REQUEST FOR CEO ENDORSEMENT[1]
PROJECT TYPE: FULL-SIZED PROJECT
TYPE OF TRUST FUND: LDCF

PART I: PROJECT INFORMATION

Project Title: Community Based Flood and Glacial Lake Outburst Risk Reduction			
Country(ies):	Nepal	GEF Project ID:[2]	4551
GEF Agency(ies):	UNDP	GEF Agency Project ID:	4657
Other Executing Partner(s):	Ministry of Environment, Science and Technology (MoEST)	Submission Date: Re-Submission Date:	January 25, 2013 Feb 19, 2013
GEF Focal Area (s):	Climate Change	Project Duration(Months)	48
Name of Parent Programme (if applicable): For SFM/REDD+ ☐	N/A	Agency Fee ($):	630,000

- **FOCAL AREA STRATEGY FRAMEWORK**[3]

Focal Area Objectives	**Expected FA Outcomes**	**Expected FA Outputs**	**Trust Fund**	**Grant Amount** (a)	**Co-financing ($)**
CCA-1	Outcome 1.2: Reduced vulnerability to climate change in development sectors	Output 1.2.1: Vulnerable physical, natural and social assets strengthened in response to climate change impacts, including variability	LDCF	**4,659,200**	**19,565,080**
CCA -2[4]	Outcome 2.1: Increased knowledge and understanding of climate variability and change-induced risks at country level and in targeted vulnerable areas	Output 2.1.1.: Relevant risk information disseminated to stakeholders (yes/no) Output 2.1.2: Systems in place to disseminate timely risk information	LDCF	897,532	

[1] It is important to consult the GEF Preparation Guidelines when completing this template
[2] Project ID number will be assigned by GEFSEC.
[3] Refer to the Focal Area/LDCF/SCCF Results Framework when filling up the table in item A.
[4] The project also contributes to CCA 2 and CCA 3.

	Outcome 2.2: Strengthened adaptive capacity to reduce risks to climate-induced economic losses	Output 2.2.1: Adaptive capacity of national and regional centers and networks strengthened to rapidly respond to extreme weather events Output 2.2.2: Targeted population groups covered by adequate risk reduction measures Output 2.3.1: Targeted population groups participating in adaptation and risk reduction awareness activities			
CCA: 3	Outcome 3.1: Successful demonstration, deployment, and transfer of relevant adaptation technology in targeted areas	Output 3.1.1: Relevant adaptation technology transferred to targeted groups Outcome 3.2: Enhanced enabling environment to support adaptation-related technology transfer Output 3.2.1: Skills increased for relevant individuals in transfer of adaptation technology	LDCF	193,268	
Project management cost				**550,000**	**787,430**
Total project costs				**6,300,000**	**20,352,510**

- **PROJECT FRAMEWORK**

Project Objective: Reduce human and material losses from Glacial Lake Outburst Flooding (GLOF) in Solukhumbu district and catastrophic flooding events in the Terai and Churia Range of Nepal.					
Project Component	**Grant Type**	**Expected Outcomes**	**Expected Outputs**	**Financing from LDCF**	**Confirmed Co financing ($)**
Glacier Lake Outburst Flood (GLOF) risk reduction in the High Mountains	TA	1. Risks of human and material losses from Glacial Lake Outburst Flooding events from Imja Lake reduced	1.1. Water level of Imja Lake lowered through controlled drainage 1.2. Protocols for GLOF risk monitoring and maintenance of artificial drainage system of Imja Lake developed and implemented 1.3. Community-based GLOF Early Warning System developed and implemented 1.4. GLOF risk management skills and knowledge institutionalized at local and national levels	3,499,883	5,763,819
Community-based Flood Risk Management in the Terai/Churia Range	TA	2.Human and material losses from recurrent flooding events in 4 flood-prone districts of the Terai and Churia Range reduced	2.1. Sediment control and stabilization of hazard-prone slopes and river banks through structural and non-structural mechanisms 2.2. Flood-proofing of water and sanitation systems in selected VDCs in target river basins 2.3. Institutionalization of flood risk management skills and knowledge 2.4. Flood preparedness training for district and VDC representatives, NGOs, CBOs and local communities in 4 flood-prone districts	2,210,117	13,739,261
Subtotal				**5,710,000**	**19,503,080**
Monitoring and Evaluation				40,000	62,000
Project management Cost				550,000	787,430
Total project costs				**6,300,000**	**20,352,510**

- **SOURCES OF CONFIRMED CO-FINANCING FOR THE PROJECT BY SOURCE AND BY NAME ($)**

sources of Co-financing	Name of Con-financier (source)	Type of Co-financing	Co-financing amount
GEF Agency	**UNDP core resource**	**cash**	**949,430**
GEF Agency	UNDP programmes	grant	7,682,900
Government	Government of Nepal - DWIDP	grant	7,000,000
Bilateral Aid Agency	USAID ADAPT ASIA	grant	157,369
Regional Agency	ICIMOD	grant	1,705,000
Bilateral Aid Agency	NRRC	grant	2,857,811
Total Co-financing			***20,352,510***

- **GEF/LDCF/SCCF RESOURCES REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY**[1]

GEF Agency	Type of Trust Fund	Focal Area	Country Name	(in $)		
				Grant Amount (a)	Agency Fee (b)	Total c=a+b
UNDP	LDCF	CC	Nepal	6,300,000	630,000	6,930,000
Total Grant Resources				***6,300,000***	***630,000***	***6,930,000***

- **CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:**

Component	Estimated Person weeks	Grant Amount ($)	Co-financing ($)	Project Total ($)
Local consultants	158	321,650	88,000	409,650
International consultants	19.2	72,500	50,000	122,500
Total		***394,150***	***138,000***	***532,150***

* Details to be provided in Annex C.

- **PROJECT MANAGEMENT COST**

Cost items	Total estimated Person Weeks/Months	Grant Amount	Co-financing	Project Total
Local Consultants	208	102,000	787,432	889,432
Office facilities, equipment, vehicles, communication	-	311,528	-	311,528
Travel	-	12,000	-	12,000
Direct Project Services (refer to budget notes in the project document)	-	124,472	-	124,472
Total		***550,000***	***787,432***	***1,337,432***

* Details to be provided in Annex C.

- **DOES THE PROJECT INCLUDE A "NON-GRANT" INSTRUMENT?** No

(If non-grant instruments are used, provide in Annex E an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF Trust Fund).

Not applicable.

- **DESCRIBE THE BUDGETED M &E PLAN:**

The project will be monitored through the following M& E activities. The M& E budget is provided in the table below.

Project start:

A Project Inception Workshop will be held within the first 4 months after the project document is signed by Government and UNDP, providing a platform for all project stakeholders to review once again the project document in line with their envisaged roles and responsibilities as discussed and agreed during the design phase. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan following approval of funding from the LDCF.

A fundamental objective of the Inception Workshop will be to re-present the modalities of project implementation and execution, document mutual agreement for the proposed executive arrangements amongst stakeholders and assist the project team to understand and take ownership of the project's goals and objectives. Another key objective of the Inception Workshop is to introduce to all stakeholders key project staff, together with the UNDP team based in Kathmandu and Bangkok, that will provide technical and fiduciary oversight support to the Government to implement the LDCF council approved project.

The Inception Workshop will address a number of key issues including:

a) Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and region-based and other staff vis à vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff and other project-related structures will be discussed again as needed in order to clarify for all, each party's responsibilities during the project's implementation phase.

b) Based on the project results framework and the relevant GEF Tracking Tool, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.

c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements including roles and responsibilities for different M&E functions, with particular emphasis on the Annual Project Implementation Reviews (PIRs) and related documentation, the Annual Project Report (APR) as well as midterm and terminal evaluations. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.

d) Plan and schedule Project Board meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 3 months following the inception workshop.

An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting. Project audit will follow UNDP Financial Regulations and Rules and applicable Audit policies.

First Annual Workplan

After the Inception Workshop, the Project Management Team (PMT) will prepare the project's first Annual Work Plan (AWP), on the basis of the Project Results Framework (PRF). This will include reviewing the PRF (indicators, means of verification, assumptions and risks), imparting additional detail as needed on the basis of this exercise finalize the AWP with precise and measurable performance indicators and in a manner consistent with the expected outcomes for the project.

Quarterly:

- Project progress made will be monitored in the UNDP Enhanced Results Based Management Platform. Quarterly Progress Reports (QPR) will be prepared by the PMT and submitted to the UNDP CO for sharing with the UNDP Regional Team.
- On a quarterly basis, a quality assessment shall record progress towards the completion of key results, based on quality criteria and methods captured in the Quality Management table as per the UNDP Nepal Project M & E Framework.
- Based on the initial risk analysis submitted, the risk log will be regularly updated in ATLAS by reviewing the external environment that may affect the project implementation. Risks become critical when the impact and probability are high. Note that for UNDP GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).
- An Issue Log shall be activated in Atlas and updated by the Project Manager to facilitate tracking and resolution of potential problems or requests for change.
- Based on the above information recorded in Atlas, a Project Progress Reports (PPR) shall be submitted by the Project Manager to the Project Board through Project Assurance, using the standard report format available in the Executive Snapshot.
- A project Lesson-learned log shall be activated and regularly updated to ensure on-going learning and adaptation within the organization, and to facilitate the preparation of the Lessons-learned Report at the end of the project.
- A Monitoring Schedule Plan shall be activated in Atlas and updated to track key management actions/events. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annually:

- An Annual Review Report (ARR) shall be prepared by the Project Manager and shared with the Project Board and the Outcome Board. As minimum requirement, the Annual Review Report shall consist of the Atlas standard format for the QPR covering the whole year with updated information for each above element of the QPR as well as a summary of results achieved against pre-defined annual targets at the output level.
- Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements. Based on the ARR, an annual project review shall be conducted during the fourth quarter of the year or soon after, to assess the performance of the project and appraise the Annual Work Plan (AWP) for the following year. In the last year, this review will be a final assessment. This review is driven by the Project Board and may involve other stakeholders as required. It shall focus on the extent to which progress is being made towards outputs, and that these remain aligned to appropriate outcomes.

The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
- Project outputs delivered per project outcome (annual).
- Lesson learned/good practice.
- AWP and other expenditure reports
- Risk and adaptive management
- ATLAS QPR
- Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

Periodic Monitoring through site visits:
UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of project cycle:
The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation (March 2015). The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC).

The relevant GEF Focal Area Tracking Tool, the AMAT, will also be completed during the mid-term evaluation cycle.

End of Project:
An independent Final Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

The Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC).

The GEF Focal Area Tracking Tool, the AMAT, will also be completed during the final evaluation.

During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons

learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

The Project Results framework provides indicators, baseline information, targets and sources of verification at the objective and outcome level. The project has one indicator at project objective level, and five indicators at project outcome leve as follows:

Project objective: to reduce human and material losses from Glacial Lake Outburst Flooding (GLOF) in Solukhumbu District and catastrophic flooding events in the Tarai and Churia Range.

- Indicator: Number of high risk settlements of the GLOF Impact Zone of Solukhumbu district downstream of Imja lake area covered by an Early Warning System (EWS)
- Indicator: Number of institutions with increased capacity to minimize human and material losses of vulnerable communities from potential GLOF events in the High Mountains and climate-related flooding in the Tarai and Churia Range

Outcome 1: Risks of human and material losses from Glacial Lake Outburst Flooding (GLOF) events from Imja Lake reduced.

- Indicator: Average depth of Imja Lake
- Indicator: Percentage of high risk settlements of Imja GLOF Impact Zone residents with a understanding of how the EWS works and what to do in the event of a GLOF
- Indicator: Number of targeted institutions with increased capacity to minimize exposure of vulnerable communities to GLOF risks

Outcome 2: Human and material losses from recurrent flooding events in 4 flood-prone districts of the Tarai and Churia Range reduced.

- Indicator: Number of additional people provided with access to safe water supply and basic sanitation services
- Indicator: Number of people and value of their material assets covered by a CBEWS in the four target project districts
- Indicator: Number of targeted institutions with increased capacity to minimize exposure of vulnerable communities to flood risks in the Tarai & Churia Range

Table: M& E work plan and budget

Type of M&E activity	**Responsible Parties**	**Budget US$** *Excluding project team staff time*	**Time frame**
Inception Workshop and Report	▪ NPD, NPM and Project Board ▪ UNDP CO, UNDP GEF	10,000	Within first four months of project start up
Measurement of Means of Verification of project results/Impacts (Outcomes &	▪ UNDP GEF RTA ▪ Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team	4,000$	Start, mid and end of project (during evaluation cycle) and annually when required.

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
Objective Indicators).	members.		
Measurement of Means of Verification for Project Progress on *output and implementation*	▪ Oversight by Project Manager ▪ Project team	2,000$	Annually prior to APR/PIR and to the definition of annual work plans
ARR/PIR	▪ NPD, NPM and team ▪ UNDP CO ▪ UNDP RTA ▪ UNDP EEG	200	Annually
Periodic status/ progress reports	▪ Project manager and team	400	Quarterly
Project Board Meetings	▪ PB Members, including NPD, Ministry of Finance, Ministry of Federal Affairs and Local Development, Department of Sagarmatha National Park and Wildlife Conservation; Department of Water Induced Disaster and Prevention & UNDP CO ▪ NPM & PMT	300	Every quarter (four times in a year, once on completion of the APR/PIR and more frequently if needed
ATLAS QPR	▪ PMT ▪ UNDP CO	100	Quarterly
Mid-term Evaluation	▪ Project manager and team ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)	40,000[5]	At the mid-point of project implementation.
Final Evaluation	▪ NPD, Ministry of Environment, Science and Technology, Project manager and team, ▪ UNDP CO	30,000	At least six months before the end of project implementation

[5] USD 40,000 will be charged to LDCF

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
	▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)		
Project Terminal Report	▪ NPD, Project manager and team ▪ UNDP CO ▪	3,000	At least three months before the end of the project
Audit	▪ UNDP CO ▪ Project manager and team	10,000	Yearly
Visits to field sites	▪ UNDP CO* ▪ UNDP RCU* (as appropriate) ▪ Government representatives	2,000	Yearly
TOTAL indicative COST[1] Excluding project team staff time and UNDP staff and travel expenses		US$ 102,000 (+/- 5% of total budget)	

- **Costs covered by IA fee: USD 62,000**
- **Costs covered by LDCF: USD 40,000**

PART II: PROJECT JUSTIFICATION

A. DESCRIPTION OF THE CONSISTENCY OF THE PROJECT WITH:

A.1.1. THE GEF FOCAL AREA/LDCF/SCCF STRATEGIES:

The project is aligned with Objective CCA-1, Reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level. It will also contribute to other outcomes of CCA-2, and CCA-3.

A.1.2. FOR PROJECTS FUNDED FROM LDCF/SCCF: THE LDCF/SCCF ELIGIBILITY CRITERIA AND PRIORITIES:

This project is in compliance with LDCF guidelines and aligned with the updated Results-Based Management Framework for the LDCF and SCCF (GEF/LDCF.SCCF.9/Inf.4 from October 20, 2010). Consistent with the Conference of Parties (COP-9), the project will implement **priority interventions from the Nepal NAPA** (corresponding to objectives outlined in NAPA profile 3 'Community-based Disaster Management for Facilitating climate Adaptation' and NAPA profile 4 'GLOF Monitoring and Disaster Risk Reduction'). Along these lines, this project satisfies criteria outlined in UNFCCC Decision 7/CP.7 and GEF/C.28/18. With regards to the LDCF Results Framework, the project is aligned with Objective CCA-1 (Reducing Vulnerability: Reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level) and compliant with Outcome 1.2 (Reduced vulnerability to climate change in development Sectors). Output 1.2.1 of the LDCF Results

Framework (Vulnerable physical, natural and social assets strengthened in response to climate change impacts, including variability) correspond with the main impact indicators of the proposed project.

The project is well-aligned with national policies and goals on climate change, disaster risk management and socially inclusive poverty reduction and human development. Through alignment with the key national disaster management policies as well as with major projects and programmes currently under definition and/or implementation in Nepal that are described further in the subsections that follow, the project will improve the adaptive value of ongoing government, bilateral and multilateral investments in a high-risk GLOF area and in four flood-prone river basins of the Tarai and Churia Range. The project will use LDCF resources to finance the additional costs of achieving sustainable development imposed by the impacts of climate change. It is exclusively country-driven and will integrate climate change risk considerations into disaster preparedness and risk management systems. In line with paragraph 12 d) of LDCF guidelines, the project puts emphasis on

- Development of early warning systems (EWSs) against climate-related extreme events;
- Monitoring of conditions for, and development of, programmes to respond to flooding and glacial lake outburst flooding (GLOF); and
- Raised awareness and understanding among local communities about the necessity and benefits of preparedness for climate hazards.

These priorities are aligned with the expected interventions articulated in the LDCF programming paper and decision 5/CP.9.

Gender mainstreaming has been given particular consideration in the design of the project considering the role of men and the important role that women often play in disaster relief and recovery. The proposed project builds especially closely on the knowledge, experience and partnerships developed by UNDP through its integrated Disaster Risk Reduction programme, particularly the following four UNDP-led initiatives, which are also contributing co-financing to this project. These aspects of project design and strategic considerations are discussed further below.

A.2. NATIONAL STRATEGIES AND PLANS OR REPORTS AND ASSESSMENTS UNDER RELEVANT CONVENTIONS, IF APPLICABLE, I.E. NAPAS, NAPS, NBSAPS, NATIONAL COMMUNICATIONS, TNAS, NIPS, PRSPS, NPFE, ETC.:

Nepal's Initial National Communications (INC) to the UNFCCC of 2004 and the NAPA have highlighted how the confluence between low degrees of human and economic development, complex topography and a high dependence on climate-sensitive natural resources has resulted in substantive human and economic losses from climate-related events over the past 10 years. According to the NAPA, "Observations of the effects of increased climatic variability in some parts of Nepal show increasing erratic and intense rains. This climatic trend combined with fragile topography, deforestation and eroded soils are leading to landslides and flash flooding hazards. It is projected that rainfall intensity will increase across many areas of Nepal with climate change. Vulnerable communities will have to increase adaptive capacity to cope with climatic hazards. These hazards also affect the availability of water resources particularly for household use. Water supplies need to be managed so they are climate proofed."

Nepal's NAPA process is embedded within the country's development objectives, which are in turn guided by an overriding poverty reduction agenda. The country's Tenth Five-Year Plan/Poverty Reduction Strategy Paper (2002-2007) and its interim Three-Year Plans (2007-2010 and 2010-2012) are aimed at achieving 'a remarkable and sustained reduction in the poverty level in Nepal', which is only possible if development gains are not undermined by climate-related disasters.

Prior to 1982 before the formulation of the **Natural Calamity (Relief) Act** (NCRA)[6], however, there were no national plans or activities specifically for disaster mitigation and preparedness. The Act describes the functions of this committee in relation to natural disasters and also empowers the government to constitute regional, district, and local level natural disaster relief committees by publishing a notification in the Nepal Gazette. The NCRA also includes provision for adequate legal backups to implement government policies and strategies addressing overall disaster management and risk reduction. Additionally, the **Soil and Water Conservation Act 1982** empowered the government to regulate land use in designated water shed areas to minimize soil erosion and landslide with a provision of controlling natural calamities such as flood, land-slide and conserving water shed areas. The Department of Soil Conservation and Watershed Management of the Ministry of Forests and Soil Conservation is mandated to implement this act.

It was only after 1991, following the declaration of the International Decade for Natural Disaster Reduction (IDNDR), that there was more concerted action on developing disaster management strategies and plans. After the global call for disaster reduction by the United Nations (UN) General Assembly, in Resolution 44/236 of December 22, 1989, the Government of Nepal (GoN) formed an IDNDR national committee. This committee felt the need for a National Action Plan on disaster preparedness, response, mitigation, rehabilitation and reconstruction as the NCRA focuses mainly on rescue and relief operations following disaster events. Accordingly GoN approved the **National Action Plan for Disaster Management in Nepal on February 18, 1996** (MoHA, 1996). The National Action Plan 1996 has four sections: (i) disaster preparedness, (ii) disaster response, (iii) disaster reconstruction and rehabilitation, and (iv) disaster mitigation.

As early as 2002, GoN developed a 25-year **National Water Resources Strategy 2002** (NWRS) in recognition of Nepal's increased vulnerability to water-induced disasters as a result of increased climate variability and projected future climate change impacts to mitigate the effects of both on water resources. The NWRS covers emergency response, rescue and relief in the event of a water-induced disaster, and also seeks to enhance institutional capabilities for managing water-induced disasters and to establish measures for water-induced disaster prevention, warning, preparedness and mitigation in at least 20 priority districts by 2010, and the whole country by 2027.

To implement this strategy, a **National Water Plan 2005** (NWP) was developed and ratified. The NWP aims further elaborates how to improve institutional capabilities for managing water-induced disasters and promote the development of effective measures for better management and mitigation of water induced-disasters. The long-term goal of the Plan is to make Nepal's water-disaster management system fully functional, effective, and responsive to people's needs (Pradhan, 2007).

Shortly after the NWP was developed, a **Water-Induced Disaster Management Policy, 2006** (WIDMP) was introduced for the management of water-induced disasters as part of the general management of river basins. One of the important objectives of the policy was to define the role of local and central government institutions, non-government organizations, community organizations, and private institutions in the management of rivers. It also aims to preserve rivers, river basins, and water-related environments for the sustainable use of natural resources and facilities such as drinking water, irrigation, river navigation, and road transport; reclaiming riverbanks and flood-affected areas. The policy has the following objectives: a) mitigating the loss of life and property arising from water-induced disasters such as floods and landslides; b) preserving rivers, river basins, and water-related environments for the sustainable use of natural resources and facilities such as drinking water, irrigation, river navigation, and road transport; c) reclaiming river banks and flood-affected areas in order to rehabilitate landless people and carry out socioeconomic activities; d) developing and strengthening institutions for the control of water-induced disasters and management of flood-affected areas; e) defining the role of local and central

[6] This act is sometimes referred to as the National Disaster Relief Act as well in English due to differences in translation.

government institutions, non-government organizations, community organizations, and private institutions in the management of rivers

The **Tenth Five Year Plan for Nepal (2002-07)** prioritized natural disaster management, including floods, landslides, debris flow and erosion. It included the first National Plan for Disaster Management with clear-cut objectives, strategies, and programmes. In relation to flood-related disasters, proposed actions under the Tenth Plan included: strengthening capabilities of institutions involved in water-induced disaster management by formulating policy and action plans on disaster management; strengthening the collection, storage, and dissemination of information about water-induced disasters by zoning of hazardous areas based on risk and vulnerability maps of areas prone to flood, debris flow, and GLOFs; preparation of a comprehensive flood and river control master plan and implementation based on prioritization; and integrated watershed management and river control programmes with community engagement.

The Tenth Plan paved the way for the development of a more comprehensive National Strategy for Disaster Risk Management in 2009A **National Strategy for Disaster Risk Management in Nepal** (NSDRM) was developed for the Government by the Nepal Society for Earthquake Technology (NSET) in 2008 and adopted by the Executive Government of Nepal in 2009. The NSDRM was developed through an extensive process of stakeholder consultations, with assistance from the European Commission and UNDP. It includes substantial data on the risk profile of Nepal and a detailed analysis of the existing and proposed institutional and legal system for DRM. The long-term vision of this strategy is to establish disaster resilient communities, who are able to bounce back from climate-related shocks and stresses. The strategy advocates strongly for integrating risk reduction measures with national goals for sustainable development and poverty reduction and protecting citizens from avoidable disaster by being sensitive to issues of social justice, social inclusion and equality, including gender, ethnicity, disabilities, acute poverty and marginalization of particular communities, such as the Dalits. The strategy aims to mainstream Disaster Risk Reduction (DRR) into development through sector-based planning, using the principles of the Hyogo Framework of Action (2005-15). The NSDRM outlines four key guiding principles for a national approach to disaster management as follows: (1) incorporating the disaster risk management issues identified in the National Development plans; (2) the inclusion of cross-cutting issues in planning and implementation (human rights, gender and social inclusion, decentralization and local self-governance, staff safety and security); (3) acceptance of a cluster approach to create sectoral working groups in line with the policy of the UN Inter-Agency Standing Committee approach; (4) and using the five key priorities in the Hyogo Framework for Action as logical steps towards achieving disaster risk reduction.

Based on the Hyogo Framework principles and to meet the objectives of the NSDRM, GoN launched the comprehensive **Nepal Disaster Risk Reduction Consortium** (NRRC) in May 2009. The NRRC is a unique institutional arrangement, bringing together financial institutions, development partners, the Red Cross / Red Crescent Movement, and the UN, including UNDP, the UN Office for the Coordination of Humanitarian Affairs (OCHA) and the UN International Strategy for Disaster Reduction (ISDR), in partnership with the Government of Nepal. Other founding members include the Asian Development Bank (ADB), and the World Bank. The NRRC was formed to support the Government of Nepal in developing a long term **Disaster Risk Reduction Action Plan** (DRRAP) building on the NSDRM. It bridges the spectrum of development and humanitarian partners and unites them under a common action plan. Participating organizations remain autonomous in implementing programme activities but agree to contribute to a prioritized common set of DRR actions. The NRRC aims to increase investment in risk reduction, to ensure more efficient and effective allocation of existing resources, and to mobilize additional funding for DRR. It also recognizes the value of empowered communities as a key driver to reduce vulnerability to disasters.

This project is particularly well aligned to Flagship Programme 4 on integrated community based disaster risk reduction/management (CBDRR/M) and also with Flagship Programmes 5 on policy/institutional

support for DRM in Nepal, which is led by UNDP. FS4, which is led by the International Federation of Red Cross and Red Crescent Societies (IFRC), acknowledges that the disaster risk management system within Nepal is currently undergoing changes driven by the recognition of the need to shift from reactive and relief-based approaches to proactive mitigation and adaptation architecture. This requires institutional, legislative and policy change to support the decentralization of responsibility such that stakeholders at national, district and village levels become more fully engaged in DRM. Through this shift, local government and civil society will be empowered to develop capacity and build sustainable approaches to reducing disaster risk and avoid more costly, external response interventions. FS4 is therefore also addressing the connection between national and local authorities in relation to resource allocation, planning, hazard mitigation and vulnerability reduction in partnership with a strong civil society.

The **Three Year Plan (2007/8-2010/11)** for Nepal follows the logic of the Tenth Plan, and emphasizes the objectives of human security and protection of livelihood assets from natural disasters through sustainable, environment-friendly and results-oriented development. It demands strengthened 'no regrets' disaster management practices, which are efficient, effective and able to reduce vulnerability in a changing climate. The Government of Nepal (GoN) has recently issued the Three Year Plan (TYP) Approach Paper (2010/11-2013/14), which has the objectives of promoting green development, making development activities climate-friendly, mitigating the negative impacts of climate change and promoting adaptation. The key expected outcomes of the current TYP (2010/11-2013/14) are to prepare and implement a national framework on climate change adaptation and mitigation, disaster risk reduction, poverty reduction and poverty environment initiatives. Based on the outcome to address CC adaptation and mitigation and DRR, Climate Resilient tool was prepared but is yet to be adopted by the sector programmes. To mainstream poverty reduction and poverty environment initiative into the development planning currently the analysis has been completed and preparation of framework is in progress. With a view to implementing these strategies, the TYP identifies the different sector agencies that will take the lead on different aspects of NAPA follow-up implementation under the overall guidance and coordination of MoEST. The project's execution and management arrangements, which are discussed in Section V are also in line with the TYP, which recommends that NAPA Profile 3 ('Community-based Disaster Management for Facilitating climate Adaptation') and NAPA Profile 4 ('GLOF Monitoring and Disaster Risk Reduction') are addressed through a cooperation between MoHA, MoEST including DHM/MoEST, DWIDP/MoI, MoA, MoFALD and UNDP.

B. PROJECT OVERVIEW:

The project has been designed to address the most urgent and immediate adaptation priorities identified in Nepal's NAPA, which has analyzed the multiple climate risks and vulnerabilities of the country. The project is also fully aligned with major relevant national policies and existing programmes on disaster risk management in the country, particularly on flood risk management. The project builds on the knowledge generated by other relevant adaptation and DRM projects and programmes in Nepal and internationally, notably on two other LDCF projects on GLOF risk reduction in Asia. The project has been designed to avoid duplication and instead will work in partnership with several key institutions and on-going or proposed initiatives that will support the achievement of the project's planned outcomes.

The LDCF resources will thus be used to achieve the following project outcomes:

1. Risks of human and material losses from Glacial Lake Outburst Flooding (GLOF) events from Imja Lake reduced.
2. Human and material losses from recurrent flooding events in 4 flood-prone districts of the Tarai and Churia Range reduced.

The Project's two main components will be implemented in two discrete geographic areas of Nepal. The activities associated with Outcome 1 (reduction of GLOF risks) will be implemented in and around Imja Lake in Solokhumbu District, while those under Outcome 2 (reduction of flood risks in the Tarai and Churia Range) will be implemented in four flood-prone districts in central and south-eastern Nepal: Mahottari, in Central East Nepal and Saptari, Siraha and Udaypur in Eastern Nepal. The main project target areas are described briefly below with further details in Annexes 2 and 3. These sites were selected based on additional analyses of risk and vulnerability and consultations undertaken during the project preparation phase.

B.1. DESCRIBE THE BASELINE PROJECT AND THE PROBLEM THAT IT SEEKS TO ADDRESS:

B.1.1. Climate change induced problem

Nepal falls within a subtropical climate zone. However, due to its unique physiographic and topographic distribution it possesses enormous climatic and ecological diversity within a north-south span of about 140 km. The climate types ranges from subtropical in the south to arctic in the north. The climate of Nepal is essentially dominated by the south-easterly monsoon which provides most of the precipitation during the rainy summer months (June to September). Nepal climate is characterized by four distinct seasons: the pre-monsoon (March-May); the monsoon (June-August/September); post-monsoon (September/October-November) and winter (December-February). Monsoonal precipitation is the most important climatic element for agriculture as well as development of water resources. Average annual precipitation in the country is 1,768 mm (Shrestha et al. 2000). Depending on the location about 70 to 85% of annual precipitation in the country occurs during this period (Singh 1985; Ives and Messerli 1989).

In general, the onset and retreat of the south-westerly monsoon is associated with the change in the direction of seasonal winds and the northward and southward shift of the Inter-tropical Convergence Zone (ITCZ). Nepal receives heaviest precipitation when the position of ITCZ is close to the foothills of Himalaya. Precipitation is also heavy when the monsoon depressions forming over Bay of Bengal pass through the country. The south-eastern part of Nepal receives the first monsoon rainfall, which slowly moves towards west. There is a marked variation of monsoon precipitation amount from east to west, as well as from south to north. The contribution of the monsoon precipitation is substantially greater in the south-eastern part of the country compared to the north-west. Even so, due to the extreme topographical variation, precipitation varies significantly from place to place both in local scale as well as in macro-scale. Most parts of the country receive an average annual rainfall of between 1,500-2,500mm, up to a maximum of 4,500mm in some places. Monsoon rainfall, which is also characterized by high inter-annual variation, is highest in the east and declines westwards, while winter rains are higher in the northwest and decline to the southeast. Temperature varies with altitude and season, generally increasing from north to south and decreasing with altitude. The winter season is the coldest, while the highest temperatures occur during the pre-monsoon months (MoE 2010). Temperature records show high inter-annual variability. The approaching monsoon winds are first intercepted by the foothills of Churia range, where heavier rainfall occurs, and rainfall increases with altitude on the windward side and sharply decreases in the leeward side. Lumle (1,642 m a.s.l.) lying south (windward side) of the Annapurna range in Nepal Himalayas receives about 5,000 mm of annual rainfall, whereas Jomsom (2,750 m a.s.l.) lying north (leeward side) of it receives only about 250 mm of rain per annum. Summer monsoon precipitation occurs as snow and ice at higher altitudes, which plays a vital role in nourishing large numbers of glaciers, especially those situated in eastern and central Nepal, the majority of which are summer accumulation type glaciers.

Winter precipitation is caused by westerly weather systems and associated systems are commonly known as westerly disturbances which have their origin further west. The low pressure systems are steered and

swept eastwards by the westerly winds aloft. These disturbances bring snow and rain during winter and spring, most significantly to the north-western part of the country. Winter precipitation contributes significantly to the annual total precipitation in Nepal's northwest. It plays a major role in the mass balance of glaciers in western Nepal, while playing a secondary role in the glaciers of eastern and central Nepal (Seko and Takahashi 1991). Although the winter precipitation is not as impressive in volume or intensity as the summer monsoon precipitation, it is of vital importance in generating water flows for agriculture. Most of the winter precipitation falls as snow and nourishes snowfields and glaciers which generate melt water during the dry season between February and April.

The maximum temperature of the year occurs in May or early June. Temperature starts decreasing from October and reaches the minimum in December or January. As temperature decreases with height, the sharp altitudinal gradients in the topography of the country have resulted in significant spatial variation in temperature. The Tarai belt is the hottest part of the country where maximum temperatures cross 45°C. The highest temperature ever recorded is 46.4°C in Dhangadhi, a town in far western Tarai, in June 1995.

Temperature data collected from the mid-1970s from 49 hydro-meteorological stations of Nepal indicate that the average temperature between 1977 and 1994 increased at a rate of 0.06 oC per year (Shrestha et al. 1999 and Shrestha and Aryal 2011; Xu et al, 2007). The warming trends varied from 0.068 to 0.128 ^{o}C/yr in most of the Middle Hills and Himalayan regions, while the Siwalik and Tarai regions show warming trends of less than 0.038 ^{o}C/yr (Shrestha et.al., 1999). A study based on data from 1975 to 2005 shows that the mean temperature of the country is increasing steadily at the linear rate of 0.04°C/year (Baidya et. al., 2007). This rate is much higher than the mean global rate of warming (0.0177 ^{o}C/year for last 25 years). Warming was more pronounced in high altitude regions such as the Middle Hills and the Himalayas i.e., the rise in temperature was greater at the higher altitudes. In fact, the adjacent plains and foothill areas experienced only negligible warming and increases in temperature were more pronounced during the cooler months (0.06–0.08 oC per year from October–February, for all of Nepal) than for the warmer months (0.02–0.05 oC per year for March–September for all of Nepal. In high-altitude areas, using the relationship between glacial retreats and climate warming, scientists have found greater temperature rises in some glaciated areas in Nepal. For example, Kadota et al. (1997) estimated a 1.4 oC temperature rise from 1989 to 1991 at the terminus of glacier AX010 in the Shorong Himal (at 4,958 masl) while studying the rapid retreat of the glacier after 1989. Relatively smaller, but nevertheless considerable, temperature increases (average of 7 stations, 0.025 oC per year) were recorded at stations around glaciers in the Dhaulagiri region during the last decades of the twenty-first century (Shrestha and Aryal 2011). Also, the increase is little higher in maximum than in minimum temperature series. The temperature data for Kathmandu, when compared with the global data in the latitude belt 24-40^{o}N, a general similarity between the two series is seen i.e. an overall decreasing trend from 1940-1970 and a monotonous increase thereafter.

Nepal being a mountainous country, the temperature variation with altitude also plays very important role in vegetation and other aspects of social life. The lapse rate of the maximum temperature is always higher than that of the minimum temperature. Differences between the highest and the lowest lapse rates for maximum and minimum temperatures are observed during the monsoon and pre-monsoon seasons, respectively due to perhaps altitudes, topography and wind patterns. The highest lapse rate is during pre-monsoon season with the temperature being the maximum. Whereas, the lowest lapse rates is seen during winter season with the minimum temperature. Strong spatial and temporal variations exist in the rainfall distributions of Nepal (Shrestha et al., 1999; Shrestha, 2000). The seasonal mean rainfall is highest during summer monsoon season and lowest during winter. Pre- and post-monsoon thunder activities and occasional passage of the western disturbances make rainfall during these periods a little higher than winter. However, variability is highest during post-monsoon and lowest during monsoon seasons (Shrestha et al., 1999; Shrestha, 2000). Although variability of monsoon rainfall is relatively small, this variability may have severe impacts on the socio-economy. All-Nepal summer monsoon rainfall time series shows both interannual variability and a slight increasing trend (about 20 % of the average per

decade). Extreme monsoon rainfall events have also been analyzed and the results show that, over a period of 47 years, 7 droughts and 8 flood conditions associated with intra-seasonal variation of monsoon rainfall occurred, which have direct impact on both agriculture and water resources (Shingvi et al., 2010)."

Nepal's economic and human development is closely tied to a number of climate-sensitive resources and sectors, such as agriculture, water and hydropower. Its population is already exposed to a large range of natural hazards, including climate-related hazards. Although, the country's overriding development priority is to achieve '*a remarkable and sustained reduction'* in the country's poverty level and promote socially inclusive development (Section 1.2), climate variability and increasing extreme weather conditions threatens to further constrain development and potentially undermine recent development gains by negatively impacting critical natural resources and economic sectors and exacerbating existing climate-related disaster risks.

The current impacts of climate change in Nepal include water shortages in the dry season due to glacial retreat; accumulation of large bodies of water on glaciers or behind thinning moraine[7] dams which increases the risk of glacial lake outburst floods (GLOFs); and increasingly erratic rainfall during the monsoon season (shorter, more intense bursts of rain that alternate with longer dry periods) which increase the risk of flash floods, landslides, erosion and reduced groundwater reserves due to excessive surface runoff. These impacts often have immediate adverse consequences for the country's population, particularly its rural poor, especially the most vulnerable among them, as well as negatively impacting the hydropower, water resources and agricultural sectors.

According to a climate change vulnerability index prepared in 2010 by Maplecroft, a British Risk Analysis firm, Nepal is the fourth most vulnerable country in the world to the impacts of global warming. A recent case study of "*Economic and Financial Decision-Making in Disaster Risk Reduction*" in Nepal supported by UNDP (MoHA, 2010) concluded that as climate change impacts increase more than 1 million people in Nepal will be vulnerable to climate-induced disasters such as floods, landslides and drought every year.

Observed trends in climate-related flooding and other hazards and related losses and damages are discussed below, followed by a summary of the key findings of climate change projections for Nepal. Further details are provided in the climate risk analysis in Annex 1.

B.1.2. Underlying causes

Observed Trends in Climate-related Flooding Hazards, Losses and Damages

Nepal faces a variety of natural hazards of geologic and climatic origin. The entire country is extremely earthquake-prone as mountain-building processes are still underway in the geologically young Himalayas. Intense monsoon rainfall and/or earthquakes also serve as triggers for floods, landslides, debris flow and other secondary hazards. Fire and drought are problems in the dry season. Landslides are the most common and frequent natural hazard, especially in the Middle Hills and High Mountains, while floods are especially common and problematic in the densely-populated and cultivated low-lying Tarai region. More recently, there has been growing concern about the increasing risk of glacier lake outburst floods (GLOFs) originating in the High Mountains due to glacial retreat and expansion of glacial lakes in some areas.

Nepal has more than 6,000 rivers and streams, which fall into three broad categories based on source and

[7] A mass of till (boulders, pebbles, sand, and mud) deposited by a glacier, often in the form of a long ridge. Moraines typically form because of the plowing effect of a moving glacier, which causes it to pick up rock fragments and sediments as it moves, and because of the periodic melting of the ice, which causes the glacier to deposit these materials during warmer intervals.

discharge (Fig. 3). The major perennial rivers, such as the Koshi, Gandaki, Karnali and Mahakali river systems, originate in the High Mountains and carry snow-fed flows with significant discharge even in the dry season. Others originate in Middle Hills or the Mahabharat Range and are fed by precipitation percolation and ground water recharge, including natural springs. Although perennial, these rivers are characterized by large seasonal fluctuations in discharge. They include the Mechi, Kankai, Kamala, Bagmati, West Rapti and Babai rivers. The third category of river systems, which originate in the Churia Range and flow through the Tarai, are seasonal, with little or no discharge during dry season, and characterized by a high rate of sedimentation and bank scouring.

Not surprisingly, given the country's topography, monsoon climate and its numerous rivers and streams covering, most of Nepal, excluding the glacier-free districts of the High Mountains to the north, is extremely flood-prone, particularly during the monsoon season. During the monsoon (June-September), perennial rivers often swell, flow faster and overflow causing widespread flooding in downstream areas as far as the Tarai. Melting snow in the High Himalaya, especially in early summer, also contributes to downstream flooding. Seasonal rivers, which drain the areas between the basins of the larger and medium-sized rivers, are also responsible for flash floods and inundation of settlements and agricultural lands in the Tarai during the monsoon. Devastating floods are generally triggered by one or more of the following events: i) continuous rainfall and cloudburst, ii) GLOFs, iii) landslide dam outburst floods (LDOFs), iv) floods triggered by the failure of infrastructure, and v) sheet flooding or inundation[8] in lowland areas due to an obstruction imposed against the flow.

Apart from injuries and loss of lives and damage to infrastructure and property, floods also cause human miseries, contaminate drinking water and destroy agricultural crops and fields. Thus, flooding causes considerable collateral damage in terms of epidemics, diseases and famines. The full potential impacts of flooding are clearly demonstrated by the last major devastating flooding event that occurred in the Central Region of Nepal in July 1993. Over 1,300 people lost their lives, while thousands became homeless, and thousands of hectares of crops were destroyed. Forty-four districts and half a million people from 73,000 households are reported to have been adversely affected by this particular event. Several important bridges on the Prithvi and Tribhuvan highways, including seven on the Prithvi Highway alone, were washed away, isolating Kathmandu Valley from the rest of the country, while the Kulekhani 1 and 2 power stations had to be shut down due to damage to the penstock pipe. Several major and minor irrigation projects were also either damaged or completely washed away. The total loss in terms of physical destruction was estimated to be approximately USD 67 million (NRs 5 billion) (Pradhan, 2007).

The disaster dataset for Nepal (Nepal DesInventar data) is an important source of information on historical natural disasters since 1971. INVENTAR, maintained by NSET with financial and technical support from UNDP, provides information on disaster-related human deaths and injuries, as well as the impact and losses from all types of hazards, including both large-scale disasters and smaller events that may not involve loss of human lives. Between 1971-2007, flood, fire and epidemics were the most common major disasters in terms of number of recorded incidents, while epidemics, landslides and floods caused the largest number of deaths (NSET, 2007). Among the different hazards, floods affected the largest number of people. Thus, of all those affected by disasters between 1971-2007, 68% were affected by floods with the highest number of deaths and injuries occurring in some of the Tarai and Middle Hill Districts.

Floods and landslides are the most devastating overall in terms of number of deaths and damage caused. Of all deaths due to natural disasters in 2010, 29% and 25% were due to floods and landslides, respectively, while 71% of all families affected by disasters in 2010 were affected by floods (DWIDP, 2011). Between 2001-08, floods and landslides: killed nearly 1,700 people; affected over 220,000 families; killed over 33,000 livestock; destroyed over 52,000 houses and washed away or destroyed over 22,000 ha of land. The monetary value of damages due to floods and landslides for 2001-2008 was

[8] To cover with water, especially flood-water

estimated at US$130 million (about 0.1% of GDP) (MoHA, 2010).

Flooding has become an increasingly serious concern as there has been a marked increase in the severity and uncertainty of flooding events and growing risks of potentially catastrophic GLOFs in certain parts of the High Mountains. Between 1971 and 2007 (i.e. a 37-year period), more than 2,500 floods were reported. These affected more than 3,000,000 people, caused at least 3,000 deaths and destroyed or damaged some 150,000 buildings (UNDP, 2009). These two types of major flooding risks, which are the primary focus of this project, are described further below.

GLOF Risks in the High Mountains of Nepal

GLOFs occur relatively infrequently, but are the most hazardous flood risk in the High Mountains. ICIMOD has identified over 2323 glacial lakes in Nepal (ICIMOD 2011). Most of these have been formed in response to warming temperatures during the second half of the 20th century (Yamada and Sharma 1993; Yamada 1998; ICIMOD, 2011), as a result of rapid glacier melting. Various studies indicate that the warming trend in the Himalaya region has been greater than the global average (ICIMOD, 2007).

Studies have shown that the majority of present day large moraine dammed lakes did not exist before the 1950s. These lakes started forming in the mid to late 1950s, and in the 1970s they grew in a rather rapid manner. Most of the glacial lake outburst flood (GLOF) events recorded in this region happened in the last three decades or so. There are strong indications that the GLOF frequency has increased in recent decades. There are over 200 potentially dangerous glacial lakes in the HKH region out of which 10 have been classified as hazardous, which could burst out and cause flash floods (ICIMOD 2007). Under the observed and projected climate scenarios, it is very likely that the risk of GLOF events will increase in future.

As the glaciers retreat, lakes start to form and fill up behind natural moraine or ice dams at the bottom or on top of these glaciers. When the water volume reaches a certain critical level, either due to glacial melt and/or potentially extreme precipitation events, the ice or sediment bodies that contain the lakes can breach suddenly, leading to a discharge of huge volumes of water and debris. These discharges, known as Glacial Lake Outburst Floods (GLOFs), have the potential to release millions of cubic meters of water and debris, with peak flows as high as 15,000 cubic meters per second. During a GLOF, the V-shaped canyons of a normally small mountain stream can suddenly develop into an extremely turbulent and fast-moving torrent, some 50 meters deep. Additionally, GLOF events in the Higher and Lesser Himalayas often have a cumulative effect on the downstream plains and Tarai region, which experiences a higher rate of sedimentation and larger area of flood inundation as a result. A recent study by ICIMOD on the formation of glacial lakes in the Hindu-Kush Himalayas and GLOF risks has identified 20 potentially dangerous glacial lakes in Nepal (ICIMOD 2010).

GLOFs have been recorded 14 times in the Nepalese Himalayas, most recently in 2004. These have sometimes had devastating consequences as in the case of Dig Tsho in 1985 and Tam Pokhari in 1998 as a result of the large volume of discharged water and debris resulting in the destruction of downstream farmland, infrastructure, and villages.

Flooding in the Tarai and the Churia Range

The Tarai is an almost flat land covered with thick deposits of alternating sand, gravel and silt, while the Churia hills, which are comprised of very fragile soils and sedimentary rock, are Nepal's first monsoon barriers, and serve as a water recharge area for the Tarai. The hills of the Churia Range are inherently fragile, being comprised of sedimentary rocks and boulders that are highly susceptible to weathering and erosion, which has resulted in slopes failures and perennial erosion at several locations. The Churia is also overlying the most active fault of the Himalayan region, known as the Himalayan Frontal Thrust and is thus earthquake prone. Earthquakes, even of small magnitude, produce cracks in the rocks that enlarge

further during each subsequent seismic event. This makes rocks more susceptible to landslides and debris flow during the rainy seasons. Additionally, the Churia Range has experienced high rates of deforestation and forest degradation in recent years as a result of growing demand for fuel wood, timber and agricultural land by local and distant communities in the plains. Declining forest cover has further accelerating natural erosion rates and increased rates of sedimentation of rivers and streams that originate or pass through the Churias. Sediments from debris flows, landslides and soil erosion are all ultimately deposited on the cultivated lands of the Tarai as well as also raising the level of the river bed, and further increasing the risks of flooding. It is estimated that river beds of major rivers in Tarai rise by about 10-15 cm every year. Vulnerability to flooding impacts is also especially high in the Tarai region due to proximity of people and their assets to the river, including a long-standing tradition of settlement and cultivation in the floodplains.

During the monsoon, rivers originating from the Mahabharat range cause great damage in the Tarai, with inundation caused by river flooding spreading as far as 10 kilometres and resulting in extensive damage to people, assets and infrastructure. Riverine floods from the major perennial rivers generally rise slowly in the southern Tarai plains. Flash floods, on the other hand, which occur with little or no warning, are characterized by a minimal time lapse between the start of the flood and peak discharge and are extremely dangerous because of the suddenness and speed with which they occur. They may be triggered by extreme rainfall, glacial lake outbursts, and/or the failure of dams due to structural reasons or caused by landslides, debris, ice, or snow. Damming of a river by a landslide is another potentially dangerous situation. Such a blockage of the river flow is more common in narrow valleys where the slopes are steep on both sides of the river. Landslide dams will eventually collapse, causing heavy downstream flooding, which generally results in loss of life and damage to property. The eastern Tarai is generally more flood-prone than the west and was the location of Nepal's most recent major flood event in 2008, when the Koshi River caused flooding in Sunsari and Saptari districts. The Ministry of Home Affairs (MoHA), estimated that at least 65,000 people lost their homes as a result of flooding during this event. The magnitude and frequency of flash floods has increased in recent years, particularly in the Tarai and the Churia range, as a result of an increasing trend in extreme rainfall events, i.e. short bouts of very intense rainfall.

Summary of Projections from Climate Change Models and Scenarios

The Intergovernmental Panel on Climate change (IPCC) assessment reports provide a comprehensive review of climate models in terms of temperature and precipitation projections (IPCC 2007; Christensen et al. 2007). Climate models show greater than average warming in the South Asian Region in summer. There is a general consistency among the models in their output for winter while the agreement is less for summer or both temperature and precipitation. In contrast, the consistency among models in precipitation predictions, as well as the significance of projected changes are low both for the winter as well as summer seasons (Christensen et al. 2007). General circulation models tend to not perform well over the high altitude regions of concern here, and regional climate models such as PRECIS model have been found to perform better (Christensen et al. 2007).

Climate change projections from the IPCC's Fourth Assessment Report (2007) based on the ensemble average of the General Circulation Model indicates that temperatures for the period 2080 to 2099 could be warmer in Nepal by 4^{o}C in winter and 2.5 to 3^{o}C in summer relative to 1980 to 1999 temperatures. The IPCC AR4 found that warming is South Asia is projected to be at least 2-4°C by the end of the century (Christensen et al. 2007). There is a clear elevation gradient in warming rates in the Nepal's Himalayan range similar to that seen in the observed historical temperature data. In general, the trend is higher increases at higher altitude regions. Another analysis by the OECD (2003) showed significant and consistent increase in temperature projections above the baseline average for Nepal for the years 2030 (+1.2^{o}C), 2050 (+1.7^{o}C) and 2100 (3^{o}C), with somewhat larger warming in the winter months than the summer months. Very recently climate change projections for Nepal were examined using Hadley Centre's high resolution regional climate model, called PRECIS (Providing Regional Climate for Impact

studies). Temperature projections derived from the PRECIS model also show a rising trend in both maximum and minimum mean temperatures during the 21st century across the whole country, with a higher rate of increase in the high altitude regions. The PRECIS simulations corresponding to the SRES A1B (IPCC) emission scenario were carried out for a continuous period of 1961–2098. The climate projections were examined over three time slices, viz. short (2020s, i.e. 2011–2040), medium (2050s, i.e. 2041–2070) and long (2080s, i.e. 2071–2098) changes.

The HadRM2 simulation of the Eastern Himalayan region projected an increase of winter, pre-monsoon, monsoon, post-monsoon, and annual precipitations respectively by 57, 46, 7, 15, and 18% of the current simulations by the 2050s (Annex 1). In general, PRECIS regional model is considered to give more consistent projections for the Himalayan region. However based on the distributions of the PRECIS projected annual precipitation for baseline period (1981-2010) and percent increment form baseline during short (2011-2040), medium (2041-2070) and long (2071-2098) term future durations, the overall annual precipitation in the country is found to be decreasing by 2%of the baseline amount by 2020s and it increases by 6% and 12% for the baseline by 2050s and 2080s respectively.

Projections of mean annual rainfall averaged over the country from different models are broadly consistent in indicating increases in rainfall over Nepal. This is largely due to increases in Jun-Aug and Sep-Nov (wet season) rainfall.

Jun-Aug rainfall is projected to change by -36mm (-22%) to +224mm (+104%) per month by the 2090s. Sep-Nov rainfall is projected to change by -17mm (-38%) to +44mm (+71%) per month by the 2090s. These increases are offset a little by projected decreases in Dec-Feb rainfall, such that annually, projected changes range from -14mm (-31%) to +59mm (58%) per month.

The increases in Jun-Aug rainfall are largest in the South-East of Nepal.

The proportion of total rainfall that falls in heavy[9] events is projected to increase in projections from most models. Annually, changes in projections range between -7 to +17% by the 2090s. Increases in Jun-Aug and Sep-Nov are offset partly by decreases in Dec-Feb.

Projections indicate that maximum 1- and 5-day rainfalls are expected to increase in the future, and that these increases may be dramatic. Annually, 1-day maxima change by -7mm to +53 mm by the 2090s, and 5-day maxima change by -16 to +129mm. These increases are most evident in Jun-Aug and Sep-Nov (wet season) rainfall, when changes of -4 to +125mm in Jun-Aug and -10 to +57 mm are projected in 5-day maxima for the 2090s; the maximum increases projected by the model ensemble are twice the magnitude of current average 5-day maximum rainfalls (C. McSweeney et. al, 2012).

Flooding hazards

Model projections on the effect of climate change on stream flow in the Himalayan Rivers vary regionally and between climate scenarios, largely following projected changes in precipitation. Climate scenarios can be useful in furthering the understanding of the changes that can be expected in the regional hydrology and water availability. Furthermore, the scenarios can be used to predict changes in the glacial mass in the Himalayas; an important source of water in the river basins during non-monsoon seasons. Model projections on the effect of climate change on stream flow vary regionally and between climate scenarios, largely following projected changes in precipitation. In south Asia, HadCM3 shows an increase in the annual runoff ranging from 0-150 mm/yr by the year 2050, relative to the average runoff for the period 1961-1990. These climate models are unable to highlight the details in seasonal runoff variations, although it is generally suggested that due to the higher evaporation and decrease in glacier mass, low flows are likely to decrease (IPCC 2007).

[9] A 'Heavy" event is defined as a daily rainfall total which exceeds the threshold that is exceeded on 5% of rainy days in the current climate of that region and season

There are still only few analyses of runoff variations due to climate change on smaller geographical scales. In 2001, a project called SAGARMATHA (Snow and Glacier Aspects of Water Resources Management in the Himalaya) investigated the impacts of climate change on the hydrology of the Indus, Ganges, and Brahmaputra basins. The results have shown the impacts of de-glaciation to vary considerably within the region and within catchments. Highly glaciated catchments and those catchments where melt water contributes significantly to runoff have been shown to be most vulnerable to de-glaciation (Rees and Collins 2004; Sullivan et al. 2004). While the relative changes are less in winter, any variation in water availability in this traditionally dry period could have serious impacts for water users. In the monsoon dominated basins such as the Ganges, the impacts are likely to be less severe.

Several recent studies (e.g., Immerzeel 2008; Immerzeel et al. 2010; Bolch et al. 2011; Miller et al. 2011) indicate that, although glacial retreat in the HKH region is occurring, the rates of retreat are less than those originally suggested by the AR4 (Cogley et al. 2010; Miller et al. 2011). Clearly more objective and transparent discussions of the evidence are needed (Miller and Rees 2011). Many of the Himalayan glaciers, which have been investigated in the eastern and central HKH region are receding, but it is still not clear how these attenuations in glacial mass will affect river discharges both upstream and downstream. Miller and Rees (2011) have summarised likely changes in the contributions of glaciers to river discharge as follows. The glacial melt that occurs in the monsoon-dominated eastern and central parts of the Himalayas does not contribute significantly to annual river discharge downstream. It is estimated that glacial melt accounts for, on average, only 10% of the river flow of the Ganges; estimates vary between 2–20% among basins. In the rivers of the eastern region, glacial melt coincides with monsoon precipitation, and by comparison, the large volume of rainwater dwarfs the contribution of melt water.

Recently Immerzeel et al. (2012) developed a high-resolution combined cryospheric hydrological model that explicitly simulates glacier evolution and all major hydrological processes. The analysis shows that both temperature and precipitation are projected to increase which results in a steady decline of the glacier area. The river flow is projected to increase significantly due to the increased precipitation and ice melt and the transition towards a rain river. Rain runoff and base flow will increase at the expense of glacier runoff. However, as the melt water peak coincides with the monsoon peak, no shifts in the hydrograph are expected. The model was used to assess the future development of glaciers and runoff using an ensemble of downscaled climate model data in the Langtang catchment in Nepal. In the catchment the glaciers are retreating steadily under climate change and it is estimated that in 2035 the glacier area will be reduced by 32% (Immerzel et.al 2012). This catchment is representative for the southern slopes of central and eastern Himalayas where glacier systems are dynamic, moderate in size and often characterized by debris covered tongues. The positive temperature and precipitation trends will increase evapotranspiration[10] and snow and ice melt while more precipitation will fall as rain instead of snow. The net result is an increase in stream flow by 4 mm y-1 that can be attributed to the increase in precipitation and the change from melt-fed river to rain-fed river. The partitioning of stream flow is indeed showing strong changes. Rain runoff and base flow are increasing, snow runoff remains more or less constant and glacier runoff is eventually decreasing. There is almost no research on impact of climate change and glacier melting in the western part of Nepal, which is relatively more impacted by the westerly disturbances compared to the central and eastern parts of Nepal.

One phenomenon that occurs parallel to de-glaciation is the growth and ultimate outburst of moraine dammed lakes. Studies have shown that the majority of present day large moraine dammed lakes did not exist before the 1950s. These lakes started forming in the mid to late 1950s, and in the 1970s they grew in a rapid manner. Most of the glacial lake outburst flood (GLOF) events recorded in this region happened in the last three decades or so. There are strong indications that the GLOF frequency has increased in recent

[10] The combined processes of evaporation, sublimation, and transpiration of the water from the earth's surface into the atmosphere.

decades. There are over 200 potentially dangerous glacial lakes in the HKH region, which could burst out at any time (ICIMOD 2007). Under the observed and projected climate scenarios, it is very likely that the frequency of GLOF events and their magnitudes will increase.

Climate change involves, perhaps most seriously, changes in the frequency and magnitude of extreme weather events. There is widespread agreement that global warming is associated with these extreme fluctuations, particularly in combination with intensified monsoon circulations. Although many other factors are involved, the growing incidence and toll of related natural disasters, such as floods and drought, is of particular concern. In parts of central Asia, regional increases in temperature will lead to an increased probability of events such as mudflows and avalanches that could adversely affect human settlements (Lafiazova 1997). In 2007, seven of the top 10 natural disasters, by number of deaths, occurred in Hindu-Kush Himalayan countries, altogether accounting for 82% of the total deaths (UN/ISDR 2007). This indicates both the prevalence of disasters in the region, and the susceptibility to such events. The lack of high frequency observational data in the region hinders a comprehensive assessment of changes in extreme climatic events. An increase in the frequency of high intensity rainfall has been observed in Nepal (Chalise and Khanal 2001). High intensity events can lead to flash floods and landslides. A recently developed database by ICIMOD suggests a steady increase in flash flood events in the region (Figure 7 bottom), which could be due to an increase in high intensity precipitation events.

B.1.3. Long-term solution and barriers to achieving the solution

The long-term solution to managing the risks associated with climate change-induced flooding in Nepal is to shift from a primarily reactive post-disaster response to a situation of increased adaptive capacity as a result of greater proactive disaster preparedness combined with concrete mitigation measures that reduce the risks of flood-related damage to people's lives, assets and infrastructure. Specific options for increasing adaptive capacity and disaster preparedness, and the barriers that need to be overcome to achieve this situation, vary in the two very distinct geographic areas targeted by this project, i.e. the High Mountains and the low-lying Tarai and foothills and slopes of the Churia hills. These are therefore discussed separately for each geographic area below.

Options and Barriers to Managing GLOF Risks in Nepal

There are a number of structural and non-structural measures that can be used, ideally in a coordinated fashion, to reduce and manage GLOF risks to human life and property in the potential GLOF impact zone. These include: implementing a real-time GLOF hazard monitoring system to provide advance information on potentially dangerous situations; increasing public understanding of GLOF risks and options for managing these; developing Early Warning Systems (EWS) to give downstream residents, tourists and owners of infrastructure sufficient time to take action to protect their lives and material assets; and undertaking structural mitigation measures to reduce the likelihood of a GLOF hazard.

The most critical factor that determines the stability of a supra-glacial (or end-moraine dammed) lake such as Imja and Tsho Rolpa is the strength and cohesion of the end moraine.[11] The volume of water in the lake is vital as it determines the hydrostatic pressure on the end moraine and will increase as the volume of water in the lake increase. Thus, the most common and effective structural mitigation measures for GLOFs is such lakes are aimed at reducing the volume of water in the lake, which not only reduces the hydrostatic pressure exerted on the end moraine dam, but should also reduce the potential peak surge discharge in the event of a GLOF (ICIMOD 2011). There are different ways to achieve this that can be used alone or in combination, as follows:

[11] In the case of a lake associated with a clean-ice glacier, GLOFs are more likely to be triggered by surge waves caused by ice, snow and/or rock avalanches into the lake that cause water to overtop the end moraine (see ICIMOD 2011 for further details.)

- Controlled breaching of the moraine dam
- Construction of an outlet control structure
- Pumping or siphoning the water from the lake
- Tunneling through the moraine barrier or under an ice dam

Such mitigation measures must be implemented with great care, however. Since moraine dam stability is a major part of the problem, any anthropogenic disturbance to the dam that arises as a result of implementing the mitigation measures, for example during construction, could actually increase the level of risk at that time. Thus, it is critical to select the most appropriate mitigation measure for an individual lake on a case-by-case basis. Additionally, stringent Safety & Evacuation Plans must be developed and implemented during the construction phase and systems put in place to monitor the physical condition of the end moraine and lateral dams, lake, glacier, and surrounding areas as part of a comprehensive GLOF Risk Monitoring System of a given high-risk lake (Annex 3 and 6).

To date, Tsho Rolpa is the only glacial lake in Nepal where GLOF mitigation measures have been implemented (Annex 3). A siphon system to remove water from the lake was installed in 1995 but met with limited success. Subsequently, an open channel was cut through the end moraine dam and a 4 metres-deep artificial spillway created. This intervention, which was completed in 2000, succeeded in lowering the lake by 3 metres (ICIMOD 2011). Early Warning Systems were also put in place, but proved to be unsustainable in the long run, partly due to their high-tech nature and thus the high maintenance involved (see Section 2.4, Outcome 1 & Output 1.3). Through the support of ADAPT ASIA, a pre-feasibility study was conducted during the PPG phase to explore possibilities for Community Based Early Warning Systems, aligning with UNDP's ongoing programme – CDRMP (Annex 6). However, to implement the possible options, the project plans to mobilise resources during the implementation period.

In addition to reduce the volume of lake water, there are several other preventative structural measures that can be implemented to help reduce the likelihood, or impact of, a GLOF. These include removing masses of unstable rocks to guard against avalanches or rock falls hitting the lake surface and causing a surge wave, as well as implementing measures to protect infrastructure in the downstream area. Other measures include check-dams, mini dams, spillways, slope stabilization and reinforcement. Check dams are helpful in reducing the flow of water coming down by gravity flow and conserving soil and thus provide downstream protective measures. Removing or restraining trigger mechanisms include stabilization of adjacent slopes. Slope stabilization may be through vegetation or engineering structures. Additionally, a last resort measure might be to relocate people and critical infrastructure from high-risk areas. However, the local communities rarely favour the former option for a host of social, cultural and sometimes economic reasons, while the latter is generally extremely costly.

Based on the experience of Tsho Rolpa, ICIMOD's extensive work on glacial lakes and GLOFs in Nepal as well as work undertaken by Kathmandu University and ADAPT-Asia as part of the preparation for this project (see Section 2.3.3, No. 7 and Annex 6), reducing the volume of Imja Lake through an artificial controlled drainage system was identified as the most suitable GLOF mitigation measure, combined with a system to monitor the risks of a GLOF at Imja Lake and a low-tech community-based EWS (CBEWS). There are, however, several major barriers to implementing this proposed integrated solution.

Institutional Knowledge, Capacity and Coordination Barriers

Government and disaster management authorities have been used to managing recurrent risks, based on seasonality and historic hazard occurrences and have limited understanding and experience of managing growing climate risks, including current variability and the projected impacts of climate change, that are increasing the range and magnitude of disasters that Nepal is having to cope with. The Department of Hydrology & Meteorology (DHM) of the Ministry of Environment, Science & Technology (MoEST) is mandated to monitor all flood risks in the country including GLOFs, but DHM currently has little

capacity for regular monitoring of GLOF risks, which are exceptionally challenging to monitor for technical, logistical and financial reasons, the latter in part due to the logistics involved. DHM undertakes bathymetric surveys and monitoring of the highest risk glacial lakes once every two years but there is limited management or application of these data for DRM and planning purposes. DHM and other national and local counterparts, including private sector partners, gained considerable technical knowledge and experience as a result of leading the successful lowering of Tsho Rolpa Lake during 1995-2000 period. However, DHM has limited human resource with specialist capacity within its Glacial Lake Monitoring Section of DHM, i.e. glaciologists, alpine geologists and hydrologists, particularly those with experience of structural measures for mitigating GLOF risks. Additionally, there are numerous complex physical and climatic factors involved in understanding and managing GLOF risks some of which are site-specific and Nepal has 2323 glacial lakes, including 20 high-risk lakes that require far greater research and systematic monitoring than DHM or its partners are currently able to provide.

The Ministry of Home Affairs (MoHA) is designated as the lead agency responsible for responding to disasters through implementation of the disaster-related acts and regulations of the government (see Section 2.3.2). The role of other ministries and departments is to support MoHA collectively in its mandates of responding to disasters, and implementing mitigation measures and risk reduction planning. MoHA manages the Central Disaster Relief Committee (CDRC) headed by the Home Minister of Nepal, the mechanism which becomes active during major disaster events in order to provide coordinated support for immediate relief to disaster victims. The machinery under the MoHA is equipped for doing search and rescue operations, and coordinating post disaster humanitarian assistance. The human resources within MoHA and its line agencies have training and experience mainly in post-disaster rescue, relief and rehabilitation activities, rather than in planning and implementing disaster preparedness and prevention. At the local level, the District Disaster Relief Committee (DDRC), which includes representation from all the main line agencies as well as local NGOs/INGOS and is headed by the Chief District Officer, directly operates under the CDRC and reports to MoHA about post disaster damage and response. Very recently the DDRCs with the support of district line agencies and development partners has remained engaged in making annual disaster response plans and their implementation at the district level. The DDRC members generally have very little knowledge about climate change or GLOF risk management and lack perspectives of long term periodic risk management planning. There is also insufficient coordination between different agencies at present for systematic information sharing on GLOF risk management and also no efficient mechanism for communicating GLOF warnings effectively. Despite the Local Self Government Act 2059(?) (LSGA) has given mandates to the local bodies such as District Development Committees (DDC) and Village Development Committees (VDC) for planning and implementation of disaster management and risk reduction activities, in lack of incentives and capacities, led by disconnect between risk reduction and development planning, and rush for hitting the annual target of development budget allocated for the district, reduction of disaster risks in delivery of development results have never been the priority at the local level.

Individual Knowledge and Capacity at the Local Community Level

Local communities in the High Mountains of Nepal vary in their level of awareness and understanding of climate change and the risks posed by a potential GLOF event. In areas such as Tsho Rolpa and Imja where many outsiders have conducted research and engaged with local communities on these issues, there is naturally relatively greater awareness and knowledge about GLOFs, but understanding of the options available to increase their adaptive capacity through community actions is more limited. In many cases, communities expect the government to undertake structural mitigation measures, but do not realize that there are actions they themselves can take to reduce their vulnerability to GLOFs. For example, there are no functional community-based EWS systems in place in areas at potential risk from GLOFs in Nepal. A community-based EWS was implemented at Tsho Rolpa for a few years, but local communities did not continue to maintain the EWS after a few years. Communities are also not aware that they could potentially undertake some relatively simple monitoring of GLOF risks locally, for example, visual

inspections of different physical parameters associated with GLOF risks such as the condition of the end moraine, the lake level at marked points, or the risks of avalanches into a lake from ice, snow and rock falls.

This lack of knowledge and low capacity is especially worrying as DDRCs are generally located in district headquarters, far from the locations and populations that are most vulnerable to GLOF risks. Thus, in the event of a GLOF, DDRCs have limited ability to manage or mitigate GLOF impacts, especially in the short-term. For example, Imja Lake is 7-9 days walk from the Solokhumbu District Headquarters in Saleri, where the DDRC is based.

Financial Barriers

One of the biggest challenges of managing and mitigating GLOF risks in Nepal is the lack of adequate financial resources available to the concerned government departments and authorities, both nationally and locally. Apart from technical and human resource capacity constraints, DHM also has very limited financial resources to implement its full mandate. Disaster preparedness and mitigation activities at the local level are the responsibility of district and local level authorities, who also generally have very limited funds for this purpose. Researching, monitoring or and reducing the risks associated with glacial lakes is also extremely expensive, in part due to the terrain and climatic conditions involved as well as the technical complexity of the methods of risk assessment and management. Even non-structural measures of GLOF risk management, such as the development of simple community-based EWSs is relatively costly to develop and implement in such remote locations.

Options and Barriers to Managing Lowland Flooding Risks

Several complementary and integrated strategies are required to effectively address climate-related flood risks in the Tarai and Churia Range, including low-cost structural (bio-dykes, bioengineering, earthen embankments and bamboo spurs) and non-structural mechanisms (community awareness and training programmes, the development of a community-based EWS, drills, etc.) that can easily be scaled up and replicated by communities, local authorities and other important local and national actors.

To date, government's response to flooding in the Tarai and Churai Range has mainly targeted the Tarai, with a heavy focus on protecting major infrastructure such as highways, bridges, major irrigation facilities and power stations. In relation to people, the emphasis to date has been more on post-disaster relief and recovery rather than pre-disaster planning and preparedness. These relatively high-cost structural methods of flood control have thus had limited coverage and varying success in actually controlling the impacts of floods on local populations and their material assets. The Department of Water-Induced Disaster Prevention (DWIDP) of the Ministry of Irrigation, which was created in 2000, is mandated to minimize human casualties and damage to infrastructure from water-induced disasters. DWIDP's main work in the Tarai in recent years has been through the People's Embankment Programme (PEP), which has been running for the last 3 years and is implemented in the middle and southern Tarai (south of the East-West Highway). Since 2009, the PEP has constructed 75 km of embankment and 533 spurs along 12 rivers in the Tarai.

There are few CBEWSs in place in the Tarai and Churia so far in 5 river basins and 7 districts (Rukum, Sunsari, Kaski, Chitwan, Dolakha, Sindhupalchok and Mahottari), but to date there has been relatively little investment by government in non-structural measures of reducing people's vulnerability to flooding (Annex 7). However, the government is placing growing emphasis on integrating disaster risk reduction planning into district-level development plans, which could potentially allow a more comprehensive and integrated approach to flood control in the Tarai and Churia Range.

Given the widespread nature of flooding in the Tarai and Churia Range and the large numbers of people affected, the ideal approach to reducing people's vulnerability to flooding in this region is to use a combination of low-cost small-scale structural interventions and non-structural measures based on a site-

specific assessment of vulnerability and the best options for minimizing human and material losses from flooding. The project proposes to do this in 4 districts in the Tarai and Churia. However, there are a number of barriers to further replication and up-scaling of this approach across the wider region, which is discussed below.

Institutional, Technical and Financial Capacity Barriers

DWIDP's mandate to reduce the human deaths and damage caused by water-induced disasters includes implementing programmes on river basin conservation, developing appropriate technology, research, information systems, human resources and institutional capacity, and raising awareness of communities in flood-prone areas to increase their ability to mitigate the impacts of water-induced disasters. However, DWIDP currently has very few technical staff and annual budget to fulfill its mandate in a systematic and comprehensive manner. Out of its annual budget of about USD 31.76 million (NRs. 2.7 billion), the Department currently spends around USD 11.76 (NRs. 1 billion) on disaster risk management in the Tarai. However, there are over 200 rivers that pass through the Tarai many of which are the source of seasonal flooding. The total length of most of these rivers is in a range of 30-50 km. Structural measures like embankment, dykes and spurs, which have to be constructed along both sides of a river, require considerable financial and technical resources and DWIDP is currently able to target only 12 flood-prone rivers in the Tarai, that too, not in their entirety.

Another key gap in interventions by DWIDP to date is sediment management in the upper catchments of rivers that flow into the Tarai. There has been considerable discussion about sedimentation control within DWIDP and while some members of DWIDP consider such an integrated approach essential for effective flood control, others remain to be convinced of the benefits of sediment management. There is a pressing need to demonstrate the value of implementing a more comprehensive approach to flood control that also includes improved management of upstream areas. However, currently DWIDP does not have the budget to implement a sediment control programme.

Department of Watershed Management and Soil Conservation (DWMSC) under Ministry of Forest and Soil Conservation (MFSC) are mandated for working on upstream soil conservation and erosion control of a watershed. Appropriate soil conservation measures if carefully applied can potentially control runoff and reduce sediment load in the downstream rivers, thereby minimizing the causes of flooding during monsoon rains. However, DWIDP with the mandates of flood management in the downstream has hardly developed a culture of working in collaboration with the DWMSC in the upstream, and thus the flood mitigation activities implemented by DWIDP mainly through embankments in the downstream area has only limited impacts in the long run because of increased sediment load in the rivers. Based on the statistics of CBS (1998), in Churia (as known as Siwalik) range Eastern Nepal, foothills of South aspect sandstone has land use ranging from forest to grazing where erosion rate is 780-3680 ton/sq.km/yr. Very recently with the support of UNDP the two departments have collaborated to work in two sub-watersheds on a pilot basis with DWMSC making efforts to control runoff and soil erosion at the upstream and DWIDP constructing flood mitigation structures at the downstream. Building upon the success of this pilot integrated flood management activities, future flood management programmes need to be up-scaled.

As noted earlier, DHM has the mandate to monitor all flood risks in Nepal, but the agency also has insufficient human and technical capacity for monitoring and forecasting recurrent flood risks, such as the annual monsoon-related flooding in the Tarai and Churia Range. A recent technical capacity assessment of DHM by UNDP found that although DHM has the equipment to monitor and forecast real-time rainfall, the Department lacks the technology and expertise to analyse the real-time rainfall data and basin level discharge data to assess the level of flood risks and other potential impacts in a given geographical area. There are also no systems in place for DHM to communicate flood risk warnings to MoHA (who in turn would relay the information to its agencies such as the Emergency Operation Centres and DDRCs), as well to DWIDP and other relevant departments.

At the local level, until very recently, there was little integration of flood risk reduction measures into district development plans. However, in recent years under the leadership of DRRC, greater attention is being given towards pre-disaster planning and preparedness, including the preparation of annual District Disaster Management Plans (DDMP) and Emergency Preparedness Plans (EPP), which are prepared specifically to prepare for the monsoons in the Tarai. DDMPs are still in a pilot phase and have been prepared for four districts. The DDMP proposes to integrate risk reduction activities into the district development plan, while the EPP is focused on responding to an actual disaster. However, line agency representatives at the district level also have limited technical capacity for planning and evaluating flood control options, particularly in the context of a changing climate.

At present, the Government of Nepal has too many competing priorities on its limited financial resources to be able to invest any significant resources in the capacity development of either DHM or DWIDP or to increase the budgets of District Authorities for DRM planning. Furthermore, while there are many institutions and actors working on flood risk management at the central and local levels, there is little systematic coordination between the different Ministries and Departments and non-governmental actors to manage flood risks in a more integrated manner.

Upstream land use patterns

The recent long-running political conflicts in Nepal resulted in displacement of people from the lower Tarai into the upstream Churia range. This has resulted in increased rates of forest logging and clearance in the Churia as people cleared land for settlements and agriculture as well as a source of income as many displaced people rely on illegal logging for their livelihood. This in turn has increased the problem of downstream sedimentation and flooding as the Churia is comprised of weak and fragile rocks that are easily eroded. Sedimentation is increasing the Upper Tarai (towards north) down to the Middle Tarai where the major depositions of coarse sediment occur, with finer sediment deposited further downstream. As a result of sedimentation, river levels are increasing, rivers are changing course, as channels narrow in some places as sediments are deposited and widen in others due to erosion. Higher sediment load in rivers means less natural scouring and deepening of the riverbed by water. Instead, riverbeds are rising in some areas due to combined impact of sedimentation and less natural scouring, such that villages and embankments are at or even below the height of the river basin in some areas. Such villages are especially vulnerable to flooding.

The Churia has severe environmental and economic impacts not only in the periphery of this zone, but has severe threat to the downstream Tarai communities as many rivers originate from the Churia, passes through Tarai and drain out to India. Deforestation, encroachment and grazing added by high rate of extreme precipitation in this zone, has enhanced the degradation of Churia range, as a result, heavy floods and sedimentation happens in the Lower Tarai causing heavy loss of lives and properties. The main governmental body responsible for Churia conservation is the Ministry of Forest and Soil Conservation (MFSC). Activities related to Churia conservation are implemented by Department of Forest (DoF) and Department of Soil Conservation and Watershed Management (DSCWM) that fall under MoFSC. The DSCWM normally addresses the problem of topsoil protection with non-structural and limited bio-engineering measures. In addition to regular programmes of afforestation, controlling deforestation, grazing and soil conservation implemented by DoF and DSCWM through their respective district level offices are also implementing complementary activities supported by Rastrapati (President's) Churia Conservation Programme (RCCP) since 2010. According to the RCCP guidelines, the major goal of the programme is maintaining balance between sustainable development and environment for poverty alleviation by increasing the productivity of land through conservation and proper use of natural resources. Specific objectives of the programme are: (a) integrated management and conservation of soil, water, forest and biodiversity of Churia area; (b) maintaining balance between environment protection and sustainable development through sustainable and environment friendly land use, physical development, infrastructure development, agriculture and economic activities. However, delivery and

effectiveness of this programme has been very slow and poor as the programme is unable to address the root causes of deforestation, and forest degradation in the Churias. Despite RCCP is a priority programme of the Government of Nepal, it lacks geographic focus and clarity about what to achieve with the limited government funds thinly spread over the entire Churia range of KM from East to West. Since all four targeted programme districts of the proposed project are also the programme districts of RCCP, there is an ample opportunity to synergize approaches undertaken by the two programmes and implement activities complementing to each other in both upstream-downstream areas.

Individual Knowledge and Capacity at the Local Community Level

Local communities in the Tarai and Churia Range have a long history of coping with annual seasonal flooding, although these coping mechanisms are fairly rudimentary. People voluntarily live in high-risk areas due to the fertile floodplain soils that they cultivate. Some live in raised platform houses. During the monsoon, people watch the water levels to decide when to leave their homes and field for a raised area such as embankments and roads where they will camp for few days until the water level goes back down. However, local communities are facing increasingly unpredictable extreme precipitation events followed by severe flooding of their homes and land. Furthermore, in some areas embankments are at the same level as the river within 2-3 years of construction due to sedimentation.

Most people are unaware of the linkages between the increasing frequency and intensity of extreme weather event and climate change. Nor are they aware of the linkages between upstream land use and the rates of sedimentation and downstream flooding. Many people do understand the importance of stabilizing riverbanks and steep slopes for erosion control, but there is relatively little local buy-in for bio-embankments (or bio-dykes) as opportunities for cash-for-work for communities are more limited in this type of soft construction. Additionally, bio-embankments must be protected against grazing and any major use until grasses and other vegetation are well established. Thus, short-term needs and benefits often prevail over longer-term less tangible benefits. Organized community engagement in managing and mitigating flood risks is very limited. For example, community engagement in the DWIDP's PEP has been largely on a cash-for-work basis, but even this has been on a small-scale thus far as most of the work is undertaken through contractors who may not necessarily use local labour.

B.1.1.4. The Baseline Project

The LDCF resources will be used to integrate climate resilient district and community planning, programmes and action in both mountain and lowlands region of Nepal. The baseline for the project is thus first of all ongoing and past investments that are/were undertaken by UNDP Nepal, bilateral in Nepal and from the government in the areas of flood management and disaster risk reduction as listed below. Some of these are also providing financial resources for complementary investments, especially in the field of community-based disaster preparedness and early warning systems, as well as facilitating the project's entry to local communities, NGOs, CBOs and the planning and decision-making processes of local government authorities. The rich accumulated experience and knowledge of several of these programmes and projects has been a major asset to the development and design of this project. Below follows a brief overview of the relevant programmes led by various stakeholders, totaling **20,147,510 USD** for 2011-2017, relevant to the project:

Comprehensive Disaster Risk Management Programme (CDRMP): The CRDMP was assigned to UNDP by the inter-agency Nepal Risk Reduction Consortium (NRRC) and addresses the NRRC's Flagship Programme 5. The CDRMP aims to strengthen the institutional and legislative aspects of DRM in Nepal, by building the capacities of MoHA, other ministries, and local and emergency preparedness and response. It focuses on national and local institutional and capacity development for disaster management, including training of district-level climate change and disaster risk management focal points, the delivery of community based risk reduction trainings, and the establishment of Emergency Operations Centers

(EOCs) at both district and central level. A particular strength of the CDRMP lies in the broad array of institutional partnerships it can mobilize to support an effective and coordinated GLOF and flood risk management effort under the current LDCF project. Three of the planned project target areas are also directly covered by the CDRMP, namely Solukhumbu where Imja Lake is located, and two of the four districts targeted by the project in the Tarai and Churia Range, Mahottari and Saptari. CDRMP's engagement will provide complementary investment to support capacity development and institutionalization of GLOF and flood risk management skills, including support to the development of Community-based Early Warning Systems (CBEWs); CDRMP-funded Emergency Operations Centres (EOCs) will be able to connect local efforts in flood early warning and preparedness with a network of district and central-level institutions which can effectively process and relay flood risk and early warning information to hazard-prone sites; as a flagship project for Disaster Management in Nepal, the CDRMP is well placed to mobilize additional resources from various funds to further complement the activities that will be financed by the LDCF and other co-financiers in this project.

Regional Climate Risk Reduction Project in the Himalayas (RCRRP) – Nepal Component: The aim of the project was to develop and implement comprehensive risk management strategies to address climate-induced hydro-meteorological hazards in the Himalayan region. In the implementation process, feasible measures to reduce the risks faced by mountain communities and to mitigate impacts of hydro-meteorological/climatic hazards were identified and implemented at community and local administration level. The project responded to the rising GLOF threat from Tsho Rolpa glacial lake through establishing a community-based, low-tech Early Warning system (EWS) in 3 downstream communities. The initiative was an important starting point for GLOF risk reduction, but of insufficient scale to incorporate other communities downstream of Tsho Rolpa and others as far as 100 kilometers down the projected GLOF Impact Zone. The proposed LDCF project will build on the experiences from the RCRRP in designing a CBEWS for the projected Imja Lake GLOF Impact Zone and will explore opportunities for additional financing to expand the reach of the existing CBEWS in Tsho Rolpa to cover a wider range of communities in all downstream high-risk areas in line with the study conducted by ADAPT Asia. The project will benefit in particular from a range of GLOF hazard maps and awareness materials that were developed with RCRRP financing, and utilize the community-based DRM training kits that the RCRRP has developed and adopted.

Regional GLOF Risk Reduction Project (RGLOFRRP) - Nepal Component: This project was designed to address the problem of GLOFs in the Himalayan region and enable comparative analysis of GLOF threats and risk mitigation efforts in Nepal, Bhutan, India and Pakistan. This comparative analysis found that a coordinated approach combining structural with sociological and community-based methods is necessary to prepare vulnerable communities against the threat of GLOFs and glacier melts in the targeted sub-region. The project has provided a community-based risk assessment of GLOF risk from Imja Lake and Dig Tsho. The project assessment report highlights that while implementing disaster risk reduction programmes in the Imja valley, it is important to combine structural programmes with non-structural activities. The assessment to this project emphasises that being a spiritually-rich community, Khumbu residents have a high regard for their spiritual leaders. The LDCF project has built on the findings and recommendations of this project by ensuring that risk reduction programmes are developed with the participation and approval of local spiritual leaders and vulnerable communities. Additionally, the report highlighted the need for greater coordination among different institutions working on glacier-related issues in the Khumbu region in order to effectively manage GLOF risks. These findings have been taken into consideration in the design of this project's Outcome 1.

Climate Risk Management Technical Assistance Support Project (CRM-TASP): The CRM-TASP project analyzes risks to development that are associated with climate variability and change, and prioritizes measures that will assist countries in better managing those risks in both the short and longer terms. It

advocates managing risks at all-time scales (weather, climate, extremes, changing climate) and integrates the analysis of climate-related risks with analysis of the institutional, decision and policy landscape; consensus-based identification and prioritization of risk management actions (in alignment with the NAPA); development of decision-support tools; and the mainstreaming of climate risk management into local and national development processes. In the context of this project, the CRM-TASP project can provide connectivity with a Regional Multi-Hazard Early Warning System (RIMES), which is coordinated by the Asian Disaster Preparedness Center in Bangkok. RIMES provides flood and storm early warning information to a number of Asian Countries, which can then be transmitted from Hydromet Departments (such as DHM) to regional and local partners. This connectivity is essential when establishing flood risk management systems and early warning protocols in the Himalayas and Tarai/Churia Range. In addition, the project will explore the potential for adapting the training modules on climate risk management developed by the CRM-TASP project for use in project target areas.

Strategic Programme for Climate Resilience (SPCR): The Strategic Programme for Climate Resilience (SPCR) was developed by the GoN, in partnership with World Bank, IFC, ADB. The SPCR will be providing valuable complementary parallel initiatives/activities. Component 2 of the SPCR ('Building Resilience to Climate-Related Hazards'), focuses on strengthening hydro-meteorological infrastructure, weather and flood forecast and information systems, and community hazard warning systems and will complement several outputs and activities planned under this project as described in greater detail in Section 2.4. This component is designed to build resilience in vulnerable communities by establishing multi-hazard early warning systems and improving access to financial instruments such as micro-insurance/finance that reduce the adverse impacts of climate induced shocks. The main objective of the SPCR Component 2 is to diminish the impacts of extreme climate related events, protect lives and assets, and support agricultural livelihoods by establishing multi-hazard information and early warning systems, upgrading the existing hydro-met and agricultural information management systems, and improving the accuracy and timeliness of weather and flood forecasts and warning. This includes strengthening the capacity of DHM. Activities will focus on the installation of real-time hydro-meteorological infrastructure, and information nation-wide, the establishment of early warning systems for priority vulnerable communities, and the creation of climate risk insurance / finance programmes for vulnerable communities, home owners and women. In particular, SPCR-supported activities under this component will complement project activities related to the establishment of the community-based Early Warning Systems in Imja GLOF Impact Zone and in the Tarai and Churia hills/range.

4th Flagship Programme (FS4) of the Nepal Risk Reduction Consortium (NRRC): The project will also coordinate with the NRCC's Flagship 4 (FS4) Programme, which focuses on integrated community based disaster risk reduction/management. The NRRC Flagship 4 (FS4), led by the International Federation of Red Cross and Red Crescent Societies (IFRC) and MoFALD, is taking the lead in reducing vulnerability to natural disasters through community-based DRR/DRM. The objectives of the FS4 are to, (a) provide an overall strategic framework for community-based disaster risk reduction (CBDRR) activities; (b) map and demonstrate the progress of CBDRR projects on a national level over a period of time; (c) attract additional resources and partners; (d) strengthen the linkages with government/administrative structures in Nepal to ensure sustainability. FS4 aims to have CBDRR projects covering 1,000 Village Development Committees (VDCs) over 5 years. More than 500 VDCs have CBDRR projects underway or in the planning that are Flagship 4 compliant. Mapping of over 275 CBDRR projects across Nepal has been done. Nine minimum characteristics of what a disaster resilient community comprises in Nepal have been agreed on as follows: (a) organisational base at Village Development Committee (VDC) / ward and community level; (b) access to Disaster Risk Reduction (DRR) information; (c) multi-hazard risk and capacity assessments; (d) community preparedness / response teams; (e) disaster Risk Reduction / Management plan at Village Development Committee / municipality level; (f) disaster Risk Reduction (DRR) Funds: (g) access to community-managed resources: (h) local level risk / vulnerability reduction

measures; (i) community based early warning systems. IFRC's Flagship 4 programme parallel investments at Siraha, Saptari and Udayapur in the Tarai region will benefit the proposed LDCF project.

The High Mountain Glacial Watershed Programme and ADAPT-Asia and other USAID-funding initiatives & Programmes: The High Mountain Glacial Watershed Programme (HMGWP) is an initiative of The Mountain Institute (TMI) funded by the U.S. Agency for International Development (USAID) through its Climate Change Resilient Development (CCRD) Project. HMGWP's goal is to increase awareness of the critical importance of high mountain watersheds in the context of climate change, highland-lowland interactions and ecosystem services. HMGWP have already started working in one of the key Project Target Areas around Imja Lake and have provided useful inputs for the design of Component 1 and their activities will be implementing a number of complementary activities to support achieving Project Outcome 1, particularly in relation to Outputs 1.3 and 1.4 on establishing a CBEWS in the Imja GLOF Impact Zone and strengthening local individual and institutional capacity for GLOF risk management. USAID's new Climate Change Adaptation Project Preparation Facility for Asia is assisting countries in the Asia-Pacific region to gain access to Climate Change Adaption Funds established collaboration with UNDP to undertake preliminary engineering/feasibility tasks during the project preparation phase that would help the GoN during the implementation phase of this project. ADAPT-ASIA along with ICIMOD and The Centre for Excellence in Production and Transportation of Electrical Energy (CEPTE) of the School of Engineering, Kathmandu University carried out Topographic Survey and Engineering Design of the Outlet Channel & Pre-feasibility Study for a Mini-Hydropower Generation Facility from Imja Glacial Lake during June - July 2012. The objectives of the study were to: i) to present detail topographical survey data and all relevant field data including the current river flows and all other information needed to design the outlet channel in a controlled and systematic manner that will be needed to reduce any GLOF risk. ii) To present data analyses and design of outlet channel with a cost estimation of earthwork excavation for the lowering down of the lake water level by 3 m and iii) To present preliminary analysis of river flows and the added hydraulics due to the controlled drainage of the Imja Lake for developing a Pre-feasibility study complete with estimated costs for a mini of micro-hydropower facility that will serve the communities downstream of the Imja Lake.

USAID is also implementing the SERVIR programme, which is a regional visualization and monitoring system that integrates earth observations such as satellite imagery and forecast models together with in situ data and other knowledge for timely decision-making. SERVIR evolved through a 'non-traditional' partnership between USAID and NASA (National Aeronautics and Space Administration) to make earth observation data, decision-support tools for interpreting the data, and online mapping capability, more generally available. Thus, SERVIR features web-based access to satellite imagery, decision-support tools and interactive visualization capabilities, and puts previously inaccessible information into the hands of scientists, environmental managers, educators and decision-makers, enabling them to respond better to a range of issues including disaster management, agricultural development, biodiversity conservation, and climate change. SERVIR-Himalaya, which is particularly relevant to this project, is being implemented by ICIMOD with a focus on the Hindu Kush-Himalayan region. Baseline data generated by SERVIR/ICIMOD has been helpful in assessing the risks associated with the GLOF and flood components of this project.

People's Embankment Programme (PEP), Department of Water Induced Disaster and Prevention (DWIDP)/Government of Nepal: The PEP-programme is a Government of Nepal/ Ministry of Irrigation led programme which is being implemented through DWIDP working in Ratu River of Mahottari district in the lowland Tarai region of Nepal. This programme is under implementation since 2009/2010 (2066/67 – Nepali fiscal year). The project combines both structural and non-structural activities like flood preparedness, helping to set up early warning for the communities and the engagement in embankment works (hardware construction) by involving local people from the region. Ministry of Irrigation/Government of Nepal has also established seven field offices for "People's embankment

Programme under the Department of water Induced Disaster Prevention. The primary objective of this programme is to conduct phase-wise river training and management works in 10 selected rivers of from high land to Nepal-India boarder to minimize the loss of land and property. Secondary objectives are

- To create opportunity of employment to the people of lower income by their involvement in the construction works of embankments
- To reclaim the land and its proper use by the concerned authorities
- To develop the embankment constructed for flood control as an alternative way of transportation
- Environment protection

The goal of People's Embankment programme it to minimize the loss of life and property, fertile farmland and infrastructures as a consequence of flood, inundation, river bank cutting, to provide safety against disaster and to improve the standard of living of the vulnerable people. The target for PEP-programme is to build 66.61 km of embankment on both sides of the Ratu River with gravelling on the top of the embankment to serve as road, and construct bioengineering to protect slopes in 55 hectares along the river. Until 15th June 2012, the PEP-programme has constructed 28.3km embankment (bio-gabions, dykes, etc.). The proposed project can complement and build on the efforts established by the PEP-programme especially in the Ratu River of Mahottari district; as this project also plans to protect the flood prone areas of the Ratu River in the upstream and downstream areas of this region. The funds allocated for the PEP-programme is taken as the parallel co-financing of USD 7 million to this proposed project.

B. 2. INCREMENTAL /ADDITIONAL COST REASONING: DESCRIBE THE INCREMENTAL (GEF TRUST FUND) OR ADDITIONAL (LDCF/SCCF) ACTIVITIES REQUESTED FOR GEF/LDCF/SCCF FINANCING AND THE ASSOCIATED GLOBAL ENVIRONMENTAL BENEFITS (GEF TRUST FUND) OR ASSOCIATED ADAPTATION BENEFITS (LDCF/SCCF) TO BE DELIVERED BY THE PROJECT:

PROJECT OBJECTIVE: *To reduce human and material losses from Glacial Lake Outburst Flood (GLOF) events in Solukhumbu District and catastrophic flooding events in the Tarai and Churia Range in Nepal.*

OUTCOME 1: Risks of human and material losses from Glacial Lake Outburst Flooding (GLOF) events from Imja Lake reduced.

Without LDCF Intervention (baseline):

A number of initiatives, including assessments by ICIMOD and the UNDP/DIPECHO-funded Regional GLOF Risk Reduction project, have analyzed the threats arising from Imja Lake to surrounding communities and economic assets and highlighted the urgent necessity to undertake structural measures to prevent a catastrophic outburst flood (see www.managingclimaterisk.org and Annex 4 Potential human and material losses from a GLOF event have been estimated by ICIMOD at US$8.98 billion, with nearly a 100,000 people potentially affected directly and a further 500,000 affected indirectly (Khanal et al. 2011; Annex 3). However, there are currently no plans or financing for implementing a GLOF risk reduction programme for Imja Lake as has been undertaken at Tsho Rolpa in Dolakha District (Annex 3).

While reducing the level of a glacial lake is considered the most effective structural means of reducing GLOF risks, undertaking such work in a remote, high altitude area that is distant from various supply and transportation routes is technically challenging, labor-intensive, costly and potentially risky. Experience from the Tsho Rolpa Mitigation and Early Warning Programme of 1995 and the subsequent Tsho Rolpa GLOF Risk Reduction has also demonstrated that low-tech community-based Early Warning Systems that require only minimal maintenance and long-term investment are likely to be more effective in remote

areas than high-maintenance, high-tech EWSs (Annex 7). However, even community-based EWSs (CBEWS) require careful planning and involve start-up costs in terms of engaging local communities, identifying locally appropriate mechanisms for monitoring and communication, establishing upstream-downstream linkages, training, and other factors to ensure the EWS remains operational and effective over the long-term. Thus, although ICIMOD studies have advocated for a GLOF Early Warning System (EWS), these recommendations have not been implemented as yet due to insufficient financial resources and technical capacity to design and implement a locally-appropriate EWS for Imja Lake. There is currently also no local disaster preparedness or planning for an effective response to a potential GLOF event either locally or at the district level.

The Department of Hydrology & Meteorology (DHM) of MoEST is mandated to monitor all flood risks in the country including GLOFs, but DHM currently has little capacity for regular monitoring of GLOF risks, which are exceptionally challenging to monitor for technical, logistical and financial reasons, the latter in part due to the logistics involved. In 2007, a team from the Asian Institute of Technology (AIT) extended WiFi (wireless LAN) from Namche village to Imja Lake over a distance of more than 27 km, and linked up a Field Server to capture images and meteorological data. These data were transferred in real-time to a server located in Japan. Since then, ICIMOD is monitoring snow cover in the Imja Lake area in coordination with DHM, both through direct observation, remote sensing and the SERVIR system (Section 2.3.3). DHM also undertakes bathymetric surveys and monitoring of the highest risk glacial lakes once every two years but there is limited management or application of these data at present. There is currently little specialist capacity within the Glacial Lake Monitoring Section of DHM, i.e. glaciologists and hydrologists, particularly those with experience of artificial controlled drainage of glacial lakes.

UNDP has recently completed an assessment of DHM's technical capacity for establishing an Early Warning System for flood forecasting under the climate risk management component of UNDP/CDRMP (Section 2.3.3). The assessment found that data management, analysis and application systems and human capacity need to be greatly strengthened and expanded. DHM has the equipment to monitor and forecast real-time rainfall, but lacks the technology and expertise to analyse the real-time rainfall data and basin level discharge data to assess the level of flood risks and other potential impacts in a given geographical area. There are also no systems in place for DHM to communicate flood risk warnings to MoHA (who in turn would relay the information to its agencies such as the EOCs and DDRCs), as well to DWIDP and other relevant departments. There is, however, little allocated government budget for the capacity development of DHM. DHM will soon be implementing a major five-year programme under the World Bank's Strategic Programme for Climate Resilience (SPCR) that will include strengthening DHM's capacity, as well as modernizing and upgrading the department's hydro-met stations and networks as well as improving its weather and flood forecasting services (see Section 2.3.3). A network of institutions working on EWS in Nepal is also being formed under the leadership of DHM with support from UNDP.

There is also little local capacity to manage GLOF Risks in the Imja Lake area. Hazard and vulnerability assessments conducted by ICIMOD in settlements downstream of Imja Lake in 2010 revealed that local communities are generally aware of the risks posed by a potential GLOF event but most are extremely reluctant to relocate from these areas, not only for cultural reasons, but also because of the relatively high economic returns they receive from tourism, which is their main livelihood source (Annex 2, 3 and 4). This was reconfirmed during community consultations conducted by ICIMOD during the project preparation, which additionally found that many local residents feel helpless and unable to manage or address GLOF risks by themselves (Annex 4). Communities favour the lowering of the lake as a mechanism for reducing GLOF risks. However, this is clearly something that can only be undertaken with external financial and technical support. In addition, the local community also suggested other options that could strengthen their adaptive capacity. Local residents are particularly interested in the potential for generating power from the water drained from the lake through the installation of a micro hydro station as was done at Tsho Rolpa (although power has not been distributed to local residents there

and is limited to few months in the year). At present, communities meet some of their energy requirements for heating and cooking through liquid paraffin gas (LPG) and kerosene as they are residents of a national park and therefore have limited access to fuel wood. Sagarmatha National Park only allows communities to collect firewood once a year, which is not enough to meet demand.

More recently, the High Mountain Glacier Watershed Programme (HMGWP) has also been engaging local communities in the Imja Valley to increase awareness about GLOF risks (Section 2.3.3-5). The programme is primarily focused on helping communities develop innovative tools and practices for adapting to climate change. The programme will identify and mentor champions within the local community who will be trained to undertake vulnerability needs assessments and build greater climate change awareness.

Thus, while there are a number of relevant and important baseline activities underway in the Imja GLOF Impact Zone, these are currently on a small scale or insufficiently integrated to provide a comprehensive and effective approach to GLOF risk management in the Imja Lake area. It is particularly important to understand the logistical context within which these GLOF risks have to be managed, which applies to many remote high-altitude areas. For example, Solokhumbu District Headquarters, where the District Disaster Relief Committee (DDRC) is based, is located in Saleri in the Solo Region, which is 7-9 days walk from Imja Lake. There is no DDRC in the Khumbu Region (the northern part of Solokhumbu), where Imja Lake is located. The nearest District Emergency Operation Centres (DEOC) are in Sankuwashaba and Dolkaha (adjoining east and west to Solokhumbu district) while a Regional Emergency Operation Centre (REOC) is planned in Dhankuta (in the Middle Hills of the eastern region). The nearest major hospital from Imja, Khunde Hospital, is about 2 days on foot from Imja. The Department of National Parks and Soil Conservation (DNPSC) has a visitor registration office in Jorsalle, at the entry of SNP, which is about 4 days walk from Imja, while the actual SNP headquarters is in Namche, which is 27 km away and about 3 days walk from Imja as well. In addition, there are other hospitals and health posts, mainly in Namche and in Lukla, which is about 5 days walk from Imja.

Under the business-as-usual scenario, GLOF risks will continue to rise with on-going glacier retreat and other climate-change related impacts. Without LDCF support, the residents of the Imja GLOF Impact Zone, tourists to SNP and vital infrastructure and other material assets will become increasingly vulnerable to the impacts of catastrophic outburst flooding from Imja Lake. Such an event would potentially not only wreak havoc in terms of human fatalities and injuries and damage to property, but it could also be potentially disastrous for Nepal's mountain tourism sector, something, which the country can ill-afford, given the contribution of this sector to both the local and national economies and the limited alternative livelihoods options available to local communities.

With LDCF intervention (adaptation alternative)

LDCF resources will enable the Government of Nepal (GoN) to undertake critical structural and non-structural means of reducing the direct and indirect risks of a GLOF event to local residents, tourists and valuable economic assets including buildings, hydropower stations, tourism infrastructure and agricultural land. Based on PPG consultations and analyses, it has been agreed that LDCF resources will be used to finance a controlled, artificial drainage project at Imja Lake, increase local GLOF risk preparedness through the development of a community-based EWS and institutionalize GLOF risk management knowledge and skills at local, district and national levels. Building on the experience of other LDCF projects, notably the Bhutan GLOF project, as well as the government's experience of lowering the level of Tsho Rolpa, LDCF support will be used to put in place stringent Safety & Evacuation Plans for the construction phase of the artificial drainage system. Protocols for continued monitoring of GLOF risks arising from Imja Lake and for the monitoring and management of the artificial controlled drainage system will also be developed and put in place.

The implementation of this component of the project will be managed by DHM, who will play a particularly large direct role in the design and implementation of the drainage channel and the development and implementation of a GLOF risk monitoring system for Imja Lake that can be subsequently scaled up to manage GLOF risks across the High Mountains of Nepal. DHM staff will receive targeted training on glacial lake inventory and monitoring of GLOF risks and systems and capacity developed to enable DHM to analyze real-time rainfall and basin discharge in order to forecast potential site-specific impacts and forecast flood warnings.

While DHM has continued to maintain the artificial drainage system at Tsho Rolpa, this is logistically difficult and costly. Although DHM will do the same in Imja, ideally, the Department is keen to have much greater local community engagement in the monitoring and management the drainage system after the construction phase. Thus, the project will also explore options for increasing and sustaining community engagement in subsequent lake and channel monitoring. The CBEWS will contribute to increasing community engagement in this area. Another potential mechanism for incentivizing local communities would be through the construction of a micro hydro power station that would use the extra water drained from Imja Lake as has been done at Tsho Rolpa (although the power has not been distributed to local communities there). While LDCF resources cannot be used for the development of a micro hydro power station, the project will explore the possibility of leverage additional finance for constructing a micro hydro at Imja, for which pre-feasibility studies and preliminary costings have also been made by Kathmandu University and ADAPT-Asia (Annex 5).The project will also coordinate closely with ICIMOD to benefit from the extensive knowledge and experience on GLOF risk monitoring, especially in relation to Imja Tsho and Tsho Rolpa.

Outputs supporting outcome 1:

Output 1.1: Water level of Imja Lake lowered through controlled drainage

Proposed Activities

- Form a Technical Advisory Team or Start-up Team comprised of technical experts and researchers, who have undertaken research and risk appraisal works on Imja Lake and surroundings, together with key local community representatives, women and national and local government stakeholders such as the DHM, including technical staff of DHM such as hydrologists and glaciologists, and the relevant District Authorities.
- Review scientific assessment data on glacier melt and GLOF risk arising from Imja Lake and compile a detailed risk profile for Imja Lake taking into account lessons learned from the lowering of Tsho Rolpa and other glacial lakes in the HKH region.
- Evaluate technical options for reducing GLOF risks through controlled drainage and undertake engineering design of the drainage system including appropriate location of the artificial channel, depth of the channel, benefits of digging a second channel, need for sluice gates, subsequent maintenance requirements of the channel(s) and other features, including the costs and benefits of specific options.
- Conduct an Initial Environmental Assessment/Environmental Impact Assessment (as per Government of Nepal's regulation) of the proposed drainage system and further adapt the proposed design based on IEA/EIA findings.
- Develop an Implementation and Management Plan (IMP) for the construction of the controlled drainage system that includes identification of suitable workforce, the appropriate ratio of manual labour to mechanized work, timing of work, how materials and other inputs needed to construct the drainage system will be procured and defines a monitoring system.

- Develop gender sensitive Safety & Evacuation Plans for the communities as well as the construction team during the construction phase of the drainage channel.
- Obtain approval of the proposed technical design of the drainage system, construction Implementation and Management plan and Safety and Evacuation Plans from the Technical Advisory Team, the Project Management Board and local stakeholders.
- Put in place approved Safety & Evacuation Plans and undertake construction of the controlled drainage system of Imja Lake in accordance with the approved technical design and the Implementation and Management Plan.
- Monitor, evaluate and document the implementation of the controlled drainage system and whether the proposed target for lowering lake level is achieved by the end of the project.
- Assess options for micro hydro development at Imja Lake and the sources of potential finance for such development, with a view to establishing more visible upstream-downstream linkages and benefits from the drainage works for local communities

Output 1.2: Protocols for GLOF risk monitoring and maintenance of artificial drainage system of Imja Lake developed and implemented

Proposed Activities

- Develop a system for regular monitoring of changes in lake water level , the condition and operation of the artificial drainage channel and other key parameters linked to GLOF risks such as increase in temperature leading to increase in snow melt, increase in rainfall, intactness of the end and side moraines, ice avalanches into the lake, and waves generated by avalanches. This will include a schedule of regular monitoring by the gauge observers as well as periodic more detailed technical monitoring by DHM engineers and specialists. The system will be developed by DHM together with relevant technical experts in close consultation with local communities and local authorities.
- Define a schedule of channel maintenance work with agreed budget and clear definition of the roles and responsibilities of DHM and local communities for undertaking the required work. DHM will undertake a more detailed technical assessment of the drainage channel and any oversee and guide any maintenance work required at least once a year.
- Develop guidelines for both regular monitoring and periodic, more detailed monitoring of GLOF risks and the channel by a) local gauge observers and b) technical experts from DHM. The guidelines will clearly specify what data to collect, when and how and where and how data are to be recorded, reported and stored in order to general time-series data for long-term GLOF risk management of Imja Lake.
- Install gauges to measure lake water level near the drainage outlet and the automatic data logger with a data transfer system.
- Train local community representatives including women, who will work as representatives for DHM (based on incentives to be provided by DHM), on using the monitoring and maintenance protocols developed under 1.2.1 so that they are able to undertake regular monitoring of lake level, channel condition and operation as well as to record and report relevant monitoring information to DHM and others as needed (e.g. the relevant Task Forces established as part of the CBEWS under Output 1.3).
- Implement lake and channel monitoring and reporting by local DHM representatives trained under 1.2.5.

- Implement more detailed regular monitoring of changes in level of GLOF risk by DHM technical experts.
- Maintain systematic records of all monitoring information and maintenance work both locally and at DHM Headquarters in Kathmandu.

Output 1.3: Community-based GLOF Early Warning System developed and implemented

Proposed Activities

- Verify and refine existing vulnerability assessments undertaken by ICIMOD and others by using participatory vulnerability and risk mapping as a tool for engaging communities and increasing their knowledge about GLOF risks and risk management options.
- Identify specific local needs and constraints for the implementation of a cost-effective and sustainable GLOF Community-Based Early Warning System (CBEWS) through discussions with key stakeholders, including local communities and authorities as well as development practitioners with experience of developing and implementing CBEWSs, including UNDP, Practical Action, Mercy Corps and Nepal Red Cross. Particular attention will be paid to the differential vulnerabilities of men, women, children, the elderly and any other marginalized groups.
- Identify the most appropriate institutional arrangements for a CBEWS in the Imja GLOF Impact Zone (focusing on high risk settlements) such as management by a local GLOF Risk Management Committee established under Output 1.4 and individual Task Forces or teams with responsibility for different aspects of disaster preparedness and response in the event of a GLOF such as a Search and Rescue Team, First Aid team and DRM volunteers who can be called upon to assist the community in case of an emergency. The project will liaise with existing committees in the Imja area such as the Sagarmatha Buffer Zone Management Committee, Tourism-related committees and Youth Groups, but it is likely that a new dedicated DRM committee of some kind will be needed to operationalize a CBEWS. Additionally, mechanisms for linking key local government stakeholders, such as Sagarmatha National Park headquarters in Namche and district headquarters will also be defined.
- Identify the most effective and sustainable mechanisms for relaying hazard monitoring information from real time automatic data logger and transfer system to the gauge observer(s) and then further to the GLOF RMC and to three (3) downstream communities (Chukkung, Dingboche and Pangboche) of Imja Lake for example, through the use of hand-operated sirens to the 3 vulnerable communities and 20 hand-held microphones, and CDMA mobile phones each to the 20 downstream communities with 75 km. The information will be further shared with DDRC at the District level to cover 120 km
- Test and finalize the design of the Community-based EWS for the Imja Lake GLOF Impact Zone (focusing on high risk settlements) that takes into account differences in specific vulnerabilities of different groups and includes warning mechanisms and identifies evacuation protocols, routes and sites, and the roles and responsibilities of different community members before, during and after a GLOF and/or other flood-related natural disasters.
- Familiarize wider community with the features and operation of the EWS through local workshops and mock drills, with specific targeting of vulnerable groups and those most at risk, such as women, children, the elderly, the disabled and/or those living in especially remote and vulnerable areas.
- Train the GLOF Risk Management Committee (or equivalent) members and other relevant community-members and local government representatives (i.e. VDC/Ward members from the three VDCs in Upper Khumbu in the GLOF Impact Zone (within the high risk settlements) and Sagarmatha

BZMC members) on operationalizing, testing, maintaining and periodically updating the CBEWS as needed, including mechanisms for ensuring CBEWS remains functional and relevant.

- Implement and periodically monitor the operation of the CBEWS through mock drills.
- Document the design and implementation of Imja Lake CBEWS for knowledge-sharing purposes with others involved in CBEWS development in other parts of Nepal and internationally, particularly in areas at risk from GLOFs.

Output 1.4: GLOF Risk Management Skills and Knowledge Institutionalized at Local and National Levels

Proposed Activities:

- Establish a local GLOF Risk Management Committee for the Imja GLOF Impact Zone (focusing on high risk settlements) with representation from all potentially affected sections of the local community, women, including those who are most vulnerable.
- Train members of the GLOF Risk Management Committee, including training of trainers/local resource people, on hazard mapping, Vulnerability Assessments, disaster risk reduction and preparedness activities in addition to the training undertaken under Output 1.3 on the effective use and maintenance of the CBEWS. Ensure that the trainings on risk management are gender sensitive.
- Undertake a participatory and inclusive planning process to develop a comprehensive community-based GLOF risk management plan for Imja that will be implemented by the GLOF Risk Management Committee and updated annually.
- Provide targeted training on DRM to staff (including women) from the Sagarmatha National Park Office and the Buffer Zone Management Committee including the Tourism Crisis Management Group to enable/support to revise the Sagarmatha National Park Management Plan and integrate gender sensitive risk reduction and mitigation measures in the management plans for the park and the buffer zone, respectively. Although both plans address the management of tourism in the park and the surrounding buffer zone, respectively, neither takes into account the potential implications or management of GLOF risks in the park and the buffer zone, particularly for the tourism sector.
- Develop information materials and the capacity of the Sagarmatha National Park Office staff to disseminate information through the SNP Information Centre at Namche to tourists and local people on GLOF risks arising from Imja Lake, risk reduction measures that are being undertaken and what to do in the event of a GLOF. All visitors to Sagarmatha and Imja Lake must first pass through Namche, which is 4-5 days walk from Imja. Namche is an important hub on the trekking route to Sagarmatha. Most visitors stay there overnight on their way in and out of the park. The SNPO is the only government office in Namche and the BZMC also has an office there. SNPO information centres. The dissemination of GLOF-related information will be integrated with existing practices of SNPO information centres, which already disseminate information on different aspects of Sagarmatha NP, including its biodiversity and habitats.
- Strengthen DHM's capacity to evaluate GLOF risks and communicate GLOF warnings to key partners such as the Imja Lake GRMC established by the project, and via MoHA to the DDRC and the NEOC. This will include assisting DHM obtain the technologies and develop the skills and systems needed to analyse real-time data on changes in lake water level, moraine conditions and other relevant parameters to forecast and communicate risk levels and warnings. A system to analyze, codify and store GLOF risk knowledge and experiences electronically within DHM's Hydrology Section will also be developed.
- Document and analyze knowledge and lessons generated from the implementation of the Imja GLOF Risk Reduction Programme (i.e. Outputs 1.1 to 1.4) and disseminate to key stakeholders including: i)

DRM practitioners in Nepal and the HKH region; ii) CBOs working in high GLOF risk areas; iii) local and national government institutions with a key role to play in the management of GLOF risks and other hazards in the High Mountains, such as DHM, MoHA, the concerned DDRCs, DNPWC.

- Conduct one national workshop at the end of the project to share knowledge and lessons generated by the Imja GLOF Risk Reduction Programme with key stakeholders.
- Conduct one regional workshop to exchange GLOF risk reduction knowledge and experiences with key stakeholders engaged in addressing GLOF risks in other parts of the region, notably Bhutan and Pakistan.
- Develop an exit strategy by mainstreaming the interventions established and achieved by the project into the existing Government mechanisms for further continuity and and sustainability.

OUTCOME 2: Human and material losses from recurrent flooding events in 4 flood-prone districts of the Tarai and Churia Range reduced

Without LDCF Intervention (baseline)

In the Tarai and the Churia Range, the monsoon period from June to September is characterized by intense rainfall. Up to around 80% of the country's total annual rainfall occurs during the monsoon. At this time, rivers flowing into the Tarai floodplains are extremely prone to flooding as river banks overflow, depositing large amounts of silt, sediment and debris on the Tarai floodplains, causing extensive damage to human life and property in the region (Section 2.3.5, para 124-126). Riverine flooding is a slow onset phenomenon that may take place over a period of days or even weeks. Flash floods, however, occur with little or no warning, and are particularly dangerous because of the suddenness and speed with which they occur.

At the community level, as flooding is a recurring annual event in the Tarai, local communities are well aware of the risks and have developed various coping mechanisms, but these are fairly rudimentary. People continue to live and farm in the floodplains as it is beneficial to do so most of the year. Some live in raised platform houses. During the monsoon, people watch the water levels and eventually leave their homes and field for a raised area where they will camp for a few until the water level goes back down.

Government response to flooding in the Tarai and Churai Range to date has mainly targeted the Tarai, with a heavy focus on protecting major infrastructure such as highways, bridges, major irrigation facilities and power stations. In relation to people, the emphasis to date has been more on post-disaster relief and recovery rather than pre-disaster planning and preparedness. Furthermore, while there are many institutions and actors working on flood risk management at the central and local levels, there are no mechanisms in place for systematic information sharing to improve coordination, minimize duplication and build on potential synergies. At present there is also no integration of flood risk reduction measures into the district development plans. However, in recent years under the leadership of DRRC, attention has been given towards pre-disaster planning and preparedness, which includes preparation of annual District Disaster Management Plans (DDMP) and Emergency Preparedness Plans (EPP), which are prepared specifically to prepare for the monsoons in the Tarai. DDMPs are still in a pilot phase and have been prepared for four districts thus far including two targeted by the project the Tarai (see Outcome 2 below). The DDMP proposes to integrate risk reduction activities into the district development plan, while the EPP is focused on responding to an actual disaster. Additionally, at the local level CDO (Chief District Officer), as the head of DRRC, has identified Emergency (Evacuation) Shelters in elevated areas.

DWIDP is the main government department mandated to reduce the impact of water-induced disasters on life and properties in Nepal (Section 2.2.2). DWIDP's main work in the Tarai in recent years has been through the People's Embankment Programme (PEP), which has been running for the last 3 years and is implemented in the middle and southern Tarai (south of the East-West Highway). The focus of the project is to strengthen and construct embankments along some 12 rivers in the Tarai. For example, on the Ratu

River, the government is constructing embankments and spurs downstream along a 60 km stretch of river south of the East-West Highway. There is also a parallel support from Government of India of around USD 12 million (NRs. 1 billion, USD 1= NRs.85) to construct embankments in several rivers including Khando and Gagan to confine the rivers within the embankments when they reach India.

The emphasis to date has been on hard construction as thee is relatively little local buy-in for bio-embankments (or bio-dykes) as opportunities for cash-for-work for communities are more limited in this type of soft construction. Additionally, bio-embankments must be protected against grazing and any major use until grasses and other vegetation are well established. However, community engagement in the PEP has been relatively limited to date other than cash for work, but even this has been on a small-scale thus far as most of the work is undertaken through contractors who may not necessarily use local labour.

A key gap in interventions by DWIDP to date is sediment management in the upper catchments of rivers that flow into the Tarai. Sedimentation is increasing the Upper Tarai (towards north) down to the Middle Tarai where the major depositions of coarse sediment occur, with finer sediment deposited further downstream. As a result of sedimentation, river levels are increasing, rivers are changing course, as channels narrow in some places as sediments are deposited and widen in others due to erosion. Higher sediment load in rivers means less natural scouring and deepening of the riverbed by water. Instead, riverbeds are rising in some areas due to combined impact of sedimentation and less natural scouring, such that villages and embankments are at or even below the height of the river basin in some areas. Such villages are especially vulnerable to flooding. Additionally, people have traditionally coped with flooding by shifting to raised embankment areas and roads during floods, but in some areas embankments are at the same level as the river within 2-3 years of construction due to sedimentation.

While there has been considerable discussion about sedimentation control within DWIDP, there is as yet no programme that seeks to manage upstream and downstream aspects of flood risk management and there is a pressing need to demonstrate the value of implementing a more comprehensive approach to flood control that also includes improved management of upstream areas. Local communities also do not understand the upstream-downstream linkages in flood risk management. Separate projects exist to address the problem of soil erosion in the Churia Range, such as one supported by the President's Fund for Soil Conservation implemented by the Ministry for Soil Conservation, but these are proving difficult to implement given the challenges of addressing the root causes of deforestation and degradation in the Churias. Furthermore, the Soil Conservation Department only addresses the problem of topsoil protection. DWIDP also has a small project, the Community-Based Natural Resource Regeneration project to regenerate wood stock in Jhapa in Eastern Nepal within 300-500 m of a river working through local NGOs and CBOs. At present there is little coordination between the different Ministries and Departments to manage flood risks in a more integrated manner.

UNDP has undertaken a number of concrete disaster risk reduction efforts to address climate-induced flooding, landslide and erosion threats in some of the most vulnerable districts in the Churia and Tarai region. Through cooperation with Action Aid, UNDP has financed embankment protection; construction of culverts; raising of hand pumps; construction of emergency shelters; installation of gabion boulder blocks along riverbeds to prevent erosion; installation of Community-Based Early Warning Systems; and the design of Emergency Plans of Action. These efforts have been complemented by integrated watershed management approaches for flood risk reduction in the Pasaha Khola Watershed of Bara District, and Kerunge Khola Watershed in Nawalparasi District in collaboration with the Department of Soil Conservation and Watershed Management (DSCWM) and DWIDP. UNDP is also conducting an assessment for the establishment of CBEWS in five other watersheds in seven districts under the UNDP /CDRMP, including Mahottari, one of the project target areas. Increasing disaster preparedness as well as development of CBEWSs in the Tarai has been a major area of focus for several NGOs such as Practical Action, Mercy Corps, Action Aid as well as UNDP's DRM Programme.

In addition, UNDP-FAO's project **"Enhancing Capacities for Climate Change Adaptation and Disaster Risk Management for Sustainable Livelihoods in Agriculture Sector"** is assisting the Ministry of Agriculture and Cooperatives (MoAC) in testing and operationalizing the process of shifting from a reactive emergency response intervention approach towards a pro-active natural hazard risk prevention/preparedness oriented approach in the agricultural sector. The project has demonstrated climate change adaptation practices in two selected pilot districts (Banke and Surkhet) to address climate variability on crops and increase awareness by local communities about evolving climate risks. These efforts not only provide insights into the factors that underpin the vulnerabilities of rural livelihoods, but also a range of complementary experiences to draw on with regards to what has worked in assessing, communicating and responding to climate risks in flood-prone agricultural areas.

Historically, government interventions have also tended to be more top-down without full engagement of local communities from the start. However, the Local Adaptation Plan for Action (LAPA), a new GoN initiative and NRRC Flagship 4 project that will be implemented in Western Nepal, seeks to provide a framework to ensure that climate change adaption planning follows a bottom up, community-based approach that is inclusive, flexible and responsive. It involves a process that will identify those who are the most vulnerable to the impacts of climate change and include them in the decision-making process from the start in identifying climate-related hazards and risks and prioritizing adaptation strategies to reduce risk and increase resilience. Thus, the LAPA framework is to be used as a tool to establish a vertical link between national, top-down climate change adaptation planning and community-based assessments of hazards, risks and adaptation priorities. The intent is to mainstream climate change adaptation approaches from local to national level planning processes and to ultimately integrate these approaches into district development planning. Specifically, the LAPA process is expected to be led by the District Authorities (i.e. the Chief District Officer's office) but implemented by CBOs and community mobilizers at the VDC/community level. This project will make use of any relevant knowledge and lessons generated by the LAPA project in local flood risk planning and management in project target areas. The LAPA project, however, is just starting implementation in 2012 after the project document is signed by GoN.

With LDCF intervention (adaptation alternative)

By the end of the project, vulnerable local communities living around flood-prone river basins in four districts of the Teria and Churia Range will experience fewer human and material losses due to flooding as a result of a number of additional structural and non-structural measures to reduce flood risks. This will include the implementation of a sediment control system and stabilization of hazard-prone slopes and river banks in at least one river basin, most probably the Ratu. This will be the first time that a comprehensive sediment control programme is undertaken in the Tarai and Churia range and will serve as a valuable demonstration of the critical importance of upstream-downstream linkages and a holistic approach to flood risk management. At least 5 km of river bank in total will have been strengthened through the construction of gabions and biodykes. Additional structural measures will include at least 2 flood-proofed drainage systems each in Ratu river basin (Sarpallo VDC and Nainhi VDC) and Khando river basin (Didhawa VDC and Pakari VDCs) will be strengthened. Similarly, access to drinking water supplies will be flood-proofed through the construction of at least 24 raised tube wells in inundation-prone areas of 6 VDCs in 3 river basins, namely Sarpallo and Nainhi VDC of Mahattori district (Ratu River), Didhawa and Pakari VDC of Saptari district (Khando River) and Tulsipur and Pipra Pra Pi VDC in Siraha district (Gagan River). Elevated zones will be constructed for the purpose of emergency shelter in 8 VDCs of four targeted districts (Jogidaha VDC and Hadia VDC in Udaypur District and the flood-prone VDCs mentioned above).

Additionally, Community-Based Early Warning Systems (CBEWSs) will be fully operational in at least 8 VDCs in five targeted river basins, including the ones with greatest flood impacts, the Ratu and the Khando. These will be based on low-cost, low-tech systems that can be easily managed and operated by

illiterate people, women, children and the elderly. Warnings will rely on observations of rain gauges and river gauges installed at suitable points, with mikes, sirens and mobile phones used to communicate warnings. Village Disaster Management Committees and Task Forces with different responsibilities will have been trained and have sufficient capacity oversee the smooth operation of the CBEWSs. Village Disaster Management Plans prepared under the leadership of the VDMCs with LDCF support and which particularly address the needs of the most vulnerable will be under implementation by the end of the project. Thus, LDCF resources will have been used to empower local communities in Udayapur, Siraha, Saptari and Mahottari districts of east and central east Nepal, including the most vulnerable among them, such as the extreme poor, women, and the elderly. The project recognizes that women can act as a major change agent in any awareness programme and one of the key indicators of disaster risk reduction is gender equity in disaster preparedness. Hence the LDCF project will ensure representative of women in disaster risk management committees and groups as formed for their increased and sustained involvement during different stages of project. Additionally, by flood-proofing water supplies, LDCF support will have also ensured the availability of safe drinking water during flooding events, which in turn will help reduce the incidence of water-borne diseases in these areas during times of flood, particularly among new-born babies and children.

By the end of the project, institutional capacity for managing flood risks in the Tarai and Churia range will also have been greatly strengthened, particularly the capacity of DWIDP, the main government agency tasked with preventing water-induced disasters, and of the DDRCs in the project districts. Notably, LDCF support will also enable the development of a sediment monitoring system within DWIDP to track sediment load in river basins, after piloting and testing in one river basin by the project. Key district line agency personnel will be trained in flood risk management and options for integrating such risk reduction measures in their sector plans as well as the district development plans. Greater understanding of upstream and downstream linkages will have been created, including among communities living these two different areas through exchange visits.

Output 2.1 Sediment control and stabilization of hazard-prone slopes & river banks through structural and non-structural mechanisms

Proposed Activities:

- Form Technical Advisory Team/Start-up Team led by DHM and DWIDP, comprising relevant national and local government counterparts, technical experts and local community representatives
- Undertake detailed technical studies and cost-effectiveness analyses to evaluate options for controlling sediment at source and stabilizing hazard-prone slopes and riverbanks in one of the four project river basins. Options for sediment control are expected to include: a series of check dams, which may be made of concrete, stone masonry, gabion boxes and/or a combination. River bank and slope stabilization will target the most erosion-prone areas and/or the most vulnerable settlements and agricultural lands and involve bio-dykes, bioengineering and/or gabion mattresses in the areas north of the East-West Highway in the upper Tarai and a small part of the Churia Range. South of the East-West Highway, riverbank stabilization will be undertaken through the DWIDP's PEP.
- Conduct consultations with flood-affected communities, with special focus to women, local government authorities, key CBO, women groups s and NGOs in target river basin to identify most locally appropriate structural and non-structural mechanisms for reducing erosion and stabilizing hazard-prone slopes and river banks, including embankments, bio-dykes, bioengineering and/or gabion mattresses
- Finalize most appropriate methods for slope/river bank stabilization (e.g. bio-dykes, gabion mattresses, riveting etc.) and structures for upstream sediment control, including number, type (e.g. concrete check dam, gabion boxes, concrete or stone masonry) and where these should be located based on findings from 2.1.2 & 2.1.3.

- Undertake detailed technical design of the programme for sediment trapping and stabilization of at least 5 km of slope/river banks in the target river basin using gabions, bio-dykes and other suitable measures.
- Conduct EIA/IEA of proposed sediment control and slope/river bank stabilization programme and further adapt design of the programme as needed based on EIA/IEA findings.
- Develop a plan for the implementation and management of the proposed programme for sediment control and hazardous slope/river bank stabilization in one target river basin including mechanisms for engaging local communities, assuring the quality of materials procured and works undertaken and a monitoring and evaluation system for assessing effectiveness of sediment control and reduction in flood risk
- Obtain approval from the Technical Advisory Team, the Project Management Board and local stakeholders of the final design and implementation and management plans of the proposed sediment control programme and slope/river bank stabilization programme.
- Establish baseline data on sedimentation rates and erosion in areas to be targeted by project and implement the approved sediment control and slope/river bank stabiliziation programmes.
- Undertake annual monitoring to assess impact of project interventions on rates of sedimentation and erosion.

Output 2.2 Flood proofing of Water and Sanitation systems in selected VDCs in target river basins

Proposed Activities:

- Identify suitable sites for flood-proofing drainage systems and/or access to drinking water supplies based on results of participatory vulnerability assessments in order to selectively target the most vulnerable groups and areas, with particular attention to the needs of women, children, the elderly and the infirm or disabled.
- Prepare technical design and implementation plan for the location and construction of elevated tube wells in the selected sites (in consultation with local communities especially women) and obtain approval from the Technical Advisory Team and DDC (District Development Committee)/District line agencies (especially District Soil and Forest Office) of the proposed design and implementation plan. Particular attention will be paid to the issue of access to safe drinking water by women and other marginalized groups in the siting and design of elevated tube wells.
- Prepare technical design and implementation plan for flood-proofing drainage system in selected sites (in consultation with local communities especially women), including mechanisms for community engagement, quality assurance and monitoring of implementation, and obtain approval from the Technical Advisory Team and DDC (District Development Committee)/District line agencies (particularly District Soil and Forest Office) of the proposed design, implementation plan and monitoring and quality assurance mechanisms.
- Construct 24 elevated tube wells in inundation-prone sites in at least 6 vulnerable VDCs in the Ratu, Khando and Gagan river basins (i.e. 2 VDCs in each river basin), in line with the approved design and implementation plan.
- Undertake flood-proofing of drainage systems in 1 VDC in Ratu river basin and 1 VDC in Khando river basin in line with the approved design and implementation plan.
- Monitor, evaluate and document the implementation process and results achieved.

Output 2.3 Institutionalization of flood risk management skills and knowledge

Proposed Activities:

- Conduct exchange visits between downstream and upstream communities in the project river basins to promote peer-to-peer learning about the role of upstream-downstream linkages in relation to flood risk management.
- Train relevant district line agency representatives on flood risk management and options for integrating flood preparedness activities into their annual and longer-term district plans so that these are properly budgeted and reflected in the District Development Plan. Key line agencies who will be trained include: the Department of Soil Conservation, DWIDP and district level line agencies such as Irrigation, Forestry, Soil Conservation, Agriculture and Drinking Water.
- Develop a monitoring system to track sediment load in at least one target river basin to measure and evaluate the impacts of the structural measures implemented by the project for upstream sediment control. The monitoring system will be institutionalized within DWIDP and expanded to cover other river basins.
- Undertake targeted training on sediment monitoring in river basins and flood risk management options in the Tarai and Churia Range for members of DWIDP within its national headquarters, with emphasis on increasing capacity of the Training & Monitoring Unit, as well as of Divisional and Sub-divisional staff within the project areas.
- Conduct annual meetings of all key stakeholders (e.g. line agencies mentioned in 2.3.2, donors, NGOs/CBOs) at the national level and quarterly meetings at the sub-regional and/or district level in the project target districts in order to increase information and knowledge sharing as well as improve coordination between the key agencies and actors in flood-risk management in the Tarai and Churia Range, thereby maximize the potential for synergies and minimizing the risks of duplication. These meetings will be coordinated by DWIDP. Minutes and outcomes of the meetings will be reported to MoHA and the concerned DDRCs and Village Disaster Management Committees. The project will support DWIDP to do this in the first two years, after which DWIDP will manage the process internally. Minutes of the meetings will also be disseminated through the NRRC Flagship 4 communication platform and coordination meetings.

Output 2.4 Flood preparedness training for district and VDC representatives, NGOs, CBOs and local communities in 4 flood-prone districts

Proposed Activities:

- Undertake a comprehensive review of Community Based EWS experiences in Nepal and lessons learned with particular reference to experience of other agencies working on EWS in the Tarai region such as Practical Action, Mercy Corps, UNDP and NRRC Flagship 4 projects.
- Conduct an assessment of flood preparedness in selected high-risk villages, including: Kong River - Jogidaha VDC (Ward Nos. 1, 2m, 3, 5, 6 and 8) and Hadia River - Hadia VDC (Ward Nos 1, 2, 4, 5, 6, 7 and 9) in Udaypur District; Gagan River – Tulsipur VDC (Ward Nos. 1-9) and Pipra Pra Pi VDC (Ward Nos. 1-9) in Siraha District; Khando River - Didhwa VDC (Ward Nos. 1, 2, 3, 5, 6, 7, 8 and 9) and Pakari VDC in Saptari District; Ratu River - Sarpallo VDC (Ward Nos. 1-9), and Nainhi VDC (Ward Nos. 1-9) in Mahottari District.
- Establish a community-level gender sensitive Village Disaster Management Committee (VDMC) and individual Task Forces or teams with responsibility for different aspects of disaster preparedness and during a flood such as a Search and Rescue Team, First Aid team, Evacuation Team and a range of DRM volunteers who can be called upon as need.

- Evaluate options for a practical, low-cost, low-tech CBEWS in at least two river basins (Ratu and Khando), i.e. one that involves manual data collection through observation of rain gauges and transmission of flood risk information and warnings between upstream and downstream communities through mikes/sirens/mobile phones. Emphasis will be placed on developing a simple system that can be operated by women, children and/or old people.
- Undertake technical assessments for the location of river gauges at appropriate spots along at least two river basins (Ratu and Khando) and identify suitable evacuation routes and emergency shelters for vulnerable communities.
- Prepare gender sensitive and inclusive village-level Disaster Risk Management Plans (DRMPs) for at least 8 VDCs under the leadership of Village Disaster Management Committees (VDMCs). Building on the findings of Activity 2.4.2, these will identify the most vulnerable in terms of their location, identity, evacuation routes and shelters as well as the agreed roles and responsibilities of different VDMC members and Task Forces during a flood.
- Design, approve and install a CBEWS in consultation and participation with concerned local communities and representatives of DDRC, VDCs, relevant CBOs, women groups and NGOs. The number of villages to be covered and other design features will be guided by the results of Activities 2.4.1-2.4.6. The CBEWS is expected to cover at least 8 VDCs and will use low-cost technology such as hand-held sirens, microphones and CDMA mobile phones. At least 4 elevated evacuation zones will be constructed in the most flood-prone areas of the Ratu and Khando river basins in Sarpallo VDC, Nainhi VDC, Didhawa VDC and Pakri VDC The design of the CBEWS will be subject to approval from the Technical Advisory Team.
- Undertake training on flood preparedness and monitoring and communicating flood risk warnings for representatives of DDRC, VDCs, VDMCs, relevant NGOs, women groups and CBOs and communities in project river basins, ensuring participation of women (at least 50% of participants), children and the elderly. Training programmes will be designed together with DDRC, NGOs, women groups and CBOs with experience in this area. Simple pictorial guidelines in colour will be developed that will be suitable for both literate and non-literate audiences.
- Analyze, document and share experiences and lessons generated by the project on flood preparedness and community-based EWS in Ratu and Khando flood-prone river basins in the Tarai and Churia districts with other key stakeholders and the public through targeted reports, the media, websites.
- Conduct one district-level workshop and one national workshop at the end of the project to disseminate project knowledge, experiences and key lessons learned.
- Develop an exit strategy by mainstreaming the interventions established and achieved by the project into the existing Government mechanisms for further continuity and sustainability.

B.3. DESCRIBE THE SOCIOECONOMIC BENEFITS TO BE DELIVERED BY THE PROJECT AT THE NATIONAL AND LOCAL LEVELS, INCLUDING CONSIDERATION OF GENDER DIMENSIONS, AND HOW THESE WILL SUPPORT THE ACHIEVEMENT OF GLOBAL ENVIRONMENT BENEFITS(GEF TRUST FUND) OR ADAPTATION BENEFITS (LDCF/SCCF). AS A BACKGROUND INFORMATION, READ MAINSTREAMING GENDER AT THE GEF.":

B.3.1. Socio-economic benefits:

The project responds to two of the most urgent and immediate priorities identified in Nepal's NAPA. By the end of the project, the following specific national and local benefits are expected.

At the national level, LDCF funding will enable the government of Nepal to address important investment

gaps in community-based climate risk reduction. Many of these gaps have been highlighted in a number of previous assessments by development partners but never been followed up due to lack of adaptation financing and sufficient institutional know-how. Specifically the project will contribute to strengthening the institutional and technical capacity of two lead government agencies with a major role in flood risk monitoring and management in relation to GLOFs and riverine flooding in the Tarai and Churia Range, namely DHM and DWIDP. Additionally, it will contribute to improved coordination between DHM, DWIDP and other key partners working on DRM within and outside MoHA at the national level.

At a local level, LDCF funding will greatly reduce the risk of human and economic losses from catastrophic flooding events in four districts of the Tarai and Churia Range and in the GLOF Impact Zone of Imja Lake and neighbouring areas. In the Tarai and Churia Range, at least 64,700 of the most poor and vulnerable households are expected to benefit from one or more of the following measures: flood-proofed water and sanitation systems, CBEWSs, sediment control and stabilization of riverbanks and slopes in the Ratu river basin. In Solukhumbu District and other areas within wider Imja Lake GLOF Impact Zone, at least 31,862 population (within the high risk settlements), somewhat 8.98 worth of material assets and infrastructure, and around 30,000 tourists annually, will benefit from the reduced risks of a GLOF event at Imja Lake through lowering of the lake and reducing its volume and through the development of a CBEWS. Additionally, in both the Tarai and Churia Range and in and around Imja, communities, including women and other disadvantaged groups, will be more empowered to plan and prepare for potential disasters themselves as a result of the capacity development and community mobilization interventions facilitated by the project, which will include the formation of village-level disaster management committees, plans and task forces. Local DDRCs in the project target areas will also have greater knowledge and technical skills for integrating DRM into district development plans and emergency preparedness plans as a result of the targeted training provided by the project as well as opportunities to engage proactively in different project interventions.

B.3.2. The gender dimension of disaster risk management in Nepal

Gender aspects have been analyzed thoroughly and fully integrated in the project. Numerous studies indicate that women often suffer disproportionately more than men from the impacts of disasters, including higher rates of mortality, due to gender-based differences in access to information, training, mobility, decision-making, resources, cultural norms and barriers as well as high rates of male out-migration (Nellemann, C., Verma, R. and Hislop, L., 2011:37). These studies underscore the importance of understanding the gender implications of disasters, including climate-related disasters, and integrating this understanding into the design of DRM and climate change adaptation measures, with particular attention to the linkages between climate-related disasters, development and women's social marginalization, lack of choice and the skewed power relations between men and women (UNDP, 2011).

Other marginalized groups that need special consideration during DRM and climate change adaptation planning, include socio-economically disadvantaged and/or marginalized communities, such as dalits, endangered and highly marginalized ethnic groups. Members of these communities are often less well-educated than other communities and also frequently excluded from the dominant communities' user groups and other activities. Because of social exclusion and poor education, marginalized communities often have limited understanding of, and access to information about, potential disasters and options for mitigating the impacts of such disasters, which make them particularly vulnerable to the impacts of climate-related and other disasters. Other vulnerable group, include the very old, the very young, and person with disabilities, especially when they are also from a marginalized community and women.

In the highly dynamic socio-ecological Tarai and Churia, water-induced hazards such as flooding, erosion, landslides, drought and water-borne diseases have been shown to collectively have a greater impact on marginalized, indigenous and poor people's livelihoods, food insecurity and health. Community interactions and consultations undertaken in Udayapur, Siraha, Saptari and Mahottari

Districts during the PPG (see Annex 4 for details) confirmed the hardships faced by different groups during floods, particularly women and young children (see Annex 4). In most of the visited communities, young men had migrated to find work as paid labour, because of the impacts of floods and sedimentation on agricultural lands and crops. Consequently, many communities are mostly comprised of elderly people, young women and children. Women are the caretakers of their homes, fields and natural resources during and after the floods. However, women are still frequently subjected to domestic and sexual violence and often do not have access to female aid workers to whom they can express their gender specific needs and concerns. Domestic and sexual violence often becomes worse during and after floods, when people are forced to move to shelters or other dry areas, where they are no separate and secure sleeping or toilet facilities for women or adequate lighting and other security measures. Flooding is particularly problematic for pregnant women or those who are about to give birth or have just given birth and women who have just given birth face more difficulties. Some women reported on the trauma of having to walk several miles in the flood-affected areas with labour pains and the complications they endured with new born-babies and young children during floods. For example, in one community two babies born during a flood immediately contracted pneumonia. These children are almost two years old now, but still suffer from frequent respiratory problems, which add to their families' difficulties and expenses. The risk of water-borne disease during floods is especially high for the very young and the very old. Additionally, floods frequently disrupt the education of children, especially small children, who may be unable to attend classes for days and weeks.

PPG consultations with local communities downstream of Imja Lake in Ghat, Namche and Dingobche revealed that women are very active as able adult men are all occupied with outside activities such as accompanying trekkers and mountaineers. Women were very aware of the risks they faced from a potential GLOF and felt they and their children were particularly vulnerable since they spend more time at home and in the area generally than the men, who may be away for long periods for work.

Despite the differential impacts of disasters on women, children and elderly, the special needs of these groups are rarely taken into account in DRM planning and implementation. They also continue to have minimal or no voice in reconstruction planning and remain marginalized in their access to relief resources. For example - ensuring of women participation in capacity building, exchange visits, flood preparedness training, establishing community level VDMC and task forces are important and not practiced frequently. The reasons for this include: lack of appreciation by decision-makers of the many benefits of mainstreaming gender and other social considerations into DRM planning and rescue and relief operations as well as lack of knowledge and experience in undertaking more socially sensitive DRM planning. There is also a lack of gender-disaggregated data in Nepal on loss of lives and properties due to disasters in order to conclusively demonstrate the benefits of mainstreaming gender into DRM planning to key decision-makers. Nonetheless, gender gender-sensitive DRM planning is slowly gaining ground in Nepal due to the efforts of DRM practitioners and other advocates of this approach. Initiatives like flood proofing to drinking water supply system through raised tube wells is also related to gender issue as destruction of tube wells during flooding compel women to reach far in search of drinking water.

This project has ensured that gender mainstreaming and other social considerations have been taken into account in the project's overall design. Feedback from especially vulnerable groups during community consultations undertaken during project preparation has been integrated into the design of specific project outputs as described further in Section 2.4. For example, the community-based early warning systems that will be developed with LDCF support will be simple enough to be managed and operated by children, women and the elderly, including illiterate people. Gender mainstreaming and other social considerations will be integrating into the more detailed planning of project activities during project implementation. These aspects will also be monitored specifically during project implementation and documented in relevant progress reports.

B.4 INDICATE RISKS, INCLUDING CLIMATE CHANGE RISKS THAT MIGHT PREVENT THE PROJECT OBJECTIVES FROM BEING ACHIEVED, AND IF POSSIBLE, PROPOSE MEASURES THAT ADDRESS THESE RISKS TO BE FURTHER DEVELOPED DURING THE PROJECT DESIGN:

The project strategy builds on various past and on-going government programmes, particularly in the fields of Glacial Lake Lowering (Tsho Ropla Lake), upgrading systems and mechanisms at the Department of Hydrology and Meteorology, Glacial lake management, Flood risk management (People's Embankment Programme (PEP), President's Churia Programme and disaster risk management. Similarly, the achievement of planned outcomes of this project will depend largely on strong engagement/involvement of Government Counterparts and key stakeholders, particularly the different departments and ministries, for effective inter-sectoral coordination. The project assumes that the Government of Nepal (especially the Ministry of Environment, Science and Technology/Department of Hydrology and Meteorology) will bring all the key stakeholders together for consultation and implementation of the activities as planned. In addition, it is assumed that the GON will ensure that the monitoring and maintenance of the systems established by the project are well functioning and operational for the benefit of the local communities. However, the current political disturbances, upcoming election and reorganising of an impending constitutional development process in Nepal, have the potential to influence the project implementation to a large extent.

There is uncertainty over the local governance and administrative structure that will eventually emerge once the constitution is in place. This will have implications during project implementation because the local government and other local bodies are seen as the key stakeholders of the project at the district and village level. The project assumes that the institutions established at the community and district level are functional and supportive to the implementation of project activities as planned. However, the institutionalization of project results at the local level will depend on continuity in the project's relationship with local government officials and civil servants at the national and district levels in addition to a smooth transition when the new governance and administrative structures are in place. Other risks include turn-over (transfers) of technically sound/trained government staff working with the project which may also result in delays to implement project activities as planned. The project assumes that the commitment by the GoN to implement the project will ensure the maintenance of technically sound staff to support the implementation of the project.

The project assumes that there will be strong community support for the project and that communities will perceive real added value in engaging with the project. However, stakeholder consultations during the PPG phase revealed 'development fatigue' and disillusionment with consultation processes, especially in the GLOF Risk areas due to the absence of tangible benefits that have yet to materialize for community members (see Annex 2). Furthermore, a volatile political environment and the tendency for greater political interference at the local level in the Tarai region could possibly pose a challenge when it comes to ensuring objectivity in the community and locations enlisting for project investment. A major challenge will be to manage local stakeholder expectations and also find appropriate ways of securing tangible benefits for local communities. The project, through its community development efforts and participation and consultation at the local level, plans to address those challenges to ensure that the communities at the targeted areas support the project's initiatives as well as maintain the systems that have been established with project's investments.

The project has two distinct components, one focused on working in the Mountain region and the other focused on working in the Tarai (lowland) and Churia region based on its diverse objectives; the stakeholders and agencies involved to support the implementation also vary for each outcome. However, under the Ministry of Environment, Science and Technology (MoEST), the Department of Hydrology and Meteorology (DHM) will be the implementing agency for this project and also responsible for both of these the components. To support DHM, the GON has chosen the Department of Water Induced Disaster and Prevention (DWIDP) to undertake the monitoring and oversight role for activities implemented under

Component 2. The project assumes that a strong coordination mechanism will be established, maintained and continued between these two agencies as well as its district line bodies for efficient and effective implementation. Likewise, the project has designed a detailed stakeholder involvement plan (Annex 5) to be followed during the implementation process.

The main indicators of the project will be the successful lowering of water levels in Imja Lake and a well-functioning Community Based Early Warning System (CBEWS) at the targeted downstream communities under Outcome 1; and a reduction of the loss of lives and livelihood assets due to flooding events over the duration of the project and a well-functioning Community Based Early Warning System (CBEWS) in the targeted communities under Outcome 2. The project assumes that the climate change induced glacier melt remains at or below the level indicated by the current climate change projection and that the rate of glacier melt at Imja does not accelerate due to other non-climatic factors. Furthermore, the project assumes that during the project period there are less/no extreme weather and climatic events that accelerate intensive rainfall that will trigger floods, debris flow and landslides in the targeted locations. The project also assumes that extra precautions are taken by the contractor to ensure the health and safety of workers in the harsh and high altitude working environment.

The proposed project is based on strong government support and plans to draw important pilot experiences that have been derived from DHM/GON and UNDP-supported disaster risk reduction projects in and around the project target areas. These experiences will support the project in minimizing and addressing the strategic and organizational risks of the project in a more effective manner.

B.5. IDENTIFY KEY STAKEHOLDERS INVOLVED IN THE PROJECT INCLUDING THE PRIVATE SECTOR, CIVIL SOCIETY ORGANIZATIONS, LOCAL AND INDIGENOUS COMMUNITIES, AND THEIR RESPECTIVE ROLES, AS APPLICABLE

Category	Institution	Involvement in the project
National Government Institution	Ministry of Environment, Science and Technology (MoEST) Focal Point: Mr. Krishna Gyawali, Secretary	During the project preparation phase (PPG phase), the MoEST was the focal Ministry to initiate the programme formulation task and was involved in the development of the initial concept (PIF) and conduct of design activities. It played a key role in bringing the partners and stakeholders together in disseminating information and helping to shape the project outcomes and outputs at every level. During the implementation phase of the full sized project (FSP), MoEST play the role of cooperating agency and will be responsible for ensuring coordination of the LDCF initiative with other on-going initiatives including promoting the various sub-initiatives undertaken in this project. It will promote ownership of the project by the GoN and ensure the interventions meet national priorities. The MoEST may approach other relevant line ministries and departments to provide input when needed. MoEST will chair the Project Steering Committee (PSC) meeting.
	Climate Change Management Division (CCMD), MoEST Focal Point: Mr. Prakash Mathema, Joint Secretary	During the PPG phase, on behalf of the GoN/MoEST, the CCMD played the role of coordinator to support the project formulation phase. CCMD was involved in the design of the concept (PIF) as well as during the PPG phase. It played a key role in securing approval for the project from the GoN. During the FSP implementation phase, CCDM within MoEST will undertake a coordinating role to support the effective role out of

Category	Institution	Involvement in the project
		project activities. The CCMD of MoEST will also ensure alignment of the proposed project with Nepal's NAPA follow-up programme. The CCMD will be the member of PSC.
	Department of Hydrology and Meteorology (DHM), MoEST Focal Point: Mr. Rishi Ram Sharma, Director General	During the PPG phase, under the guidance of the MoEST, the DHM was involved in the project formulation exercise by providing substantial inputs from their experiences and expertise to the overall design of this initiative. During the FSP implementation phase, DHM will be the implementing partner as per the GoN and UNDP's agreed National Implementation Modality. DHM shall be the overall responsible and accountable agency to deliver the objective and outcomes of the project. DHM will be Executive member of the PEB meeting and will be coordinating and supporting MOEST in organising the PSC. DHM will be responsible for reconciling all substantive and financial reporting by various responsible parties and reporting to UNDP as per agreed work plan.
	Department of Water Induced Disaster Prevention (DWIDP), Ministry of Irrigation (MoI) Focal Point: Mr. Prakash Poudel, Director General	During the PPG phase, the DWIDP was involved in providing substantial inputs on flood related information especially for component 2 from their experiences and expertise. During the FSP implementation phase, under the overall guidance of the MoEST and in close collaboration with the DHM, the DWIDP (as responsible party) shall be responsible for providing technical inputs, monitoring of the project activities that are planned to be implemented under Component 2 of the Project. The DWIDP will be a member of the Project Executive Board (PEB) and PSC as one of the Senior Beneficiaries,
	Department of Soil Conservation and Watershed Management (DSCWM), Ministry of Forests and Soil Conservation (MoFSC) Focal Point: Mr. Bharat P. Pudasaini, Director General	During the FSP implementation phase,the DSCWM under the guidance of the MoFSC and MOEST, will provide technical inputs and support on issues related to upstream watershed management and soil conservation activities to reduce flood risk in the Tarai region (under Component 2). The DSCWM will be involved in the conduct of the EIA/IEE (as appropriate) in the upstream area where structural measures will be undertaken. The Department will also play active role as a member of the PEB as one of the Senior Beneficiaries and will be a member of the PSC
	Department of National Parks and Wildlife Conservation (DNPWC), MoFSC Focal Point: Mr. Megh B. Pandey, Director General	During the FSP implementation phase, the DNPWC shall help to coordinate with the Sagarmatha National Park and Buffer Zone Management Committee to complement with the ongoing initiatives while implementing project activities for the GLOF risk reduction component (Component 1) on Imja Glacial Lake. The DNPWC will play an active role at the PEB as one of the Senior Beneficiaries and will also be a member of the PCS.
	Ministry of Home Affairs (MoHA) Focal Point: Mr. Sushil J.B. Rana, Secretary	During the PPG phase, MoHA participated in project stakeholder meetings and contributed to establish linkages with district level disaster relief committees to the design of the project. During the FSP implementation phase, MoHA will be a responsible party to the IP and implement Community-based Disaster

Category	Institution	Involvement in the project
		Management actions under both Components 1 and 2 through the central and district relief committees. Since MoHA has the mandate to work on disaster risk and preparedness activities under GON, the work will be closely linked under their jurisdiction. MoHA will also be a member of the PSC.
	Ministry of Federal Affairs and Local Development (MoFALD) Focal Point: Mr. Shital Babu Regmi, Secretary	During the PPG phase, MoFALD participated in project stakeholder meetings and contributed to draw linkages with district line agencies and the capacity related issues that would be important during the design of the project. During the FSP implementation phase, MoFALD will be a responsible party to the IP and shall support in delivering activities under Components 1 and 2. The MoFALD will play a vital role in facilitating community mobilization, institutional empowerment and capacity building, integrating project purpose, objectives and activities into the local development planning. The MoFALD will be a part of PEB as one of the Senior Beneficiaries and will also be a member of the PSC.
	Ministry of Finance (MoF) Focal Point: Mr. Krishna Hari Banskota, Secretary	During the PPG phase, MoF participated in project stakeholder meetings. They supported the design of the project by providing feedback to the design team and to ensure that the GEF resources are allocated appropriately. During the FSP implementation phase, the project will work closely with the MoF. MoF's senior official is assigned as GEF and they are the key recipient of LDCF, and responsible for the transfer of LDCF resources to the Implementing Partner, DHM and associated responsible parties according to a work plan agreed by all key stakeholders including UNDP, and perform fiscal monitoring of project spending within the Government system. The MoF will play the role at the PEB as one of the Senior Beneficiaries and will also be a member of the PSC.
	Alternative Energy Promotion Centre/Ministry of Environment, Science and Technology (AEPC/MoEST) Focal Point: Dr. Govinda Pokharel, Executive Director	During the FSP implementation phase, AEPC/MoEST will be indirectly involved in the project to provide advice on development of the utilization of drained glacial lake water out flow for energy production (under Component 1) as required.
	Ministry of Culture, Tourism and Civil Aviation (MCTC) Focal Point: Mr. Ganesh Raj Joshi, Secretary	During the FSP implementation phase, the project will work closely with the MCTC in order to benefit from and contribute to tourism infrastructure in and around the Imja lake area and to connect with the tourism industry by addressing GLOF risk reduction activities. MCTC will be a member of the PSC.

Category	Institution	Involvement in the project
Development Partners and INGOs	United Nations Development Programme (UNDP) Focal Point: Ms. Shoko Noda, Country Director	UNDP was requested by the MoEST to serve as the GEF Implementing Agency to support the Government with the formulation of the concept and preparation of the project document for CEO approval. During the FSP implementation phase, as per discussions with the MoEST/GON the project will be implemented under the National Implementation Modality where UNDP will play an active role as the Senior Supplier in the Project Board. In this role, UNDP will provide oversight support to the project as per its role as a GEF IA. UNDP provides project cycle management services (also referred to as General Management Services-GMS) via the UNDP Country Office, with specialized technical and oversight support by the UNDP-GEF unit at the regional and global level. Expected direct project services by UNDP to the Implementing Partner have been identified (if required) and are documented. The Direct Project Costs that are implementation-driven and are incurred for, and can be traced to, the delivery of project inputs have been estimated. These costs are incurred as part of Country Office support to NIM projects.
	International Center for Integrated Mountain Development (ICIMOD) Focal Point: Dr. Arun Bhakta Shrestha	During the PPG design phase, ICIMOD was involved in the project formulation exercise by providing substantial inputs from their experiences and expertise. The proposed project builds on ICIMOD's long-standing experience in monitoring and analysing GLOF risks in the Hindu-Kush Himalayan region. ICIMOD's technical input will inform all GLOF-related aspects of the proposed project (Component 1) and shall bring their knowledge gained through their previous experiences working on GLOF drainage and EWS issues. During the FSP implementation phase, ICIMOD will work collaboratively with the project team by providing substantial inputs from their experiences and expertise. ICIMOD will have provide guidance on the technical matters while implementing the project as part of the Technical Advisory Group.
	Nepal Risk Reduction Consortium (NRRC) Focal Point: Ms. Moira Reddick, Coordinator	The project aligns with the NRRC Flagship 4 priorities which aim to provide an overall strategic framework for Community Based Disaster Risk Reduction activities in Nepal. Flagship 4's target is to have 1000 Community Based Disaster Risk Reduction projects working with Village Development Committees (VDCs) within a 5 year timeframe.
	High Mountain Glacial Watershed Programme (HMGWP) Focal Point: Dr. Alton Byers, Director	During the PPG design phase, TMI and the HMGWP worked in one of the key Project Target Areas around Imja Lake and provided community focused information for the design of Component 1. During the FSP implementation phase, HMGWP will be implementing a number of complementary activities in support of achieving Project Outcome 1 related to establishing a CBEWS in the Imja GLOF Impact Zone and strengthening local individual and

Category	Institution	Involvement in the project
		institutional capacity for GLOF risk management.
	Practical Action (PA) Focal Point: Mr. Anup G. Phaiju	During the PPG design phase, PA with its long experience on CBEWS was an important partner to consult during the project preparation and to design appropriate/innovative field based EWS for the project. During the FSP implementation phase, the project shall collaborate with PA to implement Component 2 activities in the Tarai/Churia region.
	ADAPT Asian /United States Agency for International Development (USAID) Focal Point: Mr. Lee Baker, Chief of Party	During the PPG phase, UNDP leveraged the support of the USAID ADAPT Asia team to support pre-feasibility studies on lowering the Imja Glacial Lake and explore opportunities to establish CBEWS in Tsho Rolpa Lake as well as Micro-Hydro Plant downstream of Imja Lake from the drained water. The studies, financed by the ADAPT-Asia Programme, were undertaken by collaborating with Kathmandu University and Practical Action. During the FSP implementation phase, the project will also collaborate with USAID's High Mountain Glacial Watershed Programme which is formulated to address the perceived gaps in knowledge and collaboration on GLOFs and to develop follow up pilot and capacity building activities. HMGWP has the goal of increasing awareness of the critical importance of high mountain watersheds in the context of climate change, highland-lowland interactions, and ecosystem services and has a project targeted in Solukhumbu starting from mid-2012.
Academia	Academic and Research Institutions such as Kathmandu University (KU)	During the PPG phase, KU with the support of ADAPT Asia was involved in conducting the pre-feasibility of the design the outflow mechanism for Imja Lake to reduce water levels by 3m. They also conducted a design to establish CBEWS in Tsho Rolpa and also did an in-depth study on the possibilities of setting up and micro-hydro plant from the drained glacial lake water. During the FSP implementation phase, KU shall be providing their guidance and technical expertise as part of the Technical Advisory Group of the project. The Himalayan Cryosphere, Climate and Disaster Research Center (HiCCDRC) at KU along with similar research bodies from other academic institutions will be consulted during the implementation of this project for their technical knowledge regarding the condition and status of Nepal's Glacial Lakes.
Local NGOs/CSOs	Key NGO/Civil Society & private sector partners	During the FSP implementation phase, the relevant NGO Federation/Civil Society and private sector will be consulted during the project implementation. The relevant Civil Society shall be involved as the beneficiaries in the PEB. They will also be members of the PSC.
Other Relevant Parties	District Line Agencies	During the FSP implementation phase, the District Disaster Relief Committees (DDRCs), the Emergency Operation Centres (EOCs) District Soil Conservation Office (DSCO), District Chapter of DWIDP, District Forest Office (DFO), Women Development Office (WDO) and District Energy and Environment Unit/Sections

Category	Institution	Involvement in the project
		(DEEU/S) will coordinate/build collaboration with the project team during the implementation of climate induced disaster preparedness activities in the field.

B.6. OUTLINE THE COORDINATION WITH OTHER RELATED INITIATIVES:

The proposed project will build on UNDP's existing Disaster Risk Reduction portfolio to coordinate with other relevant projects ongoing or that are planned in the selected areas which are being implemented by various organizations (INGOs and NGOs). Community Groups developed or strengthened as part of this project will be taken forward to coordinate with the similar programmes. To build synergies, any organization with ongoing or planned projects will be invited for quarterly meetings which will be organized at the District office of DWIDP. Currently, there are no projects directly related to climate change adaptation that are financed by climate funds (CIFs related projects) in the project area.

In addition, the proposed project will collaboratively work with ICIMOD's "**Preparedness for Flood Risk Reduction through Mapping and Assessing Risk and Management Options and Building Capacity in Lal Bakaiya Watershed – Nepal (2013, currently under production)**" project in Terai region which facilitates collaboration between upstream-and down-stream communities in transferring flood inferring through mobile.

C. GEF AGENCY INFORMATION:

C.1 CONFIRM THE CO-FINANCING AMOUNT THE GEF AGENCY BRINGS TO THE PROJECT:

UNDP has provided and leveraged US$ 20,352,510 in co-financing for this initiative.

C.2 HOW DOES THE PROJECT FIT INTO THE GEF AGENCY'S PROGRAMME (REFLECTED IN DOCUMENTS SUCH AS UNDAF, CAS, ETC.) AND STAFF CAPACITY IN THE COUNTRY TO FOLLOW UP PROJECT IMPLEMENTATION:

UNDP's comparative advantage for the proposed project lies in its long-standing experience of working with different government entities to advance disaster risk reduction in Nepal, including MoHA, DHM, DWIDP. UNDP is one of the founding members of the Nepal Risk Reduction Consortium (NRRC) and has a long track record of investing its own core resources in disaster risk reduction and climate risk management projects, as documented in the assessment of 'who does what' in climate-related disaster risk reduction (UNDP, 2010) As indicated by the substantive cash and parallel co-financing it is contributing to the proposed project, all of which is funded by bilateral and core resources (outlined in Section B.1), UNDP is well positioned to support the targeted allocation of LDCF financing to urgent and immediate local climate risk management needs. UNDP support is provided to this project in both technical as well as financial terms (see Section C.1).

In addition to evident alignment in terms of UNDP's existing portfolio in Nepal and a verifiable track record in providing financial and technical support to climate risk management projects, the proposed project matches with UNDP's comparative advantage in capacity development (as articulated in the GEF Council Paper C.31.5 "Comparative Advantage of GEF agencies"). In this context, it is important to highlight that UNDP has garnered extensive experience in the implementation of GLOF and flood risk management projects, most notably in Bhutan (LDCF-funded) and Pakistan (AF-funded). These efforts provide immediate entry points for South-South technical cooperation and the sharing of lessons learned.

Through its network of country offices and regional advisors who act as conduits for the exchange of technical and project management experience, UNDP is well positioned to assist Nepal in the design and implementation of the proposed project.

The country office has in-house expertise covering all aspects of the project, including climate change, rural community development, disaster risk reduction, governance, decentralization, procurement and project assurance.

PART III: INSTITUTIONAL COORDINATION AND SUPPORT

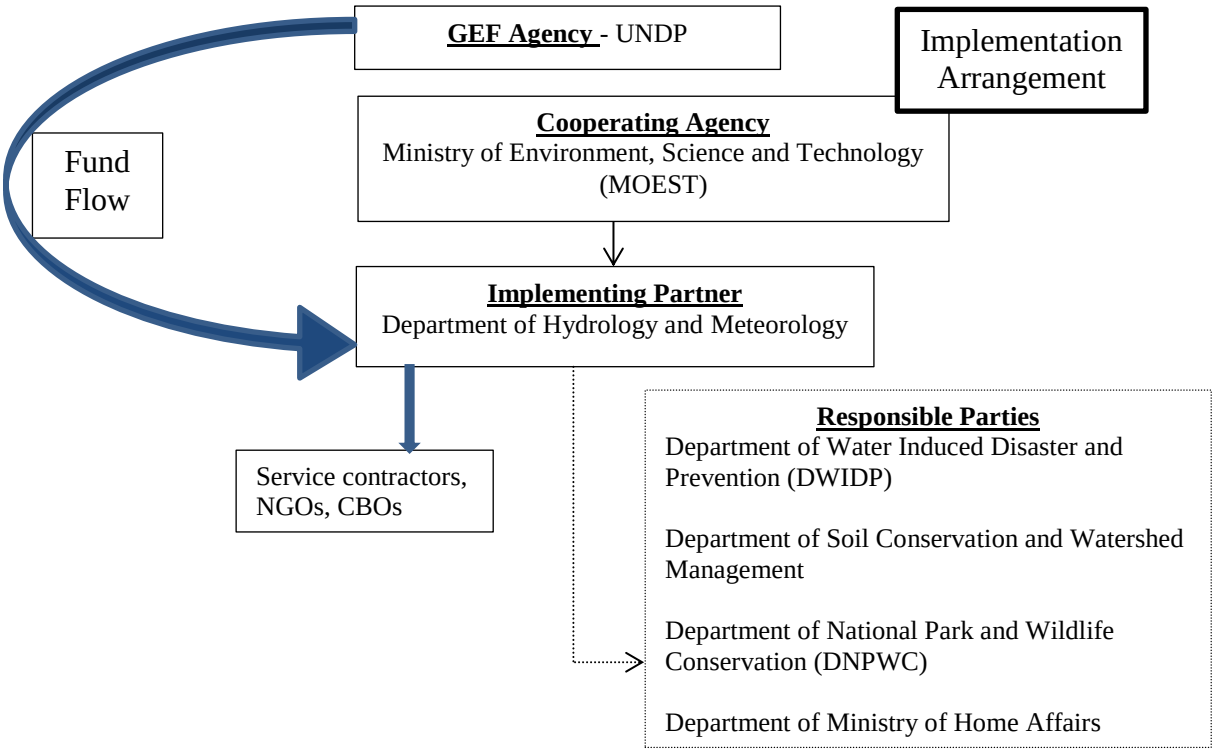
A. INSTITUTIONAL ARRANGEMENT:

This project will be implemented over the course of four years starting from the beginning of 2013. The project will be nationally executed under UNDP National Implementation Modality (NIM). The project's lead Implementing Partner will be the Department of Hydrology and Meteorology (DHM) under the Ministry of Environment, Science and Technology (MoEST) of the Government of Nepal. DHM shall be responsible for implementing both components of the project and will also house the Project Central Office. For implementation of Component 2, a dedicated project office will be set up in the field in one of the project districts in the Tarai and made operational under the overall guidance of the DHM.

The Department of Water Induced Disaster and Prevention (DWIDP) under the Ministry of Irrigation and Department of Soil Conservation and Watershed Management (DSCWM) shall be responsible for providing technical support and monitoring of activities under Component 2 of this project. The DWIDP and DSCWM will be involved in planning of project activities under Component 2.

UNDP will serve as the GEF Agency for the Project and be responsible for the provision of project cycle management services (i.e. General Management support) via the Country Office and specialized technical and oversight support from the UNDP-GEF unit. DHM/MoEST, DWIDP/MOI and UNDP will jointly monitor and evaluate all project activities. The project will be governed in accordance with UNDP's Results Based Management Guideline (RBM), LDCF rules and procedures and the Government of Nepal's operational principles within the governance structure as described in Annex 10 (also see Terms of Reference for the key positions).

B. PROJECT IMPLEMENTATION ARRANGEMENT:



Government Cooperating Agency: The Ministry of Environment, Science and Technology as a cooperating agency shall do high-level monitoring of the project on behalf of the GON, promote initiatives undertaken by the project nationally as best practice case, and ensure appropriateness of interventions in meeting national priorities. The MoEST may co-ordinate with other relevant ministries and departments in order to provide inputs to the project as and when needed.

Role of cooperating agency: The cooperating agency/MOEST will form a steering mechanism (Government Project Steering Committee/ PSC) to provide overall oversight, and strategic and policy guidance to the Project Executive Board (PEB) to help achieve the project results in a timely and cost-effective manner. The PSC will also be responsible for making decisions as required regards to approval of major revisions in the project strategy and implementation approaches. The PSC will meet at least once a year.

The Secretary of MoEST of the Government of Nepal will be the chair of the PSC. The Chair of the PSC will formally set up the PSC by inviting the below mentioned institutions and agencies, for nomination of one representative, to work as the member in the PSC. On consultation with UNDP, the Chair will also identify representatives from donors, civil society and private sector as the members of the PSC. Government agencies are expected to represent in the PSC at the level of Joint Secretary.

The composition of the PSC is given below:

1. *Chair, Secretary, MoEST*
2. *Representative, Office of the PM and Council of Ministers*
3. *Representative, National Planning Commission Secretariat*
4. *Representative, Ministry of Finance*
5. *Representative, Ministry of Forests and Soil Conservation*
    a. *Department of National Park and Wildlife Conservation*
    b. *Department of Soil Conservation and Watershed Management*
6. *Representative, Ministry of Energy*
7. *Representative of Ministry of Irrigation/Department of Water Induced Disaster and Prevention*
8. *Representative, Water and Energy Commission Secretariat*
9. *Representative, Ministry of Federal Affairs and Local Development*
10. *Representative, Ministry of Home Affairs*
11. *Representative, Donor Community*
12. *Representative, Kathmandu University and Tribhuwan University*
13. *Representative, Civil Society/NGO*
14. *Representative, Private Sector*
15. *Ministry of Tourism and Civil Aviation (and/or Nepal Tourism Board)*
16. *UNDP/GEF representative in the role of Senior Advisor (representing the interests of the parties providing funding to the project)*
17. *Representative from ICIMOD*
18. *National Project Director (NPD) appointed by the implementing partner (Member Secretary)*

Additional functions of the PSC are to: (i) ensure that LDCF resources exclusively utilized to implement the activities that relate to the achievement of the approved project objectives and outcomes (ii) provide

guidance to resolve an issue or a problem which PEB cannot settle, and facilitate with external partners to seek support for the project. There will be no remuneration to the PSC members funded by the project.

Implementing Partner: The implementing partner of this project will be responsible and accountable for achieving the project objective, outcomes and outputs in an effective and efficient manner. **The Department of Hydrology and Meteorology** as a national implementing partner under the guidance of the MoEST will implement the project under National Implementation Guidelines of UNDP. DHM shall be overall responsible and accountable for the delivery of the project objectives, while working closely with DWIDP and DSCWN who will be responsible for providing inputs to planning, and technical oversight and monitoring of Component 2 of the project.

Responsible Parties: Under the overall guidance of MoEST and direction of national implementing partner/DHM (who is responsible and accountable for the project implementation) the agencies below have been identified and confirmed as responsible parties who will be consulted and approached for collaboration and support during the project implementation.

- **The Department of Water Induced Disaster and Prevention** and **Department of Soil Conservation (DWIDP) and Watershed Management (DSCWM)** shall be responsible for providing inputs to planning, technical oversight and monitoring of the field activities under Component 2 of this project. DSCWM will work closely with the DWIDP and Project management team to plan and implement field activities and deliver outputs that are under their mandate in accordance with the Stakeholder Involvement Plan (Annex 5), and the Annual Work Plan, once prepared and approved. They will also provide inputs to PEB and PSC meetings.

- The cooperating agency and national implementing partner will coordinate with **Ministry of Home Affairs (MoHA)** to establish linkages between local institutions, district line agencies of different sectors working on climate disaster risk reduction efforts with National Disaster Emergency centres and District Disaster Relief committees.

- The national implementing partner will coordinate with **Department of National Park and Wildlife Conservation (DNPWC)** to establish linkages between the project team and national park and buffer zone management committee in order to work smoothly in the Imja Glacial Lake and its surroundings (as it is situated in the Sagarthmatha National Park).

To facilitate smooth and effective implementation of project activities, a Project Steering Committee (PSC) and a Project Executive Board (PEB) will be established. The PSC will provide high-level strategic guidance to the project, while the Project Executive Board (PEB), under the guidance of the PSC, will be responsible for taking decisions with respect to project implementation and management, in line with the project mandate, work plan and guidelines.

Due to highly technical nature of the project, the project will set up a *Technical Advisory Group* that will provide technical guidance and support to the project team during planning and implementation. The technical support and the guidance provided by the TAG will be discussed in the PEB or PSC (as relevant) and a decision will be taken if needed.

Project Executive Board: The Project Executive Board, under the guidance of the PSC, is the decision making body responsible for ensuring that the project implementation follows the agreed strategies of

implementation, project outputs are produced as per the project objectives, and project inputs are best utilized for producing maximum outputs in a timely and cost effective manner. It reviews the progress of the project performance (substantive and financial) and approves the annual work plans, budgets and reports. The members of the Project Management Team (senior technical and admin/finance staff) may participate in the PEB meetings to provide clarifications and answer to the questions raised by the PEB members.

The PEB will have three roles described as follows:

- Project executive role – will be played by the National Executive Director of DHM as the representative of the Implementing Partner. S/he will chair the Board;
- Senior Supplier role – will provide guidance regarding the technical feasibility of the project which will be played by the Assistant Country Director of Energy, Environment and Climate Change unit of UNDP;
- Senior Beneficiary role – will be played by the representative from civil society organization (still to be decided), Ministry of Finance, Ministry of Local Development, Department of Hydrology and Meteorology, Department of Water Induced Disaster and Prevention, Department of Soil Conservation and Watershed Management and Department of National Park and Wildlife Conservation to ensure the interest of beneficiaries. PEB might also consider to invite local representatives from the project site if found appropriate during the implementation period.

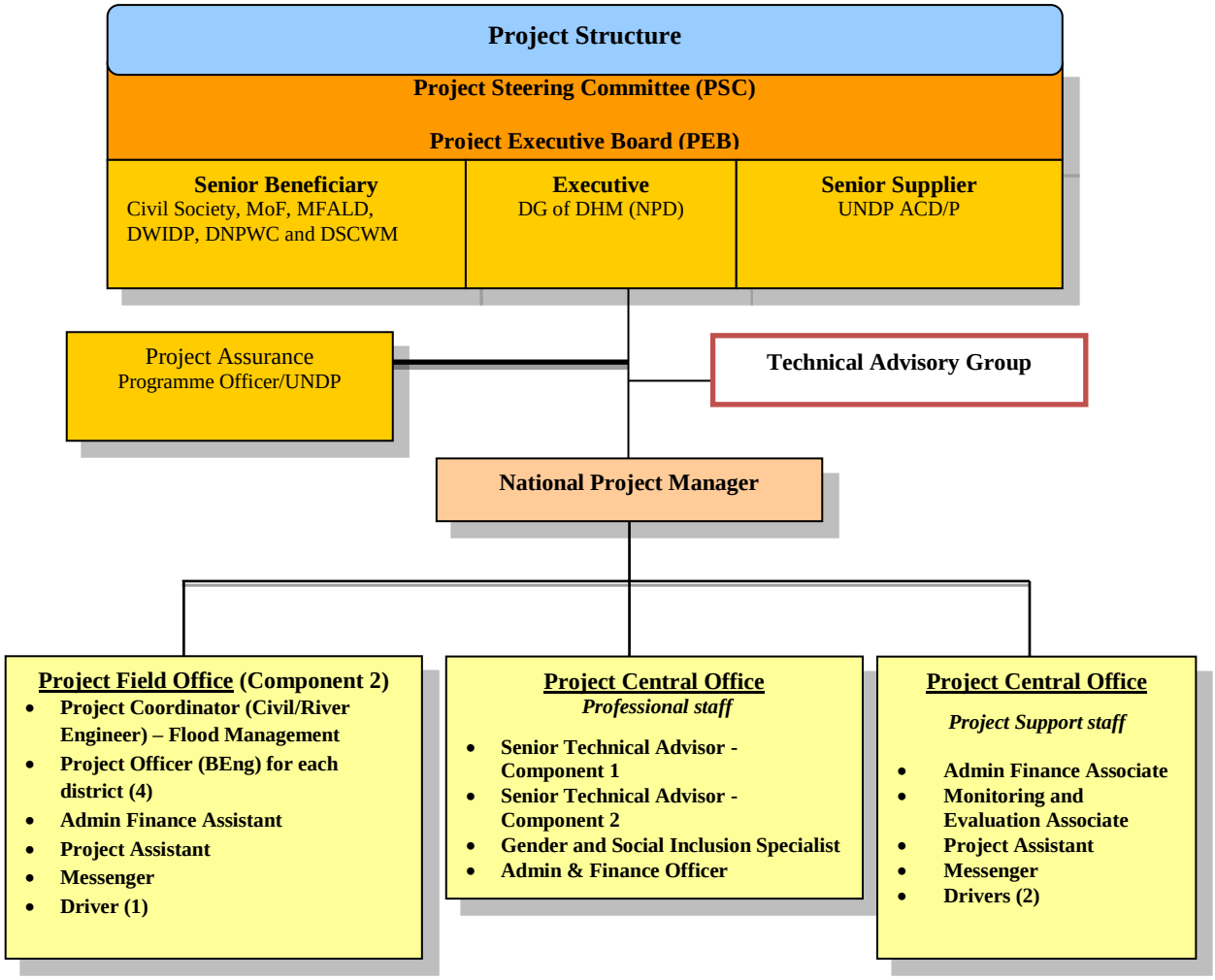
The National Project Director (NPD) shall be appointed from DHM/MOEST and will be responsible for overseeing overall project implementation and ensuring that the project objective and outcomes are achieved. The MoEST will appoint a senior joint secretary from DHM to work as **The National Project Director (NPD)**. The NPD, assisted by Project Manager, will report to the PSC on project progress. The NPD will be responsible for coordinating the flow of results, financial authority and knowledge from the project to the PSC. The NPD will provide guidance to the Project Manager and Technical Advisors on both strategic and project implementation issues. The NPD will ensure that the inputs required from the implementing partners are secured in a timely fashion and that the project, in turn, works effectively with these agencies. The NPD will be supported by a full-time National Project Manager appointed by the project to enable him to discharge his responsibilities.

National Project Manager (NPM): The **NPM is a full-time project-funded staff member** who will be the member secretary of the PEB and will perform the following key functions. The NPM will be appointed by the project as per the NIM Guidelines, and will report to the NPD and receive guidance from the NPD and PSC. The NPM is responsible for the day-to-day management, administration, coordination, and technical supervision of project implementation. S/he will monitor work progress and ensure timely delivery of outputs in a cost effective manner as per the Annual Work Plans and the Project Results Framework. The Project Manager will ensure a high quality of project planning, management, implementation, technical and financial compliance, progress reporting and monitoring. Additional required staff (see TORs in Annex 10) will be hired to support the NPM as follows.

Project Management and Support Staff: The Project Central Office will be housed within DHM/MOE, and headed by the National Programme Director (NPD). The project team, headed by the NPD, will be composed of a full-time project manager, specialists and advisors, engineers and support staff. The DHM will designate at least two of its senior technical staff to work in the project with other team members and they will spend at least 20% of their time in the project work. The DHM will provide necessary logistics support such as telephone, fax and electricity services on cost recovery basis for effective operation of the project office on day-to-day office.

Due to highly technical nature of the project, the project will set up a ***Technical Advisory Group*** that will provide technical guidance and support to the project team during planning and implementation. The technical support and the guidance provided by the TAG will be discussed in the PEB or PSC (as relevant) and a decision will be taken if needed.

Schematic diagram as below



PART IV: EXPLAIN THE ALIGNMENT OF PROJECT DESIGN WITH THE ORIGINAL PIF:

The final project design is in line with the original PIF. There are two adjustments that need to be noted:

Firstly, for component 1 Imja Lake – Solukhumbu district has been selected based on the field visit, consultations at local and national level consultations, research studies and technical justification generated during the project formulation stage. In regards to Component 2, four districts (3 river and 2 tributaries) has been selected for this project. In the original PIF, Sarlahi district, Mahottari district, Jhapa district and Ilam district were proposed for further analysis during the PPG phase. However based on the analysis through detail field visit, corresponding research studies and consultation with the local, district and national level bodies - Mahottari district, Udayapur district, Saptari district and Siraha district were selected based on strong technical justification (details are provided in Annex 2 and 3).

Secondly, the original PIF had 3 outputs under outcome 1 and 4 outputs under outcome 2. In the final project design has 2 outcomes which remain as it is however the outputs have been adjusted to reflect the field situation and adaptation alternatives more explicitly. During the PPG phase it became clear that greater efficiency could be gained by aligning all the outputs on the basis of a) interventions at the community level; (b) institutionalization of systems and protocols at both community and national level; (c) establishing community based early warning systems and (d) capacity building of local and national institutions. To implement these initiatives, UNDP Nepal has contributed from its core resources to provide the needed technical assistance and monitoring mechanisms for this success of this project.

PART V: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT(S) ON BEHALF OF THE GOVERNMENT(S):): (Please attach the Operational Focal Point endorsement letter(s) with this template. For SGP, use this OFP endorsement letter).

NAME	POSITION	MINISTRY	DATE *(MM/dd/yyyy)*
Lal Shanker Ghimire	Executive Secretary, GEF OFP	Ministry of Finance	June 27, 2011

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF policies and procedures and meets the GEF/LDCF/SCCF criteria for CEO endorsement/approval of project.

Agency Coordinator, Agency name	Signature	Date *(Month, day, year)*	Project Contact Person	Telephone	Email Address
Adriana Dinu, Officer-in-Charge UNDP/GEF		Feb 19, 2013	Keti Chachibaia, Regional Technical Advisor, Gr-LECRDS	+421 259337422	Keti.chachibaia@undp.org

ANNEX A: PROJECT RESULTS FRAMEWORK

This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD: People living in areas vulnerable to climate change and disasters benefit from improved risk management and are more resilient to hazard-related shocks (Outcome 7).
Country Programme Outcome Indicators: # of districts covered by government-owned emergency operation networks for communicating relief needs # of VDCs meeting minimum criteria for disaster-resilient communities as defined by Nepal Risk Reduction Consortium Flagship 4 on integrated community-based disaster risk reduction/ disaster risk management
Primary applicable Key Environment and Sustainable Development Key Result Area: *3. Promote climate change adaptation*
Applicable Strategic Objective from LDCF Results-Based Management Framework: The project will contribute primarily to **Objective CCA-1**: *Reduce vulnerability to the adverse impacts of climate change, including variability, at local, national, regional and global level* The project will also contribute to: **Objective CCA-2:** *Increase adaptive capacity to respond to the impacts of climate change, including variability, at local, national, regional and global level* **Objective CCA-3:** *Promote transfer and adoption of adaptation technology*
Applicable Expected Outcomes from LDCF Results-Based Management Framework: Outcome 1.2: Reduced vulnerability to climate change in development sectors
Applicable Outcome Indicators from LDCF Results-Based Management Framework: 1.2.3 Number of additional people provided with access to safe water supply and basic sanitation services given existing and projected climate change

	Indicator	Baseline	Targets End of Project	Source of verification	Risks and Assumptions
Project Objective[12] **To reduce human and material losses from Glacier Lake Outburst Flooding (GLOF) in Solukhumbu District and catastrophic flooding events in the Tarai and Churia Range**	Number of high risk settlements of the GLOF Impact Zone of Solukhumbu district downstream of Imja lake area covered by an Early Warning System (EWS) [refer to AMAT 1.2.1.9]	More than 31,862 people live in the high risk settlements of Imja GLOF Impact Zone and are directly vulnerable to GLOF impacts. They have no EWS. Other forms of disaster preparedness are also limited. c. 7,400 ropani (377 ha) of agricultural land at risk from GLOF impacts C. 800 houses at risk from GLOF impacts Infrastructure:5.5 km road, 94 km trail, 25 truss and suspension	By the end of the project, at least 100% of the population (men and women) who are directly vulnerable to GLOF impacts within the 27 high risk settlements GLOF Impact Zone are covered by a comprehensive community-based Early Warning System (CBEWS)	Project monitoring records on CBEWS including results of random tests and mock drills Independent end of project evaluation report Existing Imja GLOF risk models used to estimate change in GLOF risks with a reduced Imja lake volume following the lake lowering and additional assumptions regarding impact of EWS in providing additional lead time that allows people to safeguard their lives and a certain proportion of	The artificial drainage channel constructed by the project is stable and continues to be maintained regularly by DHM Local communities perceive value and support in developing and maintaining a community-based EWS for the Imja GLOF Impact Zone. Climate change induced glacier melt at Imja remains at or

[12] Objective (Atlas output) monitored quarterly ERBM and annually in APR/PIR

		bridges, 0.5 river embankment, 0.5 irrigation canal, 3 schools, 4 office buildings, 137 hotels, 64 teashops, 3 temple, gomba and mosque, 2 hydropower dam, 5 water mills, 7 transmission lines and 1 industry. Total direct & indirect costs of potential GLOF damages including replacement of major infrastructure estimated as $8.98 billion (see Section 2.3.5 & Annex 1 and 4)		livelihood assets. (Assumptions to be determined in Year 2.) Revised hazard maps combined with field verification Trekkers evaluation surveys (end of trek evaluation done by the SNP Office)	below the level indicated by current climate change projections. The rate of glacier melt at Imja does not accelerate due to other non-climate change-related factors
	Number of staff in institutions with increased capacity to minimize human and material losses from potential GLOF events in the High Mountains and climate-related flooding in the Tarai and Churia Range [refer to AMAT 2.2.1.1]	Weak system for flood risk management (only construction work is done) in DWIDP and no GLOF risk management committee in Solukhumbu district. Number of trained staff in DHM is limited to work in GLOF risk reduction. DDRC is mostly involved in rescue and relief for post disaster work and their activity in the targeted districts is limited.	By the end of the project, targeted training/on the job training in gender sensitive flood risk management including disaster preparedness will have been provided to least 32 technical staff from 2 key government departments, DHM (2 – senior level) and DWIDP (30 – district and regional level), 30 representatives from 5 DDRCs, 86 representatives from 1 GLOF Risk Management Committee and at least 2 university students. DHM will have the necessary	Capacity assessment report done at the end of the project. Functional institutions in place.	Political stability and security situation is favourable to implement planned activities. There will be no/limited transfers of trained technical staff in other ministries/departments or in other non-government organisations Institutions established at the community and district level are

			technologies, skills & systems to assess and effectively communicate GLOF risk levels and warnings. DWIDP will have the necessary technologies, skills & systems to monitor sediment load in flood-prone river basins in the Tarai & Churia Range The Annual District Plans of at least 3 of the 5 target project districts , incorporate budgeted flood risk preparedness activities		functional and supportive to implement the project activities.
OUTCOME 1[13] **Risks of human and material losses from Glacial Lake Outburst Flooding (GLOF) events from Imja Lake reduced**	Average depth of Imja lake	Average water depth 35.1 m in May 2009 New baseline to be established before channel constructed and water level markers placed in the outlet.	Average depth of lake kept below dangerous levels by ensuring average water depth during spring and summer months is at least 3 metres or more below the baseline level prior to the construction of the channel.	Project assessments with DHM at start and end of project Annual DHM monitoring of lake depth	The artificial drainage channel constructed by the project is stable and continues to be maintained regularly by DHM Local communities perceive value and support in developing and maintaining a community-based EWS for the Imja GLOF Impact Zone. Climate change induced glacier melt at Imja remains at or below the level indicated by current

[13] Outcomes are equivalent to activity in ATLAS. All outcomes monitored annually in the APR/PIR.

					climate change projections. The rate of glacier melt at Imja does not accelerate due to other non-climate change-related factors
	Percentage of high risk settlements of Imja GLOF Impact Zone residents (including women, children and elderly people) with a clear understand of how the EWS works and what to do in the event of a GLOF [refer to AMAT 3.2.1.1]	90% of the community have heard about GLOF risks but are not prepared for it. (Source Regional GLOF Risk Reduction Project) Baseline to be established in Year 1 of Project to identify the gender-disaggregated population (male and female) who are aware of the potential benefits of an EWS.	100% of residents from Solukhumbu district of the high risk settlements of the GLOF Impact Zone (within 75 km of outlet) understand how the EWS works and know what to do in the event of a GLOF, including men and women and elder residents.	Interview-based questionnaire surveys at the start and end of the project Project monitoring records on the CBEWS. Simulation of GLOF event and random tests of effectiveness of EWS system in a sample of villages in the GLOF Impact Zone	Communities participate in project awareness generation and training activities on GLOF risk reduction, learn how to operate and maintain the CBEWS and see value in maintaining it beyond the life of the project
	Number of targeted institutions with increased capacity to minimize exposure to GLOF risks [refer to AMAT 2.2.1.1]	No local institution to address or understand the GLOF risks which is creating unnecessary havoc of outbursts. Limited access to information as well as Government level institution in the Khumbu region (Imja lake and surrounding) to address or disseminate GLOF risks	No. of representatives from Solokhumbu DDRC, Sagarmatha National Park, the Imja GLOF Risk Management Committee, the CBEWS Task Forces trained to manage and minimize GLOF risks. No. & type of information materials disseminated to local and non-local people (i.e. tourists) by different agencies on GLOF risks, risk reduction measures and what to do in the event of a GLOF. By the end of the project, DHM is operating a GLOF Risk Monitoring System and has a	Project monitoring reports Terminal Evaluation Report Targeted surveys on awareness and availability of GLOF-risk information materials at the start and end of the project. Information materials on GLOF risks DHM Annual Report District Disaster Management Plans District Development Plans	Political stability and security situation is favourable to implement planned activities. There will be no/limited transfers of trained technical staff in other ministries/departments or in other non-government organisations Institutions established at the community and district level are

			mechanism in place to communicate GLOF risk warnings to MoHa and NEOC.		functional and supportive to implement the project activities.
Outcome 2[14]: Human and material losses from recurrent flooding events in 4 flood-prone districts of the Tarai and Churia Range reduced	Number of additional people provided with access to safe water supply and basic sanitation services	Existing tube wells in 6 VDCs get flooded during the flooding season making it difficult for 22,500 population. Water Supply/drainage systems in 4 VDCs gets flooded in monsoon making it difficult for 14,500 population	At least 70% population in 3 Districts/6 VDCs have access to 24 elevated tube wells and/or a flood-proofed drainage system	Survey, Gender disaggregated interviews, field monitoring and testing	If concentrated rainfall occurs for 24 hours currently the districts are not equipped to deal with floods like 1993 flood disaster in central and eastern Nepal. In such a scenario the activities and modalities of the current project will be affected. Political stability and security situation in Tarai is favourable to implement planned activities. Less/no extreme climate events occur that can accelerate intensive rainfall by triggering floods, debris flow and landslides in the targeted locations. Tube well and drainage system remain

[14] *All outcomes monitored annually in the APR/PIR.*

					functional through the year (during monsoon) Local community/ authorities value and support the interventions undertaken by the project Land to install tube-wells made available by local people and Government authorities.
	Number of people and value of their material assets covered by a CBEWS in the four target project districts [refer to AMAT 2.2.2.1]	There are no EWS in the 4 project target districts; 3 VDCs (Mahisthan, Hattilet and Aurahi) communities in Mahottari district – Janagha River) have been trained in CBEWS UNDP/CDRMP-programme. The total population of the most flood-prone VDCs in all the is: 64,700 people Value of material assets vulnerable to flood impacts in these VDCS will be established at the start of the project.	100 % f population covered by Community Based Early Warning Systems in all target flood-prone river basins (Refer to the previous section page 4- target 3rd paragraph)	Gender disaggregated interviews, Field survey, Monitoring and mock drill	Local community/ authorities value and support the interventions undertaken by the project including CBEWS Linkages among community, DEOC and NEOC should be intact…thereby establishing a last mile connectivity. Local community/ authorities value and support the interventions undertaken by the project
	Number of targeted	Weak system for	By the end of the	Project monitoring	Political

	institutions and staff in the institutions with increased capacity to minimize exposure to flood risks in the Tarai & Churia Range	flood risk management. DWIDP currently focuses only construction work. Number of trained staff in DWIDP on flood risk management is very limited. DDRC is mostly involved in rescue and relief for post disaster work and their activity in the targeted districts is limited.	project, at least 8 gender sensitive Village Disaster Management Plans prepared by Village Disaster Management Committees in the Tarai & Churia Range By the end of the project, at least two vulnerable VDCS of four districts will have CBEWSs and which are being effectively maintained by local communities (including women) under the leadership of the Village Management Committees.	reports Terminal Evaluation Report Village Disaster Management Plans are incorporated into the Districts and VDC development plans Results of random testing of CBEWS operation in a sample of villages by the project. DWIDP Annual Report District Disaster Management Plans District Development Plans	stability and security situation in Tarai is favourable to implement planned activities. There will be no/limited transfers of trained technical staff in other ministries/departments or in other non-government organizations Institutions established at the community and district level are functional and supportive to implement the project activities.

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work programme inclusion and the Convention Secretariat and STAP at PIF).

ANNEX C: CONSULTANTS TO BE HIRED FOR THE PROJECT USING GEF/LDCF/SCCF RESOURCES

Position Titles	*$/ Person Weeks**	*Estimated Person Weeks*	*Tasks to be performed*
For Project Management			
Local		*(208 weeks)*	
Project Manager	490.3	208	• Prepare Annual Work Plan with budget allocation based on the Annual Plans of the project and submit it to PEB for approval. • Ensure the timely mobilization and utilization of programme personnel, subcontracts, training and equipment inputs, whether these are procured by the Programme itself or by other agents. • Exercise overall technical, financial and administrative oversight of the programme, including supervision of national and international personnel assigned to the programme. • Carry out regular follow-up and monitoring to the districts and communities and facilitate joint monitoring visits from the centre. • Ensure timely preparation and submission of required reports, including technical, financial, study tour/fellowship reports. • Ensure close coordination between the programme planning of the project and government activities to achieve better synergy. • Support DHM/DWIDP to strengthen the community based flood/GLOF management activities. • Implement activities related to the human resources development, community mobilization, private sector development, NGOs strengthening and gender and social inclusion. • Maintain close cooperation with member organizations represented in PEB and TA as well as UNDP and the World Bank in implementing the programme activities. • Prepare the Individual Performance Plans and Performance Appraisal Reports of all staff. • Participate and encourage the participation of programme staff in different forums that may be organized by various agencies related to the community based flood/GLOF management related subjects. • Facilitate/Support DHM/DWIDP to take lead role in networking meetings amongst the key stakeholders of the community based flood/GLOF management and other related government and donor agencies. • Document and disseminate the lesson learned through studies, audio visual production and electronic means such as CD-ROM and DVD. • Provide additional support as requested by the GoN and UNDP and as required to make the programme a success. • Participate in meetings, trainings, workshops and events organised by UNDP. • Support and promote gender equality and social inclusion in programme activities as well as among the project staff.
Justification for Travel:			

Travel will be necessary for the project support unit team (for visiting project sites as per project workplans to be prepared) for liaising with counterparts, overseeing and monitoring project activities. The project sites in four different districts varying between two ecological zones – the mountains and Tarai lowlands. Travel to Solukhumbu district in the mountains is very difficult and can be accessed by only plane or by foot. Due to its difficult terrain and high altitude it is not possible to reach as planned as the travel is mostly dependent on weather conditions. The travel to lowlands is relatively easy, however extensive land travel is required.

Position Titles	***$/ Person Weeks****	***Estimated Person Weeks***	***Tasks to be performed***
For Local Technical Assistance		***(158)***	
7 member Technical Advisory Group (TA) for Outcome 1	2,955.5	**18**	The TA will function under the direct supervision of NPD and PEB members. TA will work closely with NPM and STAs and support the team for needed technical advice. The TA will be responsible for approving the overall technical decision of interventions as planned under the programme implementation which includes technical designs, study reports, implementation plan, monitoring and evaluation and is also authorized to change the technical designs if need be.
Local Consultants under Outcome 1	2,466	**34**	• Output 1.1.2: local consultants to be hired to conduct the review of the scientific assessment for ten days @ $200 per day. Total allocated budget amounts to $ 2,000. • Similarly, hiring a local consultant to help the international consultant (glaciologist) to accompany the field visit for 85 days @ $ 50 per day amounting to $ 4,250. • Output 1.1.4: Five local consultants to be hired for IEA/EIA and vulnerability assessment for 30 days @ $200 per day amounting to $ 30,000. Similarly, two research assistants also to be hired for 30 days @ $ 50 per day to help the consultants amounting to $ 3,000. • Output 1.1.5: One local community development expert to be hired for 30 days@ $ 200 per day amounting in total $ 6,000. • Output 1.1.8: A Consultant (University student) to be hired to document the implementation process of the artificial lowering system of the Imja Lake for 15 days in a year for four years. Thus, It is provisioned for 15 days*4 years*$50 which equivalents to $3000 in total. • Output 1.2.3: Hire a local consultant to develop guidelines on Glacial Lake Monitoring @ $200 for 30 days amounting to $ 6,000 in total. • Output 1.3.9: Hire 3 experts for TOT for 21 days@ $200 per day amounting $12,600 in total. • Further, hire a consultant to support for documentation and publication for 40 days@ $200 per day for $ 8,000 in total. • Output 1.3.10: Hire a local consultant for 30 days to establish base line data amounting to $6,000. • Output 1.4.3: (Link with 1.2.5) a Consultant to be hired for 15 days@ $200 per day to prepare a comprehensive community based GLOF risk management plan and train the community or CBOs to update annually. Total budget amounts to $ 3,000.

7 member Technical Advisory Group (TA) for Outcome 2	2,955.5	**18**	The TA will function under the direct supervision of NPD and PEB members. TA will work closely with NPM and STAs and support the team for needed technical advice. The TA will be responsible for approving the overall technical decision of interventions as planned under the programme implementation which includes technical designs, study reports, implementation plan, monitoring and evaluation and is also authorized to change the technical designs if need be.
Local Consultants for Outcome 2	1,202.6	**76**	• Output 2.1.9: to establish a base line data by hire a local consultant for 30 days@ $ 200 per day amounting to $ 6,000 in total. • Link with output 2.2.6: Consultant to document the monitoring or the implementation process for 8 days*4 times @ $200 equivalents to $ 6,400 for the project period. • Link with 2.3.2: Hire a Trainer at $200*20 days in four districts to conduct trainings in year 1 and year 2 for $ 32,000 in total • Link with output 2.3.3: to develop monitoring protocols for sediment control by Consultant for 25 days @ $200 per day amounting to $ 5000. • Link with output 2.3.4: to hire a Trainer / Consultant for 20 days per year @ $ 200 per day for four years in total amounting to $ 16,000. • Link with 2.4.1 and 2.4.2 to Review and conduct an assessment of flood preparedness in selected high risk villages by a consultant for 15 days in a year for 4 years @ $ 200 amounting to $12,000. • Link with 2.4.4. and 2.4.5: Hire a local consultant to study to evaluate options of low-cost, low-tech CBEWS to develop a simple system that can be operated by women, children and/or old people and identify technical assessments for river gauges in appropriate spots and identify suitable evacuation routes and emergency shelters for vulnerable communities for 30 days @ $200 per day amounting to $6,000. • Link with 2.4.6: To prepare a DRMP plans for 8 VDCs; therefore a consultant is to be hired for 30 days in a year for 4 years@ $ 200 to assist the planning process at the VDMC to assist to integrate into the District Level planning in total amounting to $ 24,000 in 4 years period. • Link with output 2.4.10 and 2.4.11: A Consultant is to be hired to analyse and document the best practices from the project for 30 days in a year @ $200 per day for four years amounting to $ 24,000 in total. The detail TORs as listed below.
Local Consultant to undertake midterm evaluation	3,333	**12**	Hiring local 3 consultants for conducting the midterm evaluation of the Project at the beginning of the year 3.

OUTCOME 1

Local consultants to review scientific assessment data on the Imja Lake

- The consultant will be responsible for the desk study and review of all available scientific data on Imja Lake, including

analyses and making recommends on useful data for the project

- Conduct one-on-one meetings with government and non-governmental stakeholders to discuss the project endeavours in Imja lake.
- Identify the gaps in the established scientific data and suggest areas for improvement.
- Write a report incorporating the findings of the scientific data review.

Local consultant to develop guidelines on Glacial Lake Monitoring

- Desktop study on the state of the art on glacial lake monitoring
- Conduct meetings with the governmental and nongovernmental stakeholders
- Develop guidelines on glacial lake monitoring for Imja lake
- Technical support to Imja glacial lake monitoring.
- Assist in the preparatory work of the relevant reports

Local consultant for Documentation and Publication

- Study and gather project related documents
- Consult with the project staffs and experts regarding publication materials
- Discuss, select and finalize the documents to be published
- Produce presentation materials/leaflets and consolidated reports of the project

Local consultant to prepare a comprehensive community based GLOF risk management plan and provide training to community/CBOs

- Conduct meetings with the communities, governmental and nongovernmental stakeholders
- Prepare a comprehensive community based GLOF risk management plan
- Provide training to the communities and CBOs to update the GLOF risk Management plan annually
- Provide training report to the project office

Local consultant to Develop a mechanism (plan) to link DHM with GRMC and then to MOHA and NEOC

- Conduct meetings with the GLOF Risk Management Committee, DHM, MOHA, NEOC and other relevant institutions and experts.
- Conduct situational analysis of the emergency communication mechanism and identify gaps in the process.
- Prepare a comprehensive mechanism for communication and dissemination of information in case of GLOF

OUTCOME 2

Local consultant to develop protocols for river sediment level monitoring

- Desktop study to determine the state of the art on river sediment level monitoring
- Conduct meetings with governmental and nongovernmental stakeholders
- Develop protocol for the sediment level monitoring of rivers in the Terai
- Technical support to the Ratu river sediment level monitoring.
- Provide training to DWIDP division/sub-division/PEP staffs who are working in Terai and Churia range on sediment monitoring and management.

Local consultant to review and conduct an assessment of flood preparedness in selected high risk villages

- Conduct meetings with the local communities and other relevant institutions in local level
- Conduct key informants survey in the targeted rivers
- Assess the condition about flood preparedness of the communities in the targeted rivers
- Prepare assessment report

Local consultant to evaluate and develop low-cost and low-tech CBEWS

- Conduct desktop study of relevant documents
- Conduct meetings with communities, governmental and nongovernmental stakeholders
- Review available options of low-cost, low-tech CBEWS to develop a simple system that can be operated by women, children and/or elderly people

- Conduct technical assessments for river gauges in appropriate spots
- Identify suitable evacuation routes and emergency shelters for vulnerable communities
- Propose low-cost, low-tech CBEWS to develop a simple system that can be operated by women, children and/or old people

Local consultant to analyze and document best practices of the project

- Study and gather project related documents
- Consult with the project staffs and experts regarding the best practices of the project
- Discuss, select and finalize the best practices
- Produce presentation materials/leaflets and consolidated reports of the best practices

Local Consultant to prepare EIA/IEE for both Outcome 1 and 2

- The Team should consist of 5 experts from multidisciplinary field of Glacial Lake Study (for Outcome 1 only), River Engineering (for Outcome 2 only), Disaster Management, Natural Resource Management, Socio-economics and Environment Sciences. One member takes the position of a Team leader.
- The main task of the EIA team is to provide comprehensive environmental impact assessment of the engineering interventions such as bio-engineering, sedimentation control and other flood risk mitigation activities in four river basins in Terai region.
- The consultant Team should prepare the EIA report as per the rules, regulations and EIA Guidelines issued the Government of Nepal.
- Desk study and review of all available scientific data for the purpose of the EIA Study.
- Conduct public hearing in the field in the project area of 5 rivers.
- Prepare EIA report and incorporate the comments made by the government agencies in the process of EIA approval.

INTERNATIONAL CONSULTANTS

Position Titles	*$/ Person Weeks**	*Estimated Person Weeks*	*Tasks to be performed*
For Local Technical Assistance		**(19.2)**	
International Consultants expert Glaciologist	3,794.6	**11.2**	The consultant will be responsible for assisting with the detailed study and design work of the engineering structures to be constructed to lower the water level of Imja Lake. • Assist in the study of the dynamics of cryosphere, mechanisms and adaption of its impact on climate, hydrology in Nepal; • Assist in glacier and snow monitoring based on remote sensing and in-situ observations; • Design and participate in field missions as and when necessary, most often in collaboration with national partners for field based glacier mapping and mass balance monitoring; • Contribute to the design and implementation of national training courses, workshops and seminars in the field of glacial monitoring and management; • Ensure good quality of plans, activities, and outputs related to glacial lake management. • Conduct dialogue with national stakeholders in connection with the implementation of project activities related to glacial lake management; • Along with Geotechnical expert/Geologist, review the geotechnical parameters of the lake and surrounding area. • Assist to conduct a hazard assessment of the lake area to ensure a safe work environment during construction period. • Along with the Geologist/Geo-tech expert, select the campsite for the

			entire workforce in a low hazard area. • Keep a dialogue with national stakeholders in connection with the implementation of project activities related to Imja glacial Lake Management.
International Consultant - Geologist/Geo-tech and Hydrologist	3,750	**8**	Geologist: • Technical support to Imja glacial lake lowering and lake monitoring with geological assessment and analysis. • The consultant will be responsible for assisting with the detailed study and design work of the engineering structures to be constructed to lower the Imja Lake. • S/he should, along with the Glaciologist, review the design done by the team of experts and suggest improvements. • S/he should, along with Glaciologist review, the geotechnical parameters of the lake and surrounding area and make hazard assessment of the lake area for the safety during construction period. • S/he should also identify the suitable alignment and site for canal construction. • S/he should, along with the Glaciologist, select the campsite for entire workforce in a low hazard area. • Assist with the preparatory work of the relevant reports Hydrologist: • Provide technical support to the project management unit on hydrological aspects of the GLOF risk reduction component of the project. • Provide technical inputs to the Imja glacial lake lowering and monitoring aspects. • Deliver training to the stakeholders on hydrological aspects whenever required during the consultancy period. • Design hydrological aspects for field missions, participate in the field missions and write field reports with recommendations on hydrological aspects. • Work in close collaboration with the Project Management Unit (PMU)

ANNEX D: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS

A. EXPLAIN IF THE PPG OBJECTIVE HAS BEEN ACHIEVED THROUGH THE PPG ACTIVITIES UNDERTAKEN.

Yes. The objective of the PPG phase was to produce a UNDP Project Document that would provide detail description of development baseline activities and related sources of financing, in particular a summary of relevant development and disaster management projects, investment programmes and capacity building activities that focus on disaster risk reduction and livelihood support activities in the target districts of the High Mountain, Cherai and Churia region on the following:

- Review and summary of the existing policy and regulatory framework relevant for community-based disaster risk reduction, with particular emphasis on current climate-related impacts and threats;
- Review, analysis and summary of current and past project activities by government, donors, NGOs and private sector institutions that are related to increasing community resilience
- A collation and synthesis of supporting reports (GLOF risk assessments, climate risk assessments, economic assessments of climate change impacts and cost/benefit studies of adaptation options) to justify the proposed project interventions and leverage additional co-financing for the proposed activities (especially with regards to GLOF risk mitigation in additional sites and establishment of GLOF early warning systems)
- Specification of planned adaptation activities to be financed by the LDCF and their rationale (i.e. why and how are they supposed to reduce vulnerability and/or increase adaptive capacity beyond what is already being done);
- Description of the geographic breakdown of project interventions in terms of districts and communities;
- Definition of project goal, objective, outcomes, outputs and verifiable indicators;
- Definition of a Strategic Results Framework and a Monitoring and Evaluation (M&E) system with quantifiable and verifiable impact indicators. These indicators, which will specifically address adaptation impacts, will be based on guidance by the LDCF results framework for adaptation projects. The indicators will be connected to a monitoring and evaluation plan, which will set out how and by whom these indicators will be measured and which way verification data will be collected by the project.
- Definition of implementation and execution arrangements for the project with detailed roles and responsibilities of government entities, UNDP and partnering NGOs and a timeline for project implementation;
- Definition of a stakeholder involvement plan for the preparation and implementation phase of the project, with a clear focus on community involvement and participation;
- Definition of project management and reporting arrangements;
- Endorsement letters from the government and letters confirming co-financing commitments;
- A detailed set of Annexes including a listing of PPG activities and reports from all relevant stakeholder consultations

B. DESCRIBE FINDINGS THAT MIGHT AFFECT THE PROJECT DESIGN OR ANY CONCERNS ON PROJECT IMPLEMENTATION, IF ANY:

a. The current political situation is a risk to implement project activities in all the project sites.
b. There is too much expectation by local communities in the Solukhumbu region due to past research findings and are culturally very strong. Working in the region has to be very much community based and the project needs full cooperation from the local communities to accomplish outcome 1.

C. PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES AND THEIR IMPLEMENTATION STATUS IN THE TABLE BELOW:

Project Preparation Activities Approved	***Implementation Status***	***GEF/LDCF/SCCF Amount ($)***				***Co-financing ($)***
		Amount Approved	***Amount Spent To date***	***Amount Committed***	***Uncommitted Amount****	
1. International Consultants	Completed	8,000		8,000		8,000
2. Local consultants	Completed	38,038	27,030	11,008		38,038
3. Travel	Completed	13,000	13,000			13,000
4. Training, Workshops and Conferences	Completed	4,000	4,000			4,000
5. Miscellaneous	Partially completed	462	300	162		462
Total		**63,500**	**44,330**	**19,170**	**0**	**63,500**

ANNEX E: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used**)**

Provide a calendar of expected reflows to the GEF/LDCF/SCCF Trust Fund or to your Agency (and/or revolving fund that will be set up)

Not applicable