

**PROJECT INFORMATION DOCUMENT (PID)
CONCEPT STAGE**

Report No.: PIDC46

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Project Name	Building Resilience to Climate Related Hazards (P127508)
Region	SOUTH ASIA
Country	Nepal
Sector(s)	General water, sanitation and flood protection sector (70%), General agriculture, fishing and forestry sector (30%)
Lending Instrument	Specific Investment Loan
Project ID	P127508
Borrower(s)	Government of Nepal
Implementing Agency	Department of Hydrology and Meteorology
Environmental Category	B-Partial Assessment
Date PID Prepared	05-Oct-2011
Estimated Date of Appraisal Completion	00000000
Estimated Date of Board Approval	12-Apr-2012
Concept Review Decision	Track II - The review did authorize the preparation to continue

I. Introduction and Context

Country Context

In November 2006, Nepal's decade-long conflict formally ended. In 2008, a constituent assembly (CA) was voted into power, a feudal monarchy was abolished, and a president and a prime minister were formally elected. A series of coalition governments have been formed and the process of writing a new constitution is underway. Progress has been slow, however, and the constitution (expected in 2011) remains to be completed.

Nepal is a land-locked country in the central part of the Himalayas. Nepal is one of the poorest countries in the world with 25% of the population living below the poverty line. Poverty varies widely across geographic location, ethnicity, caste and gender. The population is largely rural and, naturally, is heavily dependent upon agriculture. About 66% of the population (currently estimated at around 28 million) lives in rural areas and agriculture contributes 35% of GDP. Poverty is much more severe in rural areas (35%) compared to urban areas (10%) and particularly severe in mountainous areas. Nonetheless, over the past 10 years, many social indicators have improved, with the headcount poverty rate falling from 42% in FY1996 to 25% in FY2009.

Sectoral and Institutional Context

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Climate risk is one of the major challenges to growth and development in Nepal. Maplecroft's 2011 rankings of vulnerability to climate change ranked Nepal the fourth most climate vulnerable country in the world due to a combination of weak institutional capacity, a poor and mainly resource dependent population, and challenges posed by its varied geography. Climate projections for the country predict increases in temperature and precipitation and increase in frequency of extreme events linked with different emissions scenarios, demanding proactive strategies to adapt and integrate climate resilience into core development planning.

The greatest influence on Nepal's climate is the South Asian monsoons. The monsoons enter Nepal from the southeast, with precipitation beginning as it reaches the lower hills of the Churia range, which act as the first monsoon barrier. The high mountains of the Himalayan range act as a final barrier to the monsoon, creating a rain shadow to the north in the Himalayan Plateau. Monsoon rains are most abundant in the east and gradually decline as they move west; while winter rains are higher in the northwest, declining as they move southeast. The highest rainfall occurs in the central and mid-hills (around the Pokhara valley) and northeast and east of the Kathmandu valley. Average annual rainfall is approximately 1800 mm. Temperatures tend to increase from North to South. The highest temperatures are registered during the pre-monsoon period.

The Himalayan glaciers are another prominent feature of Nepal's climate. In addition to the effect of the high mountain range on the monsoon, the snow and ice of the glaciers act as natural water storage. Glacier melt is an important contributor to base flows in the Himalayan rivers and changes in the snow line and glacier melt dynamics could have serious effects on high altitude ecosystems and mountain communities. The melting of glaciers has also led to growth of numerous glacial lakes in Nepal. Glacial lakes form when glaciers melt and water is captured behind the glacier's terminal moraine (a natural dam of rubble and ice that forms at the tongue of a glacier.) As the pressure of the growing glacial lake increases, these natural dams can become unstable causing Glacial Lake Outburst Floods (GLOFs).

Water resources are among Nepal's major strategic assets, but extreme variability makes water resources management a challenge. Nepal is drained by a dense network of 6000 rivers. Together with groundwater, these substantial water resources underpin key growth sectors including agriculture, industry and hydropower, as well as providing essential water supplies for domestic use. But 80% of rainfall is concentrated during the summer monsoons between the months of June and September, bringing devastating floods and mudslides. During the remaining eight months there is very little precipitation and the country often suffers drought.

Hydrological variability undermines growth in several ways. Agriculture, which contributes 33% of the country's GDP and provides employment to 80% of the population, is predominantly rainfed and especially vulnerable to changes in weather patterns and extreme events. Variability in water flow and availability also has a significant impact on the hydropower sector which provides most of the nation's power. Insecure water supplies at the household level can also be extremely costly in terms of health impacts and the need for women and girls to spend additional time fetching water from more distant sources.

Nepal's vulnerability to weather-related hazards is an important obstacle to growth and an enduring threat to lives and livelihoods. Estimates made by the Ministry of Home Affairs suggest that of all the disasters reported, floods and landslides are the most devastating in terms of the number of deaths that occur and the damages they cause. Between 2001 and 2008, floods and landslides killed 1,673 people, affected 221,372 families, killed 33,365 livestock, destroyed 52,007 houses and washed away or destroyed over 22,000 ha of land. The monetary value of damages due to floods for 2001-2008 was about US\$ 130 million (US\$ 16 million annually or 0.1% of GDP).

Recent records in Nepal show increasing incidents of droughts, floods, hailstorms, landslides and crop disease. The Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report indicated that Nepal would suffer increased flooding due to changes in patterns and intensity of rainfall, leading to an increasing loss of life and decrease in crop yields. In addition, the IPCC also stressed the existence of a 'white spot' over Nepal and much of the region, indicating that the available data are inadequate for the development of reliable climate models.

A strong capacity to monitor and forecast hydro-meteorological events and climate variability, and to deliver this information in timely and usable ways to key clients (including farmers and disaster management professionals) is therefore essential for improving climate resilience in water resource dependent sectors and enabling communities to adapt. Modernization of the hydromet system in Nepal will generate water, weather and climate information that can be of substantial regional value.

The need for a well functioning early warning system has been identified as a key priority in the Government of Nepal's National Strategy for Disaster Risk Management. Key elements of a well functioning modern hydro-meteorological system include efficient data collection, transmission, storage, processing, use and dissemination to the public, government agencies and targeted user groups. In Nepal, the Department of Hydrology and Meteorology (under the Ministry of Environment) is mandated to collect, process and disseminate hydrological, meteorological and climate information to a range of users. Much of Nepal's hydrological and meteorological system relies on manual data collection with infrequent and unreliable reporting. There is real time access to some data and a limited automated hydrological network that is operated by a local private sector company on behalf of DHM. Transmission of data from the existing observation networks is also irregular and mainly relies on mobile telephones with information redistributed through the internet. From a service delivery standpoint, there is no system in Nepal for issuing authoritative warnings for weather and weather extremes to government authorities and key user groups, nor a system for issuing timely and targeted warnings to communities at high risk. For local communities, the implications of a weak early warning system have extraordinary costs in terms of the likely impact on their lives, livelihoods and management of assets.

Agro-meteorological information is another urgent priority to manage and mitigate climate risk in Nepal's large and highly vulnerable agriculture sector, and to underpin the country's food security efforts. A science-based agriculture information system is needed to deliver information and climate risk management tools that will provide the agricultural sector with a decision support information

Relationship to CAS

The proposed project is fully consistent with the FY12-13 Interim Strategy Note (ISN). The ISN is organized around three main pillars, namely (i) enhancing connectivity and productivity for growth; (ii) reducing vulnerability and increasing resilience and (iii) promoting access to better quality services. The project contributes primarily to the second pillar on reducing vulnerability and building resilience, but also to the third pillar by supporting the provision of important public sector services related to agriculture, water and disaster management. As the ISN recognizes, Nepal's vulnerability to food insecurity, climate risks and disasters is increasing, necessitating immediate action. Investments in hydro meteorological services in the country are likely to help key sectors such as agriculture, hydropower, transport, and tourism better adapt to climate risks, help reduce economic losses from hydro meteorological hazards and allow communities to cope better with impending risks over the long run. By supporting modernization of the country's hydromet facilities, associated capacity building, and improving weather forecasting and service delivery, the project supports the Bank's major emphasis on increasing resilience to climate related risks and disasters.

This project also aligns with the World Bank's commitment as an implementing agency of the Climate Investments Fund's Pilot Program for Climate Resilience (PPCR). The proposed project is one of five activities identified in the Nepal Strategic Program for Climate Resilience (SPCR). The SPCR was developed by the Government of Nepal in partnership with the World Bank, International Finance Corporation, Asian Development Bank through a broad based consultative process, and was approved by the PPCR Sub-Committee on June 28, 2011. Other activities include (i) Building Resilience of Watersheds in Mountain Eco-Regions (to be implemented by the ADB), (ii) Mainstreaming Climate Risk Management in Development (to be implemented by the ADB), (iii) Building Climate Resilient Communities Through Private Sector Participation (to be implemented by the IFC) and (iv) Enhancing Climate Resilience of Endangered Species (to be implemented by the WB). Jointly these projects will contribute to meeting the strategic objectives of the second ISN pillar.

The Bank has a strong and growing partnership with the Government of Nepal in the areas of water resource management, climate adaptation and disaster risk management. It is currently supporting improved institutional strengthening in the water sector through the Irrigation and Water Resources Management Project and the Water Resources and Climate Change (Non-Lending Technical Assistance), as well as engaging Nepal in the regional activities of the South Asia Water Initiative. The Government of Nepal, with financial support from the Global Agriculture Food Security Program (GAFSP) is in the process of designing a food security project in Nepal. One of the main components of the GAFSP project is to develop climate smart agricultural innovations and technology. The proposed project will thus contribute to the GAFSP project as well as other ongoing projects such as the Poverty Alleviation Fund and the Irrigation and Water Resources Management project that rely on quality data for agriculture and irrigation.

The Bank also has substantial expertise in supporting hydromet modernization across regions. In India, it is supporting modernization of hydrological information systems through the Hydrology I and II projects and in Bangladesh through the proposed Bangladesh Rivers Information and Conservation Project, providing opportunities for making different country networks compatible, and for regional collaboration and learning. It is also supporting hydromet modernization initiatives in the ECA region, particularly in Russia and the Central Asian republics, in Latin America through the 'Modernizing the National Meteorological Service to Address Variability and Climate Change in the Water Sector' in Mexico, and also in East Asia through the Vietnam Natural Disasters Risk Management Project. These initiatives demonstrate the Bank's comparative advantage in mobilizing funding, leading donor coordination, and bringing together global knowledge and experience on this issue, all of which are crucial for achieving the project's development objectives.

II. Proposed Development Objective(s)

Proposed Development Objective(s)

Proposed Development Objective(s): The main objective of the proposed project 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 hydromet and agricultural information management systems, and improving the accuracy and timeliness of weather and flood forecasts and warning. Activities funded through the project would help improve decision-making and planning in key climate vulnerable and water resources dependent sectors, particularly agriculture, and contribute to building resilience for communities and sectors at risk.

Key Results

Performance towards achieving the development objectives will be measured through the following performance indicators:

- # More accurate weather, hydrological and climate forecasts, extending the current 24 hours forecast to 72 hours with accuracy comparable to neighboring countries (China and India).
- # Increased accuracy of seasonal river flow forecasts. The forthcoming preparation mission will determine a baseline ("x") and define a proposed improvement ("y").
- # Introduction of an authoritative meteorological and hydrological warning system for extreme and high impact events. Establishing a baseline for accuracy and timeliness and providing year on year improvements that meet stakeholders' expectations and needs.
- # Establishment of an effective Agricultural Management Information System
- # Number of farmers reached to raise awareness of the availability and practical utility of agro-climate information products and services.

III. Preliminary Description

Concept Description

The project is likely to consist of the following components:

Component A: Institutional Strengthening, Capacity Building and Financial Sustainability of DHM (preliminary estimate US\$ 4 million)

The main objective of this component is to ensure the institutional, staffing and financial sustainability of the DHM to deliver weather, water and climate services that meet the needs of Nepal. This component will also support the development of detailed project design and project implementation and monitoring.

In view of the proposed significant upgrading and modernization of the DHM infrastructure, it is anticipated that the skills and staffing profile of DHM will change. The following areas were identified as priority needs:

- # Detailed design of the DHM systems and project management support;
- # Institutional development and system restructuring options recognizing the needs of users and limitations of financing operations costs;

- # Development of a legal and regulatory framework concerning specialized hydrometeorological services;

- # Developing and implementing a DHM capacity building and training program, possibly:

- Using the Voluntary Cooperation Program of the WMO or regional training opportunities such as the Bay of Bengal Severe Weather Forecasting Demonstration Project;

- Implementing training activities (workshops, round tables, etc.) for major users (agriculture, water resources, energy, health, civil aviation), including those dealing with the use of the hydrometeorological information to ensure timely response actions;

- # Enhancing and expanding the existing public private partnership scheme.

- # Project management, monitoring and evaluation of components A, B and C (managed by DHM)

- # Coordination with the 'Mainstreaming Climate Change Risk Management in Development Project' of the Nepal SPCR for dissemination of SPCR lessons learnt and best practices (for all Components, A, B, C and D of this project).

Component B: Modernization of the Hydro-meteorological and Environmental Observation Networks (preliminary estimate US\$ 13 million)

The objective of this component is to upgrade and expand the meteorological and hydrological observation networks to ensure the efficient and timely collection, transmission, processing and dissemination of information that is essential for the management of disaster risks, agriculture, water resources, hydropower, etc.

Collection of high-quality data is the foundation for producing reliable weather forecasts and providing timely warnings. This information will help build climate resilience in key sectors and also fulfill Nepal's international and bilateral obligations to provide information on hydro-meteorological conditions within the country. Specific activities might include:

- # Installing up to 100 automated weather stations capable of measuring meteorological parameters to the standards recommended by WMO. Up to 20% of these stations could be equipped for agro-meteorological purposes, including soil moisture. Fifteen of these sites are currently designated as synoptic stations (those designed according to WMO standards for use in large scale and global weather forecasts) and could be refurbished accordingly. Three stations could provide representative climate information for three major climatic regions of Nepal (high mountains, hills and terai) and comply with the standards set by the Global Climate Observing System (GCOS). Some of the stations could also be equipped for air quality sampling to measure PM10, black carbon, UV, and ozone. The feasibility of including at least three high altitude stations linked to the hydrological network should also be considered.

- # Installing up to 100 automated hydrological stations with the capacity to monitor stages, rainfall, and discharge. A subset of the network, up to 20%, could be designed to measure basic water quality parameters (conductivity, BOD, dissolved oxygen, nutrients) and sedimentation. An additional ten stations could be located in the upper reaches of the watersheds where current coverage is low.

- # Building capabilities to measure snow depth and density needed to forecast seasonal flows.

- # Installing up to two upper air stations measuring profiles of temperature, humidity, wind speed and direction to provide representative daily or twice daily samples of the atmosphere. These data would improve weather forecasts for Nepal and local capacity to forecast extreme weather events.

- # Installing up to two weather radar with the option to include other nowcasting systems, such as a lightning network to improve the real-time monitoring of dangerous weather events that result in flash floods and landslides, livestock losses due to hail, and hazards to aviation.

- # Installing calibration facilities for the routine calibration of meteorological and hydrological equipment. This may include a combination of fixed and mobile facilities.

- # Refurbishing DHM facilities

Component C: Enhancement of the Service Delivery System of DHM (preliminary estimate US\$ 3 million)

The objective of this component is to improve weather, water and climate services, i.e., for extreme weather warnings and decision support systems.

Currently Nepal does not issue any formal warnings for weather or weather extremes. Improving the forms and methods of providing weather forecasts for government authorities and the public, as well as specialized weather, water and climate forecasts

for specific user groups, is one of the most important opportunities of this project. Specific activities could include:

- # Introducing modern communication facilities and technologies for receiving and processing data, to enable higher quality forecast and warnings and increase warning lead times;
- # Implementing multi-purpose meteorological communication facilities and a system of hydro-meteorological data processing, archiving, modeling and visualization;
- # Transitioning experimental numerical weather prediction systems into operations;
- # Establishing a Public Weather Service in accordance with WMO guidelines for the communication of weather forecasts and warnings to the public. This could include climate and hydrological services. It could also form the kernel of a Multi-Hazard Early Warning System (MHEWS), which could support weather and climate related disaster reduction strategies across many sectors;
- # Developing and implementing information systems for various stakeholders, especially water management, transport, energy, and tourism.

Component D: Creation of an Agriculture Management Information System (preliminary estimate US\$ 5 million)
The objective of this component is to meet the information needs of the agriculture sector to better manage and mitigate climate-related production risks.

Providing a value-added agriculture management information system would require strong intra-governmental cooperation. Specific components of the system might include:

- # One-stop-shopping for agricultural data (e.g., crop, livestock, etc.)
- # Agriculture, weather and climate outlook advisory systems (e.g., crop planting advisory, pesticide application advisory, fertilizer application advisory, and soil moisture management etc.);
- # Provision of data required for developing an agriculture insurance scheme(s);
- # Capacity building, involving youth and university students, in raising climate resilient agriculture science and practices and applications of agriculture management information system;
- # Research and development, in particular the development of drought and flood resistant crops.
- # Information technology infrastructure for Ministry of Agriculture and Cooperatives, in order to stream data from DHM, archive data and house agriculture management information system.
- # Capacity building, project management, and monitoring and evaluation (Component D managed by MoAC)
- # Dissemination of lessons learnt and best practices in coordination with the Mainstreaming Climate Change Risk Management in Development Project of the Nepal PPCR.

IV. Safeguard Policies that might apply

Safeguard Policies Triggered by the Project	Yes	No	TBD
Environmental Assessment OP/BP 4.01	X		
Natural Habitats OP/BP 4.04			X
Forests OP/BP 4.36			X
Pest Management OP 4.09		X	
Physical Cultural Resources OP/BP 4.11		X	
Indigenous Peoples OP/BP 4.10	X		
Involuntary Resettlement OP/BP 4.12	X		
Safety of Dams OP/BP 4.37		X	
Projects on International Waters OP/BP 7.50			X
Projects in Disputed Areas OP/BP 7.60		X	

V. Tentative financing

Financing Source	Amount
Borrower	0.00
Strategic Climate Fund	25.00
Total	25.00

VI. Contact point

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