. Nepal has the lowest road density in South Asia: 22 percent of the population do not have road access. Maintaining a decent road network is important for economic activities. Roads also contribute to regional integration within the country.

7.1. Disaster Effects

TABLE 7.1: SUMMARY OF DAMAGES

	Disaster Effects
	Damages
Road	2490.1
Bridge	180.7
Culvert	212
Civil Aviation (Biratnagar Airport)	55
Total (NPR million)	**2,937.8**
Total (USD million)	**28.3**

Note: Strategic urban roads are included in Strategic Road Network and the remaining municipal roads are in Local Road Network.

7.2. Recovery Needs

The objective of the recovery strategy is to make all roads functional at the earliest possible. Immediate maintenance of partially damaged roads and bridges must be done within the first six months. Immediately after the floods and following disruption of communications, the

TABLE 7.2: SUMMARY OF RECOVERY NEEDS

	Financial Year		
	2017-18	2018-19	Total
Road Network	673.2	1,816.9	2490.1
Highways and Feeder Roads Repair			
Highways and Feeder Roads Reconstruction			
Bridges	90.35	90.35	180.7
Culverts	106	106	212
Civil Aviation			
Airports (Biratnagar airport repair)	55		55
Total (NPR million)	**924.6**	**2,013.3**	**2937.8**
Total (USD million)			**28.3**

Ministry of Transport along with the support of army personnel and local people identified repair and rehabilitation of critical roads and bridges. These have to be further strengthened and maintained so that these structures can withstand future floods. Larger reconstruction and maintenance will follow through in the subsequent two years. This would require preparation of detailed estimates, contracting process and actual reconstruction. The entire process of reconstruction could exceed more than two years.

The Department of Roads (DoR) and the Department of Local Infrastructure Development and Agriculture Roads (DoLIDAR) are the government agencies responsible for this sector. DoR and DoLIDAR will develop a detailed implementation plan for repairs and reconstruction.

While undertaking repairs and reconstruction, it is necessary that certain risk reduction measures are included. These measures may include improvement of drainage of water and reduction of the level of submergence. For example, the number of culverts and their width may need to be increased so that they can improve water drainage. The length and height of bridges may need to be increased so that more water can pass underneath during heavy monsoon. At certain places, the flanks of roads may need to be covered with tarmac so that erosion is reduced. In the flood-prone plains, the roads need to be planned carefully so that they do not obstruct the natural drainage of rivers and water ways.

VIII. Water, Sanitation and Hygiene

About 80 percent of household access to potable drinking water is through covered wells and tube wells, whose common water source is groundwater. There are about 1.2 million tube wells with hand pumps in the Terai region. In many cases, deep set hand pumps are installed at the community level to avoid iron, manganese and arsenic poisoning. In the past few years, main overhead systems with deep boring have been developed for small communities as an alternative to the arsenic contaminated hand pumps. The government has implemented 100 water supply improvement programs focused on permanent solutions for arsenic affected areas.[12]

Nepal has witnessed social momentum and transformation in the improvement of sanitation, with several village and municipalities being declared open defecation free (ODF). However, out of the 75 districts, only 27 have been declared ODF, of which 4 districts (Bardiya, Dang, Nawalparasi and Chitwan) are located in the Terai region. In terms of sanitation coverage, the Terai region lags behind others. It is important to mention that only 57 percent of the households have access to basic sanitation.[13] This is due to difficulty in constructing latrines, which requires additional flood resistant structure. At the same time people have expectations of subsidies.[14]

8.1. Disaster Effects

TABLE 8.1: SUMMARY OF DAMAGES

	Disaster Effects	
	Number	Damages
Water Supply Schemes	449	467.9
Shallow Tube-wells	142	158.9
Sanitation Facilities	120	218.9
Buildings	26	42
Total (NPR million)		**887.7**
Total (USD million)		**8.5**

8.2. Recovery Needs

The total recovery needs in water sanitation and hygiene sector are estimated at NPR 2,169 (USD 20.9) million.

Short-term recovery activities will build on ongoing emergency work and other committed projects. Priority will be given to:

TABLE 8.2: SUMMARY OF RECOVERY NEEDS

	Financial Year			Total
	2017-18	2018-19	2019-20	
Recovery Activities				
Capacity Building	46	32	2	80
Operations and HR Cost (5%)	62.7	32.8	6.8	102.3
Preparedness Cost (1%)	12.5	6.6	1.4	20.5
Reconstruction Activities				
Recovery of Water Supply Schemes	806	531	132	1,470
Sanitation and Hygiene	327	17	2	346
WASH Institution and Public Places	75	75	0	150
Total (NPR million)	**1,330**	**695**	**14**	**2,169**
Total (USD million)				**20.9**

[12] Ministry of Water Supply and Sanitation (2016). Sector Status Report.
[13] Ministry of Water Supply and Sanitation. Nepal Water Supply, Sanitation and Hygiene Development Plan (2016-2030).
[14] UNICEF (2014). Sanitation for All: All for Sanitation.

- Temporary or provisional repairs and basic rehabilitation of water systems;
- Rebuilding of toilets and hand-washing facilities in households, communities and institutions; and
- Resumption of Open Defecation Free campaign in the affected districts.

The short-term recovery would also include preparatory works for medium and long-term project/programme such as assessment of restoring and strengthening institutional capacity, assessment of rehabilitation of damaged projects, water source protection, revitalization of the WASH coordination structures for programming and preparedness for future disasters

Medium-term recovery activities will be implemented up to July 2019. Priority will be given to:

- Rehabilitation and reconstruction of water supply schemes that would include gravity fed systems, deep well and tube wells;
- Rehabilitation and reconstruction of sanitation facilities;
- Provision of hygiene items and promotion of hygiene behaviour;
- Exploration and promotion of alternative mechanisms and technologies as part of resilience building on water supply at community and district level;
- Continuation of rehabilitating and constructing of new rural and urban water systems.

In addition, identifying future risks of the affected districts regarding WASH services and preparedness for response is felt as mandatory for the districts to reduce losses that were experienced in this flood/landslide.

Long-term recovery activities (beyond July 2019) will be implemented but not limited to year 2020 with focus on the completion of the major reconstruction works initiated in 2018 and 2019 projects. Institutional strengthening in terms of the new federal structures, establishment of robust monitoring and information management mechanisms will be included under the long-term recovery initiatives.

The funds required for immediate repair of water and sanitation systems will be spent in the first year, aimed at restoring the WASH schemes damaged by the floods. The recovery will be indicated through functioning water supply schemes, tube wells and hand pumps. The funds required for rehabilitation and reconstruction of water supply schemes and sanitation facilities along with the promotion of hygiene behaviours will be spent over the next two years. Results of the utilization of these funds will be shown through the spread of latrines, lower rates of diarrheal diseases and reduction in open defecation in the long-term.

WASH recovery and reconstruction will be achieved through the joint effort of the Ministry of Water Supply and Sanitation and (international) non-government organizations. In addition, the recovery process can be successful if the stakeholders concerned work in close coordination with cross-cutting sectors such as health, education and nutrition. The recovery work will need existing capacities of districts affected by floods to be augmented to support the implementation, reduce further risks and be prepared for future shocks. For example, raising the levels of hand pumps, deepening tube-wells, and improving the drainage are some of the important risk reduction measures recommended.

IX. Electricity

This year's flood caused widespread breakdown of communications and electricity infrastructure in the eastern Terai. As some substations were submerged in water, the Nepal Electricity Authority (NEA) had to shut down the Duhabi substation as a safety measure. This resulted in some eastern Terai districts experiencing power outages for more than three days.

Loss of access to electricity has had a severe impact on people's ability to conduct their livelihoods and generate income, especially on households engaged in small and medium scale enterprises. Furthermore, the absence of electricity also had a negative impact on women who use it for productive activities and household work. Without electricity and lighting facilities women face an added risk of violence.

As reported by NEA, the flood damage in the electricity sector included the following components: transmission lines, substations, poles, transformers and conductors in Jhapa, Sunsari, Banke, Dhanusha, Kailali, Makwanpur, Parsa, Rautahat, Bara, Sarlahi, Saptari, Dang and Morang districts.

News media have reported that flood damage in the supply systems has severely hit electricity generation. During the floods, power generation was slashed by 100 MW as debris swept by swollen rivers choked water intake and reduced water flow into the turbines. The national grid lost around 50 MW of electricity from the private hydropower projects. In addition, floods have also had an impact in the electricity generation by NEA-owned projects, especially the 144 MW Kali Gandaki where output dropped by 44 MW.[15] Therefore, a comprehensive technical survey is required to understand the extent of damage of the private and government owned hydropower units.

During the design of hydropower plants, various technical approaches should be considered. One of them is flood data. Long flood return period (minimum 50 years) must be under consideration for no harm in hydro power plants. Likewise, NEA has taken all those technical approaches while designing its hydropower plants. Thus, major deviation and damages have not been noticed during heavy floods in August 2017. At the electricity generation site, no major impact was noted. Debris generated by the floods were immediately cleared and generation of electricity continued. The disruption of electricity access at the household level in some Eastern districts was mainly due to the factors explained above – damage to the transmission and distribution infrastructure.

A summary of damages is presented in the table below. A total of 3,627 poles, 41 transformers and 7 conductors were reported to be damaged. In addition, transmission lines and grids in four divisions were also damaged by the floods. The sector has estimated the total damage at NPR 220.3 (USD 2.1) million.

9.1. Disaster Effects

TABLE 9.1: SUMMARY OF DAMAGES

	Disaster Effects	
	Number	Damage
Pole	3,627	60.7
Transformer	41	74.3
Conductor	7	3.7
Transmission Line	2	40
Grid Divisions	4	41.6
Total (NPR million)		**220.3**
Total (USD million)		**2.1**

[15] Subedi, Bibek (2017). "Heavy flooding hinders electricity generation." The Kathmandu Post, July 11.

TABLE 9.2: SUMMARY OF RECOVERY NEEDS

	Financial Year		Total
	2017-18	2018-19	
Transmission Line	10	34	44
Grid Division	22.9	22.9	45.8
Pole	22.3	44.6	66.9
Transformer	27.2	54.4	81.6
Conductor	2	2	4
Total (NPR million)	**84.4**	**157.9**	**242.3**
Total (USD million)			**2.3**

9.2. Recovery Needs

The total recovery needs for this sector is estimated at NPR 242.3 (USD 2.3) million. The Department of Electricity Development (DoED) and NEA will prepare a detailed implementation plan for repairs and reconstruction. The following initiatives for recovery have been prioritized:

- The NEA will be responsible for the repair and maintenance of the units (pole, grid, transmission line, transformer, conductor) damaged by the flood;
- For a quick restoration of power from damaged transmission lines, new approach of emergency restoration towers (ERS) will be adopted by NEA;
- For the substation design, consideration of flood level data will be taken;
- Transmission line tower design will incorporate a high safety factor.

PART II

APPROACH TO RECOVERY AND RESILIENCE

Photo by: Prakash Chandra Timilsena, Kantipur

I. Recovery Strategy

The August 2017 floods in the Terai affected about 1.7 million people. While the flood affected families are gradually returning to their land and homes, they are in need of support for repair or reconstruction of houses; and support to resume livelihoods and income to meet their family needs. These communities are mostly dependent upon agriculture and related activities, and their income levels are generally low. As floods have severely affected these sectors, the impact on income, consumption and other indicators of well-being are high. The recent floods have exacerbated pre-crisis vulnerabilities of the Terai districts and many of these districts were already impacted by major floods in 2014 and had yet to fully recover.

As medium-term recovery assistance is being mulled and crafted, it is strongly recommended that the directly hit communities, particularly those with completely destroyed homes be assisted with urgency by the central government, before the onset of the winter. An immediate package could consist of the following five elements:

1. Quality of shelter. Assistance in kind could take form of roofing material (like corrugated galvanized iron sheets). Alternatively, direct cash transfer could be an amount that is adequate for now, but deductible from the total lump-sum entitlement during the reconstruction phase.

2. Warm clothing. The affected families must be distributed with warm clothing and blankets. These could either be items already in stock, or the government can issue a lump-sum cash grant for specified purchases.

3. Agricultural inputs. Through MoAD, free seeds and seedlings as well as subsidized fertilizers must be distributed to revive production of cereals and vegetables.

4. Health camps. Through the MoH, and with the engagement of NGOs, special outreach of health services must be organized to stem likely health-related epidemics, offer counseling and re-enforce the provisioning of basic health care.

5. Wood. A moderate quantity of wood could be provided on concessional terms to reduce the drudgery of poor women (and men) engaged in household chores and construction.

a. Balancing Household with Infrastructure Recovery

In the medium-run, households need to be assisted in terms of durable assets and livelihoods. Physical infrastructure will need to be restored and improved. This recovery strategy acknowledges that a good balance in the distribution of recovery assistance between socio-economic recovery and physical recovery is key to the success of overall recovery process. The neglect of household level recovery could have serious implications for worsening poverty.

Physical infrastructure also needs careful reconstruction with improved specifications so that they are resilient to future risks. A continuous exposure of physical infrastructure to floods leads to degradation of these assets. Over the years, roads and bridges provide a reduced level of service and efficiency, affecting all economic activities. It has a serious implication for regional development of the Terai. The physical infrastructure, therefore, needs to be reconstructed with more stringent specifications.

b. Broadening Coverage of Population and Sectors

Those households which have experienced deaths as a result of the floods need to be assisted foremost. While these households received *ex gratia* assistance from the government for the family members who died, there should be additional assistance. Some of the families may have lost income earners, and some financial assistance for their livelihoods would be helpful in getting them back on their feet. The recovery programme should create assets and skills for people affected by the disaster. Creating assets and skills will reduce vulnerability and promote long-term resilience.

Those households who have been rendered homeless should receive assistance for recon-

structing their homes. The assistance may not be on a replacement basis, but it would be meaningful enough to help them mobilize their resources for reconstruction. A uniform assistance for all the households which lost their homes would be a timely support and it will have a positive impact on the affected communities. Those households whose houses are partially damaged should also be given a small lump sum assistance to repair their houses.

Damages to houses caused by floods should not be compared with housing losses caused by the 2015 earthquake. These are two different disasters in terms of the scale of damages, mortality, trauma and recurrence. Floods have a much higher return period, and would always target mud houses more than brick houses. Housing losses are extensive, but they are in no way as destructive as during the earthquake. So, the housing assistance should be determined in a manner that is fiscally sustainable.

While developing the recovery programme, it is extremely important to consider gender equity. Post-disaster recovery provides opportunity to build back better, not only the physical infrastructure but also address deep rooted social inequities. Post flood recovery programme should ensure women-headed households are identified and provided with assistance. There should be a special programme of economic recovery for women to diversify their income opportunities through training.

Though the Assessment does not include the environment sector, there are serious environmental losses, particularly the damage to forest cover. The Terai and Churia regions of the country are also known for their environmental hotspots. The Chitwan National Park, the home of the endangered one-horned rhinoceros as well as the world heritage site, Koshi Tappu Wildlife Reserve (home of the only wild buffalo available in Nepal), Bardia National Park (home of tigers) and Krishnasar Conservation Area (home of the highly endangered blackbucks) located in this region were affected by the floods.

c. Enabling Rapid Recovery

Agriculture is the mainstay of the rural economy in the Terai. The farmers must be assisted as soon as possible to resume their cultivation. An optimal assistance which could lead to replanting other crops would help them. A huge area of agriculture fields close to the rivers that flooded have been covered by sand and may not be suitable for paddy cultivation for some years. Appropriate crops suitable to such soil should be encouraged and supported.

Over 9,429 livestock and 812,850 poultry have been lost during the recent floods resulting in a significant rural impact. If the households can purchase cattle heads and poultry with some government assistance, it would be helpful to these households. Replacement of cattle would also help the local dairy and provide more opportunities for diversification of income opportunities in the region.

Release of financial assistance to home-owners and farmers would encourage local investments and buoy the local economy. It would generate local employment. Channeling assistance through banks would reduce leakages in disbursement and improve financial inclusion. Over a period, building on the past experiences, the government will develop standard and transparent method of delivering recovery assistance, which would be helpful to individual households and the local economy.

Encouraging livelihoods through non-farm activities would reduce people's dependence on agriculture and make them more secure in terms of income and consumption. A component of the recovery programme needs to focus on supporting the affected population for non-farm activities and related skill building programmes. NGOs and private sector entities would be roped in for supporting non-farm livelihood activities.

d. Facilitating Resilient Recovery Through a New Act

The recently enacted Disaster Risk Management Act provides an opportunity for the Government of Nepal to implement the recovery strategy and the resilience framework elaborated in this section. Specifically, the Act provides legal basis for mobilizing relevant stakeholders for implementing the proposed resilience measures to reduce future risks and better prepare for rapid response

and sustainable recovery. The Act empowers local governments in the implementation of disaster risk management and post disaster recovery.

Recovery after the floods is clearly linked to socio-economic development of the Terai region. A failure to assist the process of recovery increases the level of poverty and vulnerability and increase regional disparity within Nepal.

As the Terai region is highly exposed to floods, it is also important to promote an optimal flood management approach along with recovery. A flood management approach recognizes that people need to adapt to floods rather than prevent them. It is about reducing mortality and losses, improving early warning systems, and supporting preparedness and response measures which reduce exposure to flood losses. A resilience approach to flood management as enunciated in the following section would be promoted as an integral part of the recovery programme.

e. Setting up a Recovery Programme

A well-organized recovery programme has been a recent public policy initiative in Nepal, which began with the earthquake recovery. The public policy supporting recovery should continue, though the programme may not be on the same scale. A systematic policy addressing the most urgent recovery needs in the Terai, based on the assessment of damages and losses, should be laid down, and annual allocations made for its implementation.

The total cost of recovery needs is NPR 73,224.8 (USD 705.1) million. The government plans to provide recovery assistance for selected sectors and geographical areas, depending on the impact. The issue of targeting recovery assistance becomes critical. There is a hierarchy of recovery needs, and depending upon the budget, the assistance will be made available for different sectors and segments of the population.

f. Going Beyond Government Recovery

As is the case in any recovery programme, this will not be an exclusively government programme. The government will invite other stakeholders to join the recovery programme. A collective recovery effort pools more expertise and financial resources, and addresses risk and vulnerability in a more comprehensive way. The recovery programme will also involve local stakeholders such as banks, cooperatives and business groups.

Greater participation of the affected people in the recovery programme would be welcome. It would improve the design of the programme, bring more innovation and develop more solutions. Women's participation in the programme would be essential for the overall household recovery. It will also have a great impact on women's empowerment as community leaders and economic actors.

The recovery programme will be implemented effectively in an open, accountable and transparent manner. Major decisions taken with respect to flood recovery will be widely disseminated through public media and other relevant channels as feasible.

g. Implementing the Strategy

It is proposed that the Recovery Programme in the Terai region be implemented as an umbrella programme with several components by the respective line ministries through the respective local governments. This may not require a special institutional arrangement such as the National Reconstruction Authority (NRA), but a dedicated unit or agency, nested either inside the NRA or independently, will be needed for coordination and monitoring of progress.

The capacity of the lead agency and the local government could be expanded through deployment of additional technical experts who may be hired from the market for a time-bound period. To improve tracking of budget and recovery results, the lead agency may set up a monitoring framework for the entire programme and develop a management information system (MIS).

The housing component is recommended to be implemented through the owner-driven modality. Support for livelihoods could be provided through NGOs or those national programmes which focus on the provision of livelihoods. The experiences and lessons of the earthquake recovery programme should inform the flood

recovery programme. Though the Government of Nepal has taken a decision so far not to seek external assistance for flood relief, it remains open to receiving technical assistance for recovery through interested development partners.

A database of the programme beneficiaries will be prepared, and the programme can be evaluated on a concurrent basis to assess the impact on the affected people. The programme can collect information on how it has helped people recover from the impact of floods.

The total budget for the recovery programme is approximately NPR 73,224.8 (USD 705.1) million. The amount is to be spent over a period of three years, 2018 to 2020. Resources available through different windows would be tracked and made public.

One of the ways in which the government will make resources available for recovery is to provide allocations through its regular development programmes. Linkages with these programmes make it easier to allocate resources and implement the programme on the ground.

While the government is the principal supporter of the recovery programme, it must be noted that programme beneficiaries also contribute to their own recovery. In fact, their own contribution always exceeds government assistance. The beneficiaries are never passive recipients, and the government essentially ought to play the role of catalyst.

II. Resilience Framework

The Terai covers the alluvial and fertile plains along the Southern stretch of Nepal and on the northern edge of the Indo-Gangetic belt. It is known as the granary of the nation. The topography of the Terai is almost flat with a gentle slope towards the south.[16] It forms a nearly continuous strip from the east to the west, exception being along the Chitwan and Rapti valleys. Several major rivers of Nepal, originating in the Mahabharata or Siwalik hills, flow through the Terai, making the region prone to floods.

If we take the high mortality caused by the 2015 earthquake as exceptional, it is the floods which cause a maximum number of deaths and extensive damage in Nepal on a regular basis. In terms of the numbers of people affected by all types of natural disasters, the flood is the main disaster affecting 68.3 percent of the total affected people between 1971 to 2007.[17]

In the recent past, floods, landslides and inundation in 2016 caused as many as 102 deaths across 43 districts of Nepal. In 2014, devastating floods that occurred in the Karnali river basin caused 53 deaths and extensive damage. In June 2013, unprecedented rainfall in Uttarakhand State of India and Far-western region of Nepal caused flooding in the Mahakali river, causing heavy loss of life and property in Darchula and Kanchanpur districts. In 2008, the Koshi embankment breach caused one of the largest floods in Nepal's recent history. The floods of 1993 resulted in the death of 1,336 persons. The floods also inundated 60,000 hectares of agricultural land in the Terai and washed away 67 irrigation systems.

The intensity and magnitude of precipitation events in Nepal have increased over the past few decades due to the impact of climate change. Along with the precipitation, risk exposure has also increased. As a result, the larger floods are becoming more frequent, are of longer duration, and have widespread impact. The rising of river beds due to siltation has increased flooding of riverside settlements. As the drainage congestion has increased due to increased settlement and construction, the extent of water- logging has increased, rendering lands uncultivable.

The Terai experiences flooding from three different types of river systems in Nepal as follows:

- Large rivers originating from the Higher Himalayas,
- Medium rivers originating from the Mahabharat Hills, and
- Small rivers originating from the Siwalik and Churia Hills.

The largest four rivers of Nepal -- Koshi, Gandaki, Karnali and Mahakali -- originate from the high Himalayas and carry large discharges. In the Terai, these rivers often cause floods and inundation over a large stretch of land adjoining their banks.

The medium rivers that originate from the Mahabharat hills are the Kankai, Kamala, Bagmati, Tinau, West Rapti and Babai. These rivers experience monsoon discharge of 2,000 cubic meter/sec to 8,000 cubic meter/sec and have caused extensive floods and inundation in the Terai. These rivers widen as they enter into the plains and start meandering after the Bhabar zone.

The small rivers originating from the southern slope of the Churia hills are known as the Churia rivers. The length of these rivers up to the Nepal-India border ranges between 25 km to 85 km. These rivers drain a total of around 18,860 sq. km. consisting of the Churia range and the Terai. The catchment of most individual Chure

[16] Adhikari, B. R. (2013). "Flooding and Inundation in Nepal Terai: Issues and Concerns"
[17] NSET (2007). "Disasters in Nepal." Inventory of Events and Analysis of Impacts (Period Covered 1971-2006)

rivers are generally less than 350 sq. km. As these rivers flow from Nepal to India, they acquire a trans-boundary character.[18] These rivers are numerous and cause local erosion and deposition in the Terai belt. Some of these rivers are: Biring, Ratuwa, Bakraha, Lohendra, Sunsari, Khando, Balan and Gagan, Rato, Jhim, Lakhandehi, Lal Bakiya, Pashaha, Rohini, Banganga, Khutiya, and Dhondha. These rivers have special morphological characteristics that aggravate the flooding and inundation in the Terai.[19]

As the Terai experienced excessive rainfall (more than 400 mm within 24 hours), it led to flooding of the Churia rivers. The entire region is highly degraded because of weak rocks, the high rate of deforestation upstream as well as encroachment in the river beds. There is a high level of soil erosion in the slopes of Churia hills, and when the Churia rivers flow downstream, they carry huge volumes of sediment. Due to the higher sediment load, the bed level of several rivers has risen significantly, causing them to meander through villages and farms. As rivers have lost their carrying capacity, high rainfall in the region leads to sudden rise in the water level, causing flash floods. In general, the run-off duration is less than one day and the flood hydrograph is sharp with high peak discharge.[20]

These rivers are used extensively for irrigation and thus support agriculture, the local economy and livelihoods. Using pumps and wells, the contiguous groundwater aquifers are drawn on to meet drinking and irrigation needs. However, as river levels increase, communities in the Terai live below the river bed, and they get inundated in the rainy seasons. Since a majority of Nepal's agriculture and forestry resources are dependent on the Siwaliks and Terai, climate induced floods are causing significant human and economic devastation.[21]

A draft report on the study of climate and climatic variations over Nepal commissioned by the DHM has the following observations: "The extreme rainfall distribution is quite different from the annual and seasonal distribution. The Siwalik and Terai belts, which generally receive less total seasonal rainfall compared to the middle hills, received the highest 24 hour rainfall. These regions are therefore prone to landslides, flash floods and inundation. Especially the southern parts of the central and western development regions are more prone to such hazards compared to other regions as these regions get high total annual rainfall and the Churia hills in the regions are getting more intensive rainfalls." [22]

It is clear that the Terai region is likely to experience floods almost on a regular basis. It could be both riverine and flash floods. As the drainage congestion in the area increased further due to intensification of settlements close to river beds, the duration of floods will increase, causing heavier damage to agriculture and livestock.

Recovery assistance has not adequately been an integral part of the DRR system in Nepal to date. The government has tended to focus much more on public infrastructure in its recovery efforts: rebuilding roads and bridges, and repairing and upgrading river control and irrigation systems. In the current floods too, households were provided with relief assistance after the floods, which is NPR 10,000 each and NPR 70 per person per day for 30 days. Money was distributed as per the MOHA housing data. For long-term recovery the households generally rely on support from friends and family, and on remittances sent by relatives who migrate to India, Middle-East and other countries for seasonal labour.

In the Terai, the structural measures for flood protection are supported through embankments. On the other side of the border in India, embankments have been constructed all along the rivers. However, these embankments have obstructed natural drainage and made the problem of flood management more difficult. Embankments are often poorly maintained; hence, they frequently breach, inundating large tracts of land. There is also a problem of water from smaller rivers and streams not being able to drain due to embankments along major rivers, causing backflow and aggravating flooding. It is perhaps time to rely less on embankments as

[18] Dixit A. et al. (2007). "Flood Disaster Impact and Responses in Nepal Terai's Marginalised Basins"
[19] Adhikari, B. R. (2013). "Flooding and Inundation in Nepal Terai: Issues and Concerns." *Hydro Nepal*
[20] ibid
[21] Dhakal, S. (2013). "Flood Hazard in Nepal and New Approach of Risk Reduction." *International Journal of Landslide and Environment*
[22] http://www.dhm.gov.np/uploads/climatic/47171194ClimateandClimaticvariabilityofNepal-2015.pdf

flood protection measures and to focus on non-structural measures for flood mitigation which might be more sustainable and cost-effective.

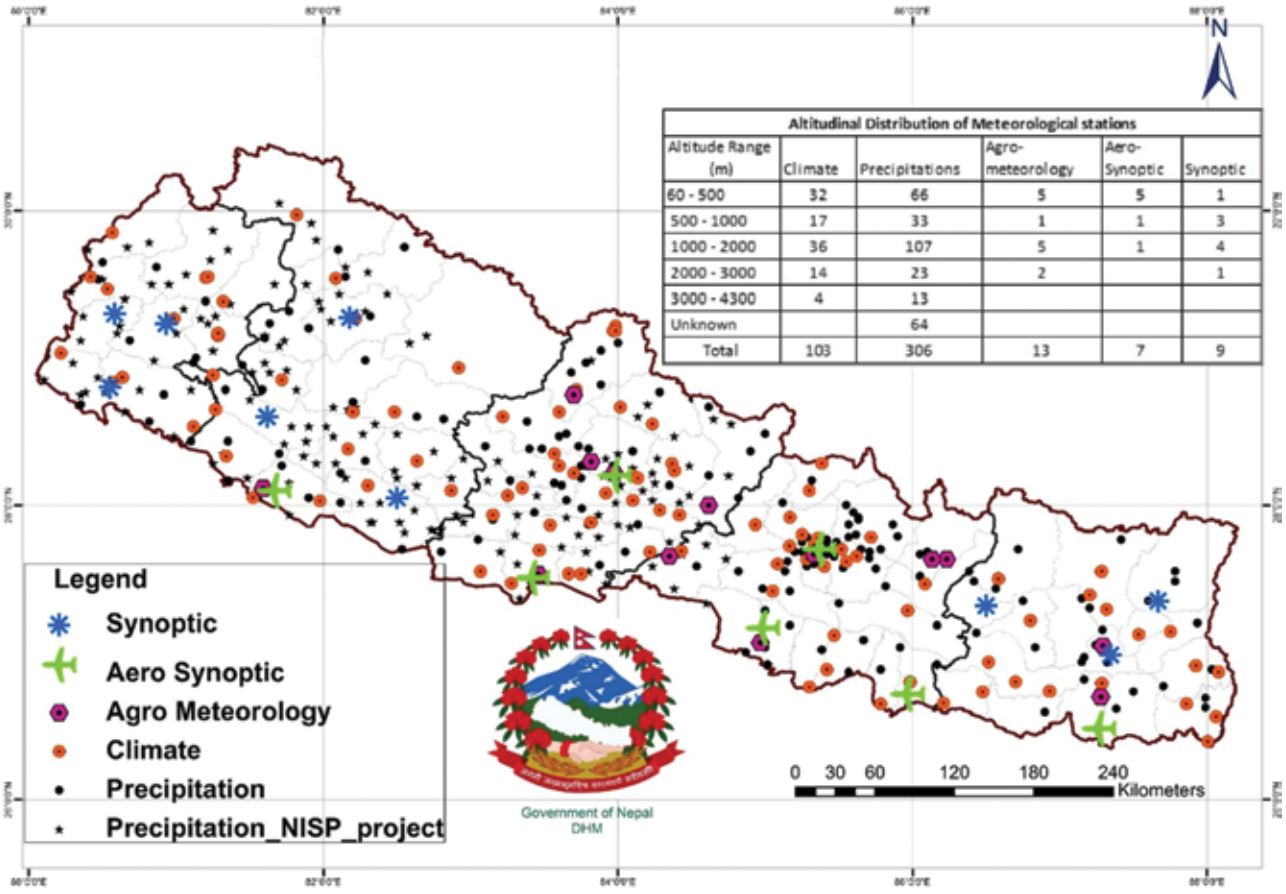
We see a need for a resilience framework which includes an optimal flood management approach that simultaneously strengthens peoples' coping capacities. The network of rivers across the Terai is so dense that the region cannot avoid floods on an annual basis. However, the region can manage floods much better through more prepared local governments and communities. The proposed resilience framework for the Terai region has three important components as follows:

a. Strengthening Early Warning System (EWS)

In Nepal, the Department of Hydrology and Meteorology is the agency which maintains the EWS network and provides early warning messages at the national and district level. The DHM has consistently improved its capacity for providing early warning services. In the current floods, it provided information upon rainfall to the National EOC and district EOCs, and issued SMSs to 11 million cell phone users. It also provided messages through television and radio about the floods. Its timely messages directly contributed to reducing mortality. The meteorological and hydrological stations maintained by the DHM is shown on the maps below.

The early warning network maintained by the DHM needs to be further strengthened. First, both the meteorological and hydrological networks for Nepal seem to be inadequate. The DHM needs to install more automated weather stations and water level recorders, given the density of river network in the Terai region. The maps showing the meteorological and hydrological stations below clearly show that the number of weather stations and water level recorders need to increase in the Terai region, particularly towards the east. In addition, Doppler radar need to be installed so that the amount of rainfall could be forecast with better accuracy. The

MAP 2: METEOROLOGICAL STATIONS ACROSS NEPAL



Altitudinal Distribution of Meteorological stations

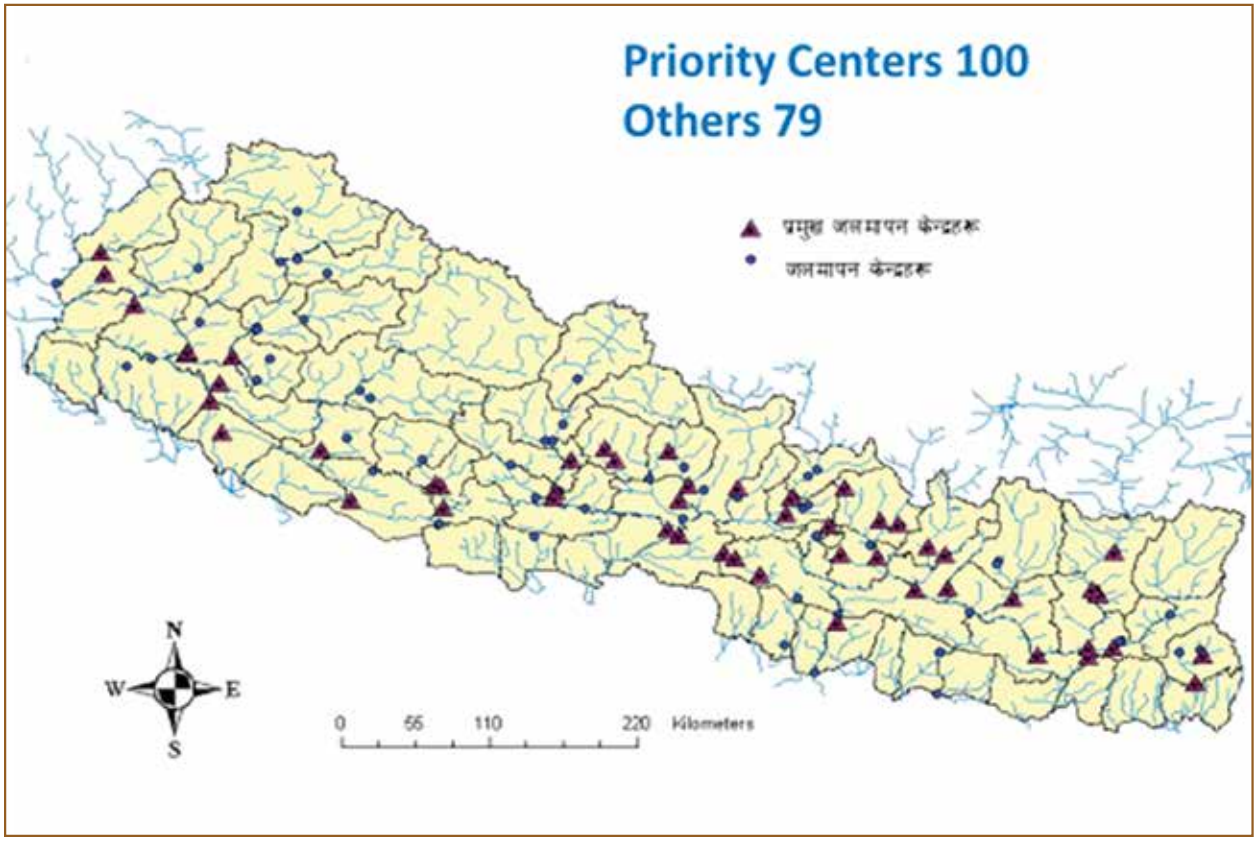
Altitude Range (m)	Climate	Precipitations	Agro-meteorology	Aero-Synoptic	Synoptic
60 - 500	32	66	5	5	1
500 - 1000	17	33	1	1	3
1000 - 2000	36	107	5	1	4
2000 - 3000	14	23	2		1
3000 - 4300	4	13			
Unknown		64			
Total	103	306	13	7	9

data available through different sources could be calibrated to provide high resolution forecast.

Communications proved to be a weak link. Following the floods, the DHM could not contact the district headquarters due to a communication breakdown. A more robust communication network with built-in redundancies would be essential for providing early warning. All the sub-national headquarters and administrative units need to be connected through multiple layers of emergency communications. It could include satellite and Internet-based communications so that the national capital and all the districts in the Terai are in continuous communication, and the forecast is made available on a real-time basis. Video-conferencing facilities with district headquarters would also be helpful in discussing preparedness, response measures, and monitoring.

At present, the DHM issues forecast three days ahead of the rainfall event. With better calibration and modeling, a weekly forecast could be issued. It is also time to introduce Flash Flood Guidance System (FFGS) in Nepal. The FFGS is designed and developed for use by meteorological and hydrologic forecasters throughout the world. The FFGS provides the necessary forecast to issue warning for flash floods from rainfall events using remote-sensed precipitation (e.g., radar and satellite-based rainfall estimates) and hydrologic models. The hydrological models take into consideration local conditions such as slope, drainage congestions, and flood protection structures. Based on the severity of rainfall and land surface conditions, the FFGS can evaluate the potential of flash floods and issue warning over hourly to six-hourly time scales for stream basins that range in size from 25 to 200 sq. km. in size. A quick dissemination of FFGS

MAP 3: HYDROLOGICAL OBSERVATION CENTERS ACROSS NEPAL



through DHM would be useful for many parts of Nepal which are prone to flash floods.

In Nepal, flood hazard maps have been developed for most frequent flood prone river basins. In close consultation with the national focal departments for flood mitigation i.e., DHM and DWIDP; seven rivers have been identified for flood hazard and risk assessment as follows: Rapti, Babai, Bagmati, Narayani, Tinau, Kankai and Kamala. The flood hazard maps show the flood inundation and flood water depth with respect to various return period scenarios. These return periods are 10 years, 25 years, 50 years, 100 years and 500 years. In common terms, the bigger the return period the worst is the flood scenario. There are in total 21 districts covered under different return period flood scenarios.

However, flood hazard maps need to go beyond these seven rivers to include all the river basins of Nepal. In view of the frequency and spread of floods, a national programme could be supported to undertake flood mapping for all the river basins in Nepal. Along with the flood hazard map, it is necessary to develop detailed flood inundation maps for the country. These provide information on the severity of floods and indicate the magnitude of damages and losses.

b. Consolidating Preparedness, Response and Recovery

There is greater need for concerted efforts to improve preparedness, response and recovery programmes. Investments in improved disaster management would reduce mortality and lessen the impact of disasters on economic activities.

Each province and local government in the Terai should now have a disaster management plan. The plan should indicate all the resources through which early warning messages are disseminated to communities, and rescue operations are organized. The plan should include details of temporary shelter, food and other relief assistance. As an important priority, each district should develop its own disaster management plan. Multi-hazard zonation and identification of vulnerable sites/settlements should form a core part of the District Disaster Management Plan.

One of the weaknesses in the response this year was that many districts did not have any Emergency Operations Center (EOCs). EOCs are useful facilities through which the district administration coordinates emergency responses. Setting up the EOCs requires a work space, emergency communications, computers, and maps, and the facility should be supported on a round-the-clock basis, especially during a disaster. An important priority would be to set up the EOCs in all the districts of the Terai region.

As floods recur in the Terai, the provision of boats is important for supporting rescue operations. Each district should have boats in several places through which the people could be taken to safer places. In the current floods, boats were not available in requisite numbers which hampered evacuation of the people stranded by floods.

Each district would also need a volunteer search and rescue team. The functions of search and rescue team could be carried out by community volunteers who are trained in rescue operations. Each district can set up teams of community volunteers. The youth should be trained in search and rescue activities.

People who are affected by floods need access to community shelter. New community shelters could be constructed, or existing structures could also be identified as community shelters. Community shelters are essential elements of flood response, and their details should be included in the district disaster management plan. Early warning should be well connected to the evacuation system and communities should be informed of community shelter locations prior to the event.

It is recommended that all floods should be followed by assessments. These assessments should include the causes of floods, its effects on communities, and a recovery plan. While the Disaster Assessment Guidelines was developed in 2015, its implementation following the floods in the Terai expose several gaps. The Immediate Rapid Assessment (IRA) planned to be conducted within 24 hours took more than a week to complete. The Cluster Specific Disaster As-

sessment tools were also not utilized effectively. Given its vulnerability to different hazards Nepal needs to put in place a robust assessment mechanism, including adequate capacity to administer these tools.

The officials at the national and district levels should be better trained in assessments in a way that these exercises could be led through a national team. The formats for data collection should be prescribed, and unit cost in different sectors standardized. All the damages and losses should be estimated based on clear and transparent parameters. Recovery needs to be emphasized in a disaster management plan. Without the recovery, people slide into poverty and deprivation. Recovery is not just a government hand-out provided after a disaster. It needs to be carefully planned and implemented so that it enables households and communities to pool their own resources for effective recovery. All the recovery programmes should include risk reduction.

c) Diversifying Peoples' Livelihoods and Risk Transfer

Each successive disaster erodes peoples' assets, and most often their coping mechanism is to migrate. People are dependent upon agriculture for their livelihoods, but it is highly exposed to climate risks. In such a situation, the people need to diversify their livelihoods. Within the farm sector, the affected people should be encouraged to take alternative cropping practices. It could mean cultivation of watermelon, guavas, and vegetables which could grow well in sand deposits. Farmers can also start floriculture and nurseries. The income through agriculture could be supplemented through dairy and poultry. The Terai region is full of swamps and wetlands, and they could be used to encourage fisheries. One of the ways in which risks could be reduced is to encourage agriculture and cattle insurance which is already in practice but needs to be widened in coverage.

Peoples' exposure to risks could be reduced significantly only if they shift to non-farm activities. It could ask for promotion of cottage industries, which include candlestick making, incense stick making, bicycle and motorbike repairing, and other businesses such as handicrafts, shops and eateries. It can expand the local markets, financial services and educational and training opportunities, thus buoying up the regional economy.

Women are particularly vulnerable in such situations. Impoverishment reduces women's standing in intra-household arrangements. One of the ways in which women's position could be improved is through financial inclusion. Women's access to financial services could be improved considerably through credit and savings group. Women should also be encouraged as economic actors, and assistance be given to them for various livelihood activities.

In organizing these activities, communities' access to information needs to be increased. People should be provided with more information related to policies and programmes, and they should have access to government's relief and recovery activities. Similarly, people should have access to information on rainfall, farm prices and other adaptation measures. The more information they get through mass media (such as radio and television), the more empowered they are in dealing with their risks.

In the Terai, large populations come from weaker social backgrounds. The population also includes large proportion of Dalits and other marginalized groups. Strengthening social cohesion in the region through recovery assistance would also be an important objective. However, it also requires that those who need assistance must be covered through the recovery programme. Some of these segments, which often intersect, are as follows:

- Women-headed households;
- People from the Dalit and marginalized groups;
- Extremely poor households with minimal assets.

The people affected by floods in the Terai region are living in a vicious cycle of poverty and risks. It would require a multi-pronged strategy to im-

prove their living conditions and livelihoods and reduce their exposure to annual floods. Use of locally applicable insurance schemes is an important measure to reduce risks due to the impact of disasters. Considering the increasing frequency and intensity of disasters, the government may consider promoting insurance schemes to protect the vulnerable families from the impact of disasters due to loss of housing, livestock, crops and other important household assets. There are plenty of experiences in the region and globally that Nepal could explore and identify the most suitable options.

Based on the discussion above, a resilience framework for the Terai is proposed as follows:

TABLE 10: SUMMARY OF RESILIENCE FRAMEWORK

Early Warning System	Disaster Risk Reduction	Livelihood Diversification & Risk Transfer
• Improved hydrological & meteorological network • Improved rainfall forecast • Robust communication systems • Flash flood guidance system • Community- level Early Warning System • Flood hazard maps • Inundation maps	• Financing disaster risks by establishing a separate Disaster Management Fund at the central level as prescribed in the DRM Act • Disaster Management Plan with budget allocation at the provincial, local and community level • Emergency Operations Center • Provision of boats • Multi-hazard zonation and identification of vulnerable sites/ settlements • Search and Rescue Teams and community volunteers • Access to community shelters • Damage and Loss Assessment • Preparation of recovery plans	• Alternative cropping practices • Diversification of farm and non-farm activities • Adoption of broad insurance schemes for crop, livestock and housing • Encouragement of small businesses; expansion of local markets; and consolidation of savings and credit groups • Strengthening of social-cohesion • Empowerment of women as economic actors • Increased access to information

Photo by: Angad Dhakal/Kantipur

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Annex 2: Acronyms

DDRC	District Disaster Relief Committee
DHM	Department of Hydrology and Meteorology
DOED	Department of Electricity Development
DOLIDAR	Department of Local Infrastructure Development and Agriculture Roads
DOR	Department of Roads
DUDBC	Department of Urban Development and Building Construction
ECED	Early Childhood Education and Development
EDCD	Epidemiology and Disease Control Division
HEOC	Health Emergency Operation Center
MOAD	Ministry of Agriculture Development
MOE	Ministry of Education
MOH	Ministry of Health
MOHA	Ministry of Home Affairs
MOI	Ministry of Irrigation
MOLD	Ministry of Livestock Development
NEA	Nepal Electricity Authority
NPC	National Planning Commission
NRA	National Reconstruction Authority
ODF	Open Defecation Free
RCC	Roller Compacted Concrete
UNDP	United Nations Development Programme
WASH	Water, Sanitation and Hygiene

GOVERNMENT OF NEPAL

NATIONAL PLANNING COMMISSION

KATHMANDU