CLIMATE CHANGE ASSESSMENT

I. Basic Project Information

Project Title: Urban Water Supply and Sanitation (Sector) Project
Project Budget: $175 million
Location: 20 municipalities in Nepal
Sector: Water supply, sanitation, drains infrastructure and services
Theme: Environmental Sustainability, Governance, Gender Equity, and Capacity Development
Brief Description: The project will support the Government of Nepal expand access to community managed water supply and sanitation (WSS) in 20 project municipalities by drawing on experiences and lessons from three earlier projects funded by the Asian Development Bank (ADB). The project will finance climate-resilient and inclusive WSS infrastructure in project municipalities and strengthen institutional and community capacity, sustainable service delivery, and project development. **Impact:** quality of life for urban populations, including the poor and marginalized, improved through the provision of sustainable WSS services. **Outcome:** inclusive and sustainable access to WSS service delivery in project municipalities achieved. **Output 1:** WSS infrastructures in project municipalities improved. **Output 2:** Institutional and community capacities strengthened

II. Summary of Climate Risk Screening and Assessment

A. Sensitivity of project components to climate and weather conditions

As the magnitude of climate change impacts in Nepal is predicted to increase due to climate change and rising temperature, it is expected that Nepal will experience more climate impacts associated with increased rainfall variability. River flooding would exacerbate occurrence of landslides, water logging, and erosion issues in subproject areas. Out of 20 selected municipalities, 13 are in the hills area, 2 in the mid-hills (Churiya) region, and 5 are in the plain (Terai) region. Heavy rain as well as the drought may impact on the water sources. Climate stresses can impact potable water and sanitation systems. Water supply systems reliant on surface sources, both in quality and quantity, are sensitive to increases in temperature, spatial variability and decrease in rainfall distribution, and changes in cumulative precipitation, which can manifest as either drought or flood conditions. Due to topography, hydrology, and ecology the impacts on the water sources through landslide, drought, and flooding incidences may vary.

Project components	*Sensitivity to climate and associated impacts*
1. Urban water supply 2. Urban sanitation 3. Urban drainage 4. Septage management	**Temperature increase** may lead to (i) increased evaporation losses at surface sources and storage facilities; (ii) risk of deterioration of water quality and increased treatment requirements; (iii) variation in source and/or quantum availability restricting supply quantity, optimal utilization of infrastructure, and need for identification of new sources; and (iv) reduced efficiency of mechanical and electrical equipment due to higher operating temperature range. **Higher frequency and intensity of extreme rainfalls, storm events and glacial lake outburst floods** may lead to (i) disruption of water supply and sanitation services, damages to infrastructure (intakes, water treatment plants, reservoirs, tanks) and equipment (pumps, electronic system) requiring higher maintenance cost for renewals and/or

	replacements; (ii) more frequent disruptions of services due to flooding or landslides caused by intense rainfall and storm events; and (iii) higher cost of water treatment due to increased turbidity levels. **Decreased annual average rainfall and high spatial variability** may lead to (i) reduced raw water availability and requirement for additional storage to mitigate shortage, (ii) increased energy charges (higher drawdown at source) during combined impact periods of reduced precipitation and lean flow, (iii) unavailable raw water during droughts, and (iv) raw water quality deterioration in reservoirs (reduced dilution) leading to increased treatment requirement costs.
B. Climate Risk Screening	
Risk topic	*Description of the risk*
1. Increased temperature	1. Reduced capacity of infrastructure (pumps, pipes, storage, and treatment facilities) to meet increased demands; decreased water quality increasing likelihood that treatment infrastructure is inadequate; lower waste water quality due to increased algal blooms and pathogens, and lower dissolved oxygen.
2. Increased intensity of precipitation and storm events	2. Increased turbidity loading in reservoirs, due to greater runoff; less groundwater recharge due to faster runoff; inundation and overflow of latrines; clogging of drains during extreme rainfall events may damage structures; drains to cater to more intense rainfall.
3. Prolonged droughts	3. Droughts may affect watersheds; need for additional water sources and associated delivery, storage, and treatment infrastructure; reduced treatment performance due to lower flows.
4. Floods	4. Increased soil erosion and washout of road-supporting culverts during flash floods can lead to failure of sanitation systems and impact community health.
5. Rainfall-triggered landslides	5. Threat of rainfall-triggered landslides in hilly area; inundation, bank cutting, and sediment deposition may impact infrastructure
6. Seismic risks (non-climate)	6. Increased maintenance and construction costs to withstand earthquakes
Climate risk classification: Medium. Nepal is a high-risk country to the impacts of climate change; however, subprojects will not be implemented in sensitive, high-risk locations.	
C. Climate Risk Assessment Climate risks for subprojects vary from low to high for a variety of hazards. The project has considered earthquake threats as non-climatic hazards since several subproject municipalities were severely affected by the 2015 earthquake. Subprojects will consider earthquake threats and be guided by the government standards for such risks. Given the increased frequency and intensity of rainfall and flood events, engineering designs have incorporated mechanisms to inherently respond to climate risk impacts from landslide, erosion, flooding, and water logging. Additional adaptation measures in terms of bioengineering, water channelization, and awareness raising on climate impacts and water efficiency as a major adaptation measure, have been incorporated in the project design.	

III. Climate Risk Management Response within the Project

1. **Subproject site selection.** Climate risk screening was done for each project municipality and subprojects undergo a climate risk and vulnerability assessment to suggest appropriate range of climate change projections, mitigation and adaption measures, and inform detailed project design. Subproject sites will be carefully selected with reference to existing local hazard maps or actual surveys.
2. **Engineering measures.** Key subproject design criteria have been prepared to account for climate impacts. Considerations include (i) groundwater source from deeper aquifers where yields are not affected by changes in precipitation; (ii) pipes to be laid below ground to avoid damage during floods; (iii) additional measures for protection of sources and project related infrastructure due to landslides, erosion, or earthquakes; (iv) no construction in floodplains and landslide prone areas; (v) additional free-board allowance to design parameters, such as channel depth, width and slope, and increased safety easement for key facilities such as production tube wells, pump houses, and water treatment plants; (vi) review of the interaction of reinforcing elements, such as rebar, steel, and iron, for standing water impacts on concrete curing, design life, and depth of reinforcement from concrete edge; (vii) 10% additional capacity in drainage and water storage systems to accommodate additional run-off due to increased rainfall intensity; and (viii) power backup generators to ensure operation.
3. **Bioengineering measures**. To protect water sources and address potential impacts from rainfall induced landslides, bioengineering approach have been put in place. The catchment areas' ecology will be closely monitored to protect water sources for subprojects.
4. **Fecal sludge collection and treatment.** Regular emptying of pits and septic tanks will reduce chances of pit overflow. Fecal sludge treatment in drying beds and percolates should be treated with trickling filters. Treatment of fecal sludge will reduce improper disposal in low-lying areas and water bodies and prevent surface and ground water pollution.
5. **Capacity building.** Staff of the implementing agency, the project management office, project municipalities, and Water Users and Sanitation Committees will receive trainings to incorporate climate change resilience approaches and procedures when undertaking safeguards due diligence. Capacity building on climate change risks, vulnerabilities, mitigation and adaption options will be provided, as necessary during project implementation.
6. **Operation and maintenance.** Regular operation and maintenance activities and equipment inspections will be carried out for all subprojects to help mitigate damage and ensure continuous operations as well as fast recovery after disaster events.

Project outputs have been designed to ensure climate-resilient comprehensive and sustainable water supply and sanitation systems for project beneficiaries. Climate change financing is estimated based on adaptation measures incorporated into project designs.

Adaptation Activity	**Target Climate Risk**	**Estimated Cost** ($ million)	**Cost Justification**
Output 1: Water supply and sanitation infrastructures in project municipalities improved			
Safeguard subproject structures against identified climate risks with engineering measures (including applicable costs consultancy services)	• All identified climate risks	22.4	This includes measures such as (i) deeper aquifers as source where yields are not affected by changes in precipitation; (ii) pipes to be laid below ground to avoid damage during floods; (iii) additional measures for protection of sources and project related infrastructure due to landslides, erosion, or earthquakes; (iv) additional free-board allowance to design parameters, such as channel depth, width and slope, and increased safety easement for key facilities such as production tube wells, pump houses, and water treatment plants; (v) review of the interaction of reinforcing elements, such as rebar, steel, and iron, for standing water impacts on concrete curing, design life, and depth of reinforcement from concrete edge; (vi) 10% additional capacity in drainage and water storage systems to accommodate additional run-off due to increased rainfall intensity; and (vii) power backup generators to ensure operation.
Safeguard subproject structures against landslides and floods with bioengineering measures	• Increased frequency and intensity of floods (both from heavy rains during monsoon and glacial lake outburst floods) • Precipitation-induced landslides • Increased temperature	1.20	Bioengineering measures for plantations and landslide prone areas through drainage channels, construction of ponds and dams.

Adaptation Activity	Target Climate Risk	Estimated Cost ($ million)	Cost Justification
	leading to leading to the risk of potential glacial lake outburst floods		
Source protection and catchment/basin area management through construction of ponds, trenches, and plantation near the water sources and implementation of an ecological maintenance program for the basin and catchment areas	• Increased temperature • Prolonged droughts	1.2	Bioengineering measures for the protection of sources and catchment areas for project related infrastructure in response to landslide and erosion risk.
Channelization of water courses and river protection and construction of coffer dam/check dams using excavated material	• River flooding from heavy rains • Glacial lake outburst floods due to temperature increase	2.7	Construction of stormwater drains
Smart water management to ensure water management and water conservation	• Changes in precipitation • Prolonged droughts	4.2	SCADA to improve monitoring and control and provision of household level meters to implement volumetric tariff-based systems for water conservation by beneficiaries improving system resilience during periods of drought and lowered precipitation
Output 2: Institutional and community capacities strengthened			
Climate-resilient planning and subproject design improved • WASH plans for project municipalities integrate climate resilience principles • Subproject designs for future investments include climate-resilience measures • WUSC business plans and tariff guidelines address climate impacts	• All identified climate risks	1.5	Loan consultants to support municipalities in preparation of WASH plans including public consultations; and incorporate adequate measures in future investment subproject designs. TDF and ISSAU supported by loan consultants provide trainings and workshops to WUSCs.
• Capacity and awareness on climate resilience strengthened for	• All identified climate risks	0.7	Trainings in water supply and sanitation service delivery and smart utility management

Adaptation Activity	Target Climate Risk	Estimated Cost ($ million)	Cost Justification
improved service delivery • WUSCs to provide climate-resilient and sustainable O&M for water supply and sanitation facilities • Smart utility management improves water use efficiency • Awareness of project beneficiaries on water conservation and sustainable hygiene behavior raised			incorporating awareness building on sector specific climate and disaster risks management and adaption measures. Awareness campaign for project beneficiaries

ISSAU = Institutional Support and Service Advisory Unit, O&M = operations and maintenance, SCADA = Supervisory control and data acquisition, TDF = town development fund, WASH = water, sanitation and hygiene, WUSC = water users' and sanitation committee.