CLIMATE CHANGE ASSESSMENT

I. Basic Project Information

Project Name	South Asia Subregional Economic Cooperation Highway Improvement Project
ADB Financing Amount	US$ 180.0 million
Location	South-East Terai region, Nepal
Sector	Road transport
Theme	Inclusive economic growth; environmentally sustainable growth

Brief Description of Project

The scope of the project entails: rehabilitation and upgrading of 87 km of a road; construction of a modern office building for the Project Directorate (ADB) for the Department of Road in Kathmandu; and improvement of planning and management of road safety.

The road, which is the main component with climate risks, is located between the settlements of Kanchanpur and Kamala along the East West Highway in south eastern part of Nepal. It will be widened to a four-lane standard road with a design speed of 100 km/h. Improvement works will also include increasing the number and capacity of drainage structures and improving 54 bridges.

Overall, the broad objectives of the project are: (i) to contribute to improving the national and regional transport connectivity in the eastern part of Nepal, (ii) to help ease growing traffic congestion, and improve road safety and maintenance, and (iii) to promote socio-economic development to support the goal of Nepal to graduate from the status of least developed country by 2022.

The project impacts are transport connectivity within Nepal and with neighboring countries improved, and physical connectivity and multimodal linkages for land-based transport along major trade routes enhanced.

II. Summary of Climate Risk Screening and Assessment

A. Sensitivity of Project Component(s) to Climate/Weather Conditions

Project components	*Sensitivity to climate/weather conditions*
(1) Road (2) Longitudinal and cross drains (3) Bridges	Design of project components need to focus on sensitive weather parameters that are subject to a wide variety of changing climate/weather conditions in future such as increased intensity and frequency of precipitation and extreme flooding.

B. Climate Risk Screening

Risk topic	*Description of the risk*
(1) Extreme temperature	(1) According to the Nepal National Adaptation Programme of Action (NAPA) project mean annual temperature is 1.2°C – 1.4°C by 2030; 1.7°C – 2.8°C by 2050 and 2060 ad 3°C – 4.7°C by 2090 and 2100.
(2) Extreme rainfall and related flooding in low level Terai region	(2) Although the NAPA precipitation data does not reveal any significant trends, on analysis of data from 166 stations across Nepal from 1976 to 2005 showed an increasing trend of annual rainfall in eastern, central and far-western Nepal. Another study on precipitation extremes show an increasing trend in total and heavy precipitation events and more weather related extreme events such as floods and landslides. (3) Devastating floods are triggered by different mechanisms such as: (i) continuous rainfall and cloudburst (CLOFs), (ii) glacial lake outburst floods (GLOFs), (iii) landslide dam outburst floods (LDOFs), (iv) floods triggered by the failure of infrastructure, and (v) sheet flooding or inundation in lowland areas due to an obstruction imposed against the flow. Nepal is highly vulnerable to recurrent floods in the Terai region.

C. Climate Risk Classification: **Medium to High**

Climate risk assessment

As part of the initial environmental examination, a section on climate risk and vulnerability assessment (CRVA) has been prepared. Key climate change risks identified were related to increased extreme temperature, increased rainfall intensity and subsequent flooding in the Terai region, including overflowing of rivers/streams by continuous heavy rainfall under a changed future climate. The CRVA highlights the documented risks associated with climate change and vulnerabilities, and in response examines the adaptation approaches engaged in the design of the project road with the particular objective of reducing the perceived negative impacts under an uncertain future climate.

III. Climate Risk Management Response within the Project

To mitigate risks particularly due to increased frequency and intensity of future rainfall, the following design measures have been incorporated in the design of the Kanchanpur–Kamala road:

(i) Rainfall intensity estimates has been increased by 10%;
(ii) The design return period for drainage structures is now taken as 20 years as opposed to 10 years customary practice in Nepal;
(iii) The total number of cross-drainages has been increased;
(iv) The size and design of existing culverts has been changed to increase their capacity;
(v) Level of sophistication improved in the determination of high flood levels for rivers in the project and calibrated corresponding to 100-year return flood;
(vi) Customary freeboard maintained at 1.5 m for bridges by Nepal standards now adopts 2m freeboard, a 33% increase above normal hydraulic clearance requirements;
(vii) Road level has been increased in selected sections; and
(viii) Bioengineering works have been included for slope stabilization.

The total cost for the above design measures is approximately $4.93 million. With ADB financing 69.4% of the civil works costs, ADB financing for adaptation is equivalent to $4.5 million. The cost breakdown is provided in the table.

Adaptation Measure	**Details**	**Estimated Cost** ($)
A. Drainage		
1. Addition of new cross drainage structures	6 numbers (900mm dia. Hume pipe)	0.01
2. Increase in size of pipe culverts	65 numbers (600mm to 900m diameter)	0.08
3. Replacement of pipe culverts with box culverts	111 numbers; increase in capacity by over 10%	2.35
4. Replacement of slab culverts with box culverts	102 numbers; increase in capacity also	0.68
5. Replacement of old box culvert with new one with higher capacity	33 numbers; with some increase in capacity	0.15
6. Increase in size of longitudinal drains	4.5% increase to accommodate higher anticipated rainfall	0.87
B. Road		
7. Increase in road level	About 10cm increase throughout the road	0.82
C. Bridges		
8. Increase in freeboard by up to 0.5m hence increase in flood carrying capacity	40 bridges; additional freeboard by median value of 0.47m	0.70
D. Bioengineering		
9. Slope protection measures	Vegetation of road embankment slopes	0.67
Total cost		**6.32**

C = Celsius; cm = centimeter; CRVA = climate risk and vulnerability assessment; HFL = high flood level; m = meter; mm = millimeter; NAPA = National Adaptation Programme of Action.
Source: Asian Development Bank.