CLIMATE CHANGE ASSESSMENT FOR TRANCHE 3

I. Basic Project Information

Project Title: Ulaanbaatar Urban Services and *Ger* Areas Development Investment Program (Tranche 3)

Project Cost: Program $344.20 million / Tranche 3: $114.20 million

Location: Ulaanbaatar, Mongolia

Sector: Water and Other Urban Infrastructure and Services

Theme: Environmental Sustainability

Brief Description:

Ulaanbaatar's informally settled *ger* areas are home to about 60% (850,000) of the city's residents. *Ger* areas spread uncontrolled to the east, west, and north with northern expansion often taking place on vulnerable hillsides or in natural drainage courses exposing residents to a range of climate change risks. Rural-urban migration is the main cause of urban expansion resulting from a collapse of rural industry with the fall of the Soviet Union and ongoing climate change forcing traditional herders off the land. Grazing is highly vulnerable to rapidly depleting natural water resources (drying glaciers, streams, lakes, and aquifers), droughts and increasingly severe and frequent winter storms (*dzuds*). Rural-urban migration is also driven by the global trend of youth seeking better social and economic opportunities in urban centers.

Ger areas are characterized by a lack of formal planning of roads and drainage with poor access to other basic services including water, sanitation, and heating. These conditions leave *ger* residents particularly vulnerable to climate change impacts. Flooding, pollution from over-flowing pit latrines, and air pollution from coal-fueled heating and cooking endanger the well-being of *ger* residents and have negative impacts on the city as a whole. The majority of urban migrants are ill-equipped for employment in the urban sector leaving them further susceptible to multi-dimensional poverty with few resources to improve their living conditions.

The Ulaanbaatar City Urban Development Master Plan (2030)[a] addresses these issues partly by proposing development of a series of *ger*-area subcenters in which infrastructure will be improved in support of *ger* area redevelopment with improved infrastructure and social and economic facilities. Development of six of these subcenters is addressed by this program with Tranche 3 focused on Sharkhad (6 kilometers [km] to the east with 8,445 residents) and Tolgoit (12 km to the west with 26,000 residents).

Tranche 3 outputs include:

(i) roads and urban services comprising (a) road construction, (b) water supply, (c) wastewater, (d) district heating, (e) electricity supply, (f) telecommunications, and (g) drainage facilities;

(ii) economic and public services comprising (a) kindergartens, (b) community centers, (c) training centers, (d) sports complex, (e) primary health care center, (f) social housing and green open spaces; and

(iii) strengthening institutional capacity for program management and urban development.

Integral to all of these proposed investments is both the need and opportunity to address climate change risk adaptation and mitigation. Mongolia is a signatory to all the major international climate change protocols and operates under its own National Action Plan on Climate Change (2011–2021) and Green Development Policy (2014–2030).

Asian Development Bank's country partnership strategy, 2017–2020 for Mongolia acknowledges that "climate change impacts are causing significant environmental degradation that needs to be arrested to make growth more sustainable" and emphasizes the need to support greater developmental resilience.

[a] State Great Hural (Parliament) of Mongolia. 2013. *Adjustments to the Ulaanbaatar City Urban Development Master Plan 2020 and Development Directions 2030.* Ulaanbaatar.

II. Summary of Climate Change Finance–Tranche 3

Project Financing		Climate Finance	
Source	**Amount** ($ million)	**Adaptation** ($ million)	**Mitigation** ($ million)
Asian Development Bank			
Ordinary capital resources (regular loan)	25.05	1.97	0.00
Ordinary capital resources (concessional loan)	18.60	0.87	0.87
European Investment Bank	18.65	7.34	0.00
Municipality of Ulaanbaatar	51.90	1.99	0.25
Total	**114.20**	**12.17**	**1.12**

III. Summary of Climate Risk Screening and Assessment

Climate risk identification and program vulnerability and adaptation assessments are based on a review of Mongolia climate change reports and data prepared by the Asian Development Bank (ADB),[1] World Bank, United Nations, Intergovernmental Panel on Climate Change, Green Climate Fund, and the Government of Mongolia climate change policy documents and their Third National Communication to United Nations Framework Convention on Climate Change.[2] ADB project reports for related Mongolia and regional projects were also reviewed. In addition, meetings were held with key government stakeholders and local government *khoroo* officials in both subcenters to gather personal on-the-ground inputs. Greenhouse gas (GHG) reduction calculations were based on national energy consumption figures and international energy/GHG emission and carbon capture rates.

A. Sensitivity of Project Components to Climate or Weather Conditions and the Sea Level	
Project components (construction, materials, and operation): 1. Roads and bridges 2. Water supply, wastewater 3. District heating 4. Electricity, telecommunications 5. Drainage infrastructure 6. Economic and social facilities 7. Green spaces	**Sensitivity:** 1. Extreme seasonal temperature variations 2. Increased summer temperatures 3. More severe and unpredictable precipitation events (flooding) 4. Increased threat of droughts and *dzuds* 5. Depletion of water resources

B. Climate Risk Screening	
Risk topic: 1. Extreme seasonal temperature variations 2. Increased summer temperatures 3. More severe and unpredictable precipitation events (flooding) 4. Increased threat of droughts and *dzuds* 5. Depletion of water resources	**Description of risk:** 1. Thermal stress on all exposed construction materials and structures 2. Heat wave health risks and additional thermal stress on construction materials; increased evaporation rates for limited water resources; threats to landscape vegetation 3. Flooding risks, including damage to above ground infrastructure (roads, bridges and drains, and economic/social facilities) 4. Damage to landscape vegetation, increased dust during and after construction 5. Threat to water supply and wastewater operations
Climate Risk Classification: *Medium*	

[1] ADB. Regional: Supporting Adaptation Decision Making for Climate Resilient Investments.
[2] Prepared in 2018 under the United Nations Framework Convention on Climate Change by Mongolia's Ministry of Environment and Tourism.

C. Climate Risk and Adaptation Assessment

1. **Extreme seasonal temperature variations.** Mongolia has long adapted to extreme temperature changes in its establishment of construction standards, materials, and technologies. This places thermal stress on all exposed construction which will increase with projected increases in temperature spreads.

2. **Increased summer temperatures.** Mongolia is projected to experience some of the world's highest summer temperature increases due to climate change, as much as 6°C (Green Climate Fund Country Climate Profile). This will increase thermal stresses on all construction materials and structures. It will also increase the potential for heat waves with related health threats to residents, particularly the elderly and other vulnerable groups. Urban heat sink phenomena are more likely to be experienced. Damage to landscape and agricultural vegetation can be expected. Water evaporation rates will increase.

3. **More severe and unpredictable precipitation events.** Flooding is identified as the greatest threat to project investments and the well-being of project communities. A projected increase in the frequency of thunderstorms and short, high-intensity rainfall events will increase the number and severity of flood events causing increased asset loss/damage, increased health risks from overflowing pit latrines until they are entirely replaced, and more disease from standing water. Overall annual levels of precipitation are projected to increase slightly but primarily with increased amounts of winter snow fall. More snow will mean more dangerous roads, more icing, and more structural loading on buildings and other exposed infrastructure.

4. **Increased threat of droughts and *dzuds.*** Temperature increases and more erratic precipitation events will increase the number and severity of droughts. Higher temperatures will accelerate evaporation of Mongolia's already limited and diminishing natural water resources. More droughts will lead to an increase in dust storms which are already a serious health and comfort issue throughout much of the country. Winter temperatures are not projected to increase as much as summer temperatures, but increased snowfall is projected and may increase the severity of *dzuds* and their impacts on traditional grazing and herds. This in turn will lead to more rural-urban migration and even greater challenges for *ger* area infrastructure and services, and further increase the need for *ger* area redevelopment.

5. **Depletion of water resources.** This is a national climate change impact that is affecting water supply and therefore development throughout Mongolia. Glaciers, lakes, rivers, and aquifers are drying up. A shortage of water supply will eventually impact Ulaanbaatar and have negative impacts on the ongoing operation of proposed water supply and wastewater networks. It also mandates that all possible due care be taken to conserve and recycle water usage in the subcenters in all of the project's investments.

D. Climate Risk Screening Tool and/or Procedure Used

1. This climate change assessment was prepared through a combination of desk and field work in collaboration with ADB and the consultant team preparing the Tranche 3 feasibility study.

2. Preparation of this assessment relied primarily on the use of available secondary data supplemented and ground-checked by a short period of field work. Primary data sources include:

(i) World Bank climate data on Mongolia: World Bank's Climate Change Knowledge Portal (2018)
(ii) Global climate data from the Intergovernmental Panel on Climate Change AR5 report
(iii) Government of Mongolia's Third National Communication to the United Nations Framework Convention on Climate Change
(iv) Climate risk and vulnerability assessment prepared for ADB's Ulaanbaatar Green Affordable Housing and Resilient Urban Renewal Sector Project (MON 49169, 2018)
(v) Climate risk and vulnerability assessment prepared for ADB's Ulaanbaatar Combined Heat and Power Plant Number 5 (CHP5) (MON 46343, 2015)
(vi) Feasibility study for Tranche 3 prepared by ADB's consulting team in September 2019, including initial environmental examination and environmental management plan

(vii) USAID Mongolia Climate Profile (2017)
(viii) Global Climate Fund Profile – Mongolia

3. Field work included meetings with the consultant team preparing the Tranche 3 feasibility study, key Government of Mongolia stakeholders, and subcenter *khoroo* officials. Field visits were also made to the subcenters.

4. The overall assessment and decision-making methodology applied follows ADB's accepted climate risk assessment methodology comprising five components and 20 steps as modified by the specific terms of reference for this assessment.

IV. Climate Adaptation Plans Within the Project

The direct risks of climate change and required adaptation responses to specific project investments during construction and operation are not significant with the exception of potential flood events that can impact all infrastructure and socioeconomic facilities. Temperature extremes are well known in Mongolia and the projected increased spread from summer to winter will not require anything new in terms of construction standards but will require increased attention to construction details and likely higher maintenance budgets. However, in addressing the wider need for climate change adaptation and mitigation in Mongolia, and Ulaanbaatar in particular, there are several recommended responses and co-benefit opportunities to reduce GHG, improve water resource use, mitigate heat waves, save energy, and generally improve the well-being of *ger* area residents that can be integrated into the project:

Adaptation Activity	**Target Climate Risk**	**Estimated Adaptation Costs** ($ million)	**Adaptation Finance Justification**
Road strengthening and design alterations	Increased summer temperatures and greater seasonal variations with potential to damage infrastructure	3.71	Higher summer temperatures will require attention to expansion-joint construction and ensured quality of asphalt. Roads are most vulnerable to increased flooding and cross-section designs must accommodate both increased on-surface drainage and runoff from adjacent neighborhoods. The innovative use of "sponge" infrastructure is suggested wherever possible in place of traditional non-porous structures. This will reduce the damage caused by high-speed storm water runoff and provide opportunities for re-use of that water for roadside green irrigation which in turn stabilizes soil, reduces dust, and contributes to urban cooling. This is fully in-line with ADB's current push to maximize the use of nature-based infrastructure as a climate change adaptation and resource conservation mechanism. Regular maintenance is always the key to asset preservation and increased maintenance budgets should be planned for.
Bridge design	Increased summer temperatures and greater seasonal variations with	Included with roads	Bridges will require more robust design and construction of abutments to handle more severe storm events, and expansion joints designed to handle a wider temperature range.

Adaptation Activity	Target Climate Risk	Estimated Adaptation Costs ($ million)	Adaptation Finance Justification
	potential to damage infrastructure		
Drainage infrastructure	Increasingly severe and unpredictable precipitation events	5.09	Drainage infrastructure will be under risk from an increased number and severity of precipitation events. Failure of drainage systems in turn threatens other community assets, both public and private. As noted above, it is recommended that more nature-based "sponge" infrastructure be utilized in place of traditional non-porous construction. This will slow down water speeds, increase the re-use of stormwater to maintain green spaces with related cooling, dust control, and erosion control. Maximizing the use of rapidly diminishing water resources wherever possible is necessary. Examples of appropriate "sponge" infrastructure are found throughout Ulaanbaatar in similar drainage situations. Dedicated drainage networks can also provide the co-benefit use as public green corridors and pedestrian ways.
Water supply and sewerage	Diminishing national water resources Increasingly severe and unpredictable precipitation events	2.25	National water resources are diminishing and resulting in supply challenges to many parts of Mongolia including Ulaanbaatar as it continues to grow. Critical efforts are required to improve efficiency of water supply networks, reduce system losses, introduce water conservation measures including recycling, rainwater harvesting, stormwater retention for reuse, pollution control on existing resources through improved sanitation, and low-flow showers and toilets.
Economic and social facilities	Temperature increases; increasingly severe and unpredictable precipitation events; droughts; increased snowfall	1.05	These are proposed as "green" buildings and by definition should employ the full range of "green" elements including orientation for maximum winter solar gain and minimal winter wind impact, high insulation, natural ventilation, low-energy lighting, water-saving toilets, rain water harvesting, planted green surroundings, etc.; regular and adequate maintenance of all systems is necessary to maintain the advantages; and roof designs to accommodate projected increased snow loads.
Green spaces	Increased summer temperatures; droughts;	0.07	Should be maximized throughout with drought and extreme temperature-resistant planting to control drainage and soil erosion, contribute to urban cooling,

Adaptation Activity	Target Climate Risk	Estimated Adaptation Costs ($ million)	Adaptation Finance Justification
	increasingly severe and unpredictable precipitation events; increased snowfall		and act as carbon sinks while also serving as recreation spaces improving urban livability for residents. Adequate maintenance is essential and can be coordinated in partnership with *khoroo* officials and other local community development organizations that may exist or are established for the purpose.
Total		**12.17**	

V. Climate Mitigation Plans Within the Project

Mitigation Activity	Estimated GHG Emissions Reduction (ton of carbon dioxide equivalent/year)[a]	Estimated Mitigation Costs ($ million)	Mitigation Finance Justification
Economic and public services	Dependent upon design details of buildings during detailed engineering design	1.05	These are proposed as "green" buildings and by definition should employ the full range of "green" elements including orientation for maximum winter solar gain and minimal winter wind impact, high insulation, natural ventilation, low-energy lighting, water-saving toilets, rain water harvesting, planted green surroundings, etc.; regular and adequate maintenance of all systems is necessary to maintain the advantages; and roof designs to accommodate projected increased snow loads.
Green space development and site landscaping	131,931	0.07	Maximizing green space and landscaping development to add carbon capture mitigation role to adaptation role in flood control, urban cooling, water resource management.
Total		**1.12**	

[a] Energy savings/year x emission factor = GHG emissions reduction.

In addition, adaptation and mitigation will both be supported by:

(i) **Public awareness, participation, and capacity development.** Ongoing information, education, and communication programs are required at all levels starting with ensuring that high-level decision makers are fully informed and supportive.

(ii) **Non-engineering.** Includes strengthened urban planning and development control; ongoing public information, education, and communication programs including among high-level decision makers to promote political will, strengthened interagency cooperation, and institutional capacity building.