CLIMATE CHANGE ASSESSMENT

I. BASIC PROJECT INFORMATION

Project Title:	**CAREC Corridors 1 and 3 Connector Road**
Project Cost ($ million)**:**	**(i) $114.35 million (2016 ADB-financed section only - Epkin–Bashkugandy)** **(ii) $90.75 million (proposed additional financing for Balykchy to Km43 and Kochkor to Epkin road sections)**
Location:	**Kyrgyz Republic**
Sector:	**Transport**
Theme:	**Inclusive economic growth, environmentally sustainable growth, and regional integration**
Brief Description:	The proposed Central Asia Regional Economic Cooperation (CAREC) Corridors 1 and 3 Connector Road (the project) will improve national and regional connectivity by rehabilitating of road sections connecting the CAREC Corridors 1 and 3 in the center of the Kyrgyz Republic. The project will: (i) reduce the cost of transporting passengers and cargo between the southern and northern regions by providing safer and faster access; (ii) provide a more direct transit route between Kazakhstan, Tajikistan, and beyond; (iii) stimulate trade; and (iv) improve road maintenance practices in the country. Road sections comprise: Section 1: Balykchi to kilometer-post 43 (Km 0 to Km 43), approximately 43 km; Seciokn 2: Kochkor to Bashkugandy (Km 64 to Km 159), approximately 93 km (separated into Sections 2A and 2B); and Section 3: Aral to CAREC Corridor 3 via the Suusamyr valley (Km 195 to Km 286), approximately 91 km. The Climate Change Assessment covers climate risks for the project, estimation of greenhouse gas levels with and without the project, and recommendations for project design.

II. SUMMARY OF CLIMATE CHANGE FINANCE

Project Financing for Sections 1 and 2A		**Climate Finance**	
Source	**Amount** ($ million)	**Adaptation** ($ million)	**Mitigation** ($ million)
Asian Development Bank			
Ordinary capital resources (concessional loan)	68.50	2.75	0
Special Funds resources (ADF grant)	9.50	0	0
	78.00	**2.75**	0

ADF = Asian Development Fund.
Source: Asian Development Bank.

III. SUMMARY OF CLIMATE RISK SCREENING AND ASSESSMENT

A. Sensitivity of Project Component(s) to Climate or Weather Conditions and the Sea Level

1. Construction activities for project Section 3[1] (e.g., on road base, road pavement, pavement widening, reconstruction of river-crossing bridges, river bank stabilization works). There is an avalanche hazard at the Suusamyr valley close to the project section 3. The section 3 does not, however, cross the

[1] "The project sections 1 and 2 are located in the mid-mountain zone (from 900–1,200 up to 2,000–2,200 m), while the elevation rises at section 3 going to Suusamyr with elevation of 2000–2600 m and surrounding peaks of up to 4,500 m" and is "characterized by cool summer and cold, sometimes heavy snowy winter." Section 3 is currently not included in the scope of the proposed project.

highest mountains most at risk of avalanches. Rising winter temperatures can in the future increase the risk of unpredictable avalanches, as temperature changes can be more sudden.
2. Pavement Rehabilitation on the entire study road. Increase in peak temperatures could soften asphalt road and lead to rutting and pavement integrity; increased precipitation could undermine the pavement quality and serviceability; "Later onset of seasonal freeze and earlier onset of seasonal thaw results in pavement deterioration due to increased freeze-thaw conditions."
3. Road side drainage improvement/ construction. A greater "rainfall intensity will affect the capacity of drainage and overflow systems to deal with stronger or faster velocity of water flows."
4. Slope stabilization works. An "increase in intense precipitation events increase the potential of road damages due to landslides and mudflows."

B. Climate Risk Screening

1. Temperature Increase. Increase of mean and extreme temperatures may lead to faster pavement rutting due to increase of plasticity of bitumen in the wearing course; the estimated increase in extreme temperatures and drought impact most especially the road condition and lifecycle. Possible surface damages that can occur on pavements include rutting, cracking, potholes, and fretting. One of the factors contributing to surface damage is high road surface temperatures. The low albedo of road surfacing means that it is an efficient absorber of sun radiation, and the increasing frequency of extreme temperatures entails more prevalent damage.
2. Increase in number of freeze-thaw cycles. Increase in freeze-thaw cycles may lead to premature pavement degradation.
3. Increase in flooding and frequency of landslides and rock slides. Landslides, avalanches, and flood events may affect bridge/road access, performance, and longevity. On the mountainous part of the road section 3, there is a medium risk for landslides, as well as rockslides. As precipitation is not expected to increase in the area, the risk is not likely to increase significantly, but should, however, be taken into account in the road planning. On the section 3, there is also a risk of flooding, as the road is located very close to the Kokomerin River. 6. Potential landslide risk areas along the road are: Km 10–Km 12, Km 90–Km 120, Km 130–Km 135, and Km 215–Km 225. Avalanche prone areas are at the Kiz Art Pass from Km 200 to Km 240 (Section 3).

Climate Risk Classification: Medium

C. Climate Risk and Adaptation Assessment

1. Overall methodology for the risk and adaptation assessment and the data and key assumptions used. A climate risk and vulnerability assessment (CRVA) was undertaken during project preparation. The draft final CRVA report is attached.

2. Key climate risks to the relevant project components. The main hazards identified include:
   (i) River floods and water logging in spring, due to more intense rainfall. This will mainly affect lower altitudes and areas susceptible to flooding;
   (ii) Heat stress in the summer, especially at lower altitudes;
   (iii) Mudslides related to more intense rainfall in the spring at medium altitudes (and in a lesser degree also high altitudes); and
   (iv) Flash floods in the summer especially at higher altitudes, related to higher temperatures together with the increase in winter, spring and autumn rainfall (snow at higher altitudes).

   Analysis of climate simulations by IFAD[1] indicates that the CAREC Corridors 1 and 3 Connector Road is located at an area with low vulnerability risk as compared with the north of Chuy Oblast and other high-altitude areas. Vulnerabilities identified for the project are mainly related to increased heat stress at the project areas with low altitudes and mudslides at medium altitudes.

Hazards	Road Section 1	Road Section 2	Road Section 3
Landslides, precipitation	Low risk	Low risk	Medium risk
Landslides, earthquakes	Low risk	Low risk	Medium risk
Avalanches	Very low risk	Very low risk	Medium risk
Floods	Low risk	Low risk	Medium risk
Strong winds	Very low risk	Very low risk	Very low risk
Extreme temperature	Medium risk	Medium risk	Low risk
Drought	Medium risk	Medium risk	Low risk

3. Adaptation options identified and prioritized for managing the risks. The CRVA has identified and recommended the following climate change adaptation measures, which have been incorporated into the feasibility-level design.
   (i) Risk of flooding. The priority adaptation measures identified are as follows, increasing size and number of drainage structures, raising embankment height to avoid over-flooding, realigning natural water courses, updating design for drainage systems, conducting slope stability studies in an attempt to minimize landslides and mudflows as a result of increased precipitation, and implementing measures to enhance slope stability and prevent landslides and rock fall.

   (ii) Risk of increased temperatures and head waves. The priority adaptation measures identified are as follows: improving pavement material specifications, and using polymer-modified bitumen, and other advanced construction technologies to prevent pavement deformation and deterioration.

   (iii) Risk of temperature changes resulting in increasing number of frost-thaw cycles and increase the risk for avalanches. The priority adaptation measures identified are the of implementation of snow fences, preferable living snow fences and appropriate artificial anti-avalanche structures, like galleries

D. Climate Risk Screening Tool and/or Procedure Used

"The assessment of climate change impacts at CAREC Corridors project area is based on climate modelling by The International Fund for Agricultural Development and UNEP's Global Risk Platform data. The socioeconomic profile of the project area with components for each of the road sections is used for the vulnerability assessment. The socioeconomic data based on surveys, statistical inputs etc. will be available in March 2016."

"The International Fund for Agricultural Development has assigned climate change simulations to identify vulnerabilities and to define adaptation strategies for rural regions in Kyrgyzstan. The methodology used included the utilization of six climate models used by the IPCC in its Fifth Assessment Report, gathering historical observations from available monitoring stations, and adaptation and application of a statistical downscaling methodology."

IV. CLIMATE ADAPTATION PLANS WITHIN THE PROJECT

Adaptation Activity	Target Climate Risk	Estimated Adaptation Costs ($ million)	Adaptation Finance Justification
Procurement and use of improved materials for asphalt layers and use of polymer modified bitumen for the following road sections, i.e., (i) Km 0–Km 43 (Balykchi–	Increase of mean and extreme temperatures lead to faster pavement rutting due to increase of plasticity of bitumen in the wearing course	5.4	A CRVA has been conducted and these measures have been recommended. The procurement and use of polymer modified bitumen shall cover approximately 227 Km of road project. "For cost estimation

Adaptation Activity	Target Climate Risk	Estimated Adaptation Costs ($ million)	Adaptation Finance Justification
Km-post 43); (ii) Km 62–Km 89 (Kochkor–Epkin); (iii) Km 89–Km 159 (Epkin–Bashkugandy); (iv) Km 195–Km 274 (Aral–Too-Ashuu)			purpose the usage of 'Duroflex (WA-80)' additive has been assumed. The price of the additive is 1.68 USD66 per kg. Additional 25% for delivery and ancillary costs are added, resulting in a unite price of 2.1 USD per kg, equivalent to 2,100 USD per ton. "
Extension of drainage system for the following road sections, i.e., (i) Km 0–Km 43 (Balykchi–Km-post 43); (ii) Km 62–Km 89 (Kochkor–Epkin); (iii) Km 89–Km 159 (Epkin–Bashkugandy); (iv) Km 195–Km 274 (Aral–Too-Ashuu)	Risk of road over flooding and water ponding along the road due to a risk of 20% increased precipitation during the life of the project.	3.0	The assumed adaptation cost of the extended drainage is 20% of the total drainage cost amounting to $6.056M.
			Over-all, the $8.4M additional cost of the above adaptation measures represent 4.01% of the total Civil Works Costs.

Source: Asian Development Bank.

V. CLIMATE MITIGATION PLANS WITHIN THE PROJECT

Mitigation Activity	Estimated GHG Emissions Reduction (tCO_2e/year)[a]	Estimated Mitigation Costs ($ million)	Mitigation Finance Justification
Not applicable.			