A Project Climate Risk Assessment and Management Reporting

I. Basic Project Information

Project Title: Irrigation Management Improvement Project
Project Budget: :$46,000,000
Location: Feni Bangladesh (Figure 1)
Sector: Agriculture, Natural Resources and Rural Development
Theme: Inclusive economic growth
Brief Description *(particularly highlighting aspects of the project that could be affected by weather/climate conditions)***:** The project impact will be sustained high growth in irrigated agriculture. The outcome will be increased productivity and sustainability of three large irrigation schemes. The project has three outputs: (i) performance based irrigation management and agriculture support services are established involving contracting private irrigation management operators (IMO) under performance based management contracts to supervise modernization works, establish sustainable MOM and provide agricultural support services. Efficient management systems will be established to maximize water use efficiencies and establish viable and effective operations and maintenance (O&M) cost recovery mechanisms; (ii) the irrigation system infrastructure is rehabilitated and modernized including the physical rehabilitation and modernization of irrigation infrastructure include technologies that help O&M cost recovery through the pre-paid metering systems; and (iii) the project is efficiently managed with effective institutional development including the establishment of a competent project management to successfully administer and support PPP contracts to manage large scale irrigation schemes.

II. Summary of Climate Risk Screening and Assessment

A. Sensitivity of project component(s) to climate/weather conditions and sea level

Project component:	Sensitivity to climate/weather conditions and sea level:
1. Modernization of irrigation and drainage scheme 2. Repair of flood embankment	1. Temperature increase change in rainfall patterns 2. Increased intensity of rainfall and associated flood discharge 3. Sea level rise

B. Climate Risk Screening

Risk topic:	Description of the risk:
1. Flood	1. Flood embankment heights and drains capacity calculated with current climate statistics may be insufficient with project increase in flood discharge
2. Drought	2. Disturbed rainfall distribution, reduced rainfall and temperature increase may cause unbalance between irrigation water demand and water availability and lead to reduce irrigated area and crop production.
3. Sea Level Rise Increased Storm Surge	3. Downstream sea level rise reduces the slope of the water surface, which may cause higher flood water levels. Flood embankment heights calculated with current climate statistics may be insufficient with project increase in flood discharge.

Climate Risk Classification *:* Medium

C. Climate risk assessment

Assessments:

Climate change assessments were based on: (i) Climate Observations and Projections for Bangladesh by the UK Met Office Hadley Centre 2011; and (ii) the Coastal Embankment Improvement Project Phase I implemented by BWDB and World Bank 2012 Various other studies including the ADB TA7417 India Support to the National Action Plan for Climate Change 2011 were used as supporting reference material as the river catchments are in India.

The Hadley centre study report for Bangladesh assessed that: (i) the A1B emissions scenario projected temperature increases over Bangladesh are in the region of 3 to 3.5°C by 2100. The agreement between models is high over the entire country; and (ii) precipitation is projected to increase in Bangladesh under the A1B emission scenario with increases of 5-10% in the vicinity of the Muhuri Project Area. Agreement across the CMIP3 ensemble is moderate to high.

Studies by the Hadley centre indicate an increase in mean and extreme precipitation over Bangladesh. This confirms conclusions from the IPCC AR4 however large uncertainties remain, particularly with respect to how the large-scale

monsoon system might respond to climate change and changes in precipitation associated with tropical cyclones. Studies carried out by the Institute of Water Modeling (IWM)[1] which included simulation modelling of rainfall intensities. From this the IWM who are responsible for the detailed design of the drainage improvements have recommended to increase the drainage modulus to a 1:25 year flood. The project will excavate 450km of drains (Khal) these will be designed to meet the projected increased levels of rainfall intensity project under climate change.

Studies by the Hadley centre indicate that although there are many uncertainties in predicting water stress but from the few regional assessments available it is suggested that: (i) Bangladesh could be exposed to moderate to high water stress with climate change. However, further research is required to quantify the potential magnitude of any change: (ii) simulations by the Hadley centre using the AVOID programme broadly agree with the global- and projecting an increase in water stress for Bangladesh as a whole with climate change. However, the uncertainty in the projected changes is large. Monsoon variations and increased chance of periods of drought even during the monsoon will be reduced by provision of access to irrigation supply throughout the year.

The PPTA has implemented a detailed water balance model based on 17 years of historic data. No obvious trend in the flows was seen. Flows are affected by upstream abstractions in India, overexploitation of the groundwater and possibly climate change. Modeling of future flows was not attempted due to the poor quality flow data and the difficulties of assessing current and future abstractions from the upstream catchments in India.

A preliminary analysis including some modeling was carried out by the PPTA through the Institute of Water Modeling to assess the required crest height and cross section of the coastal embankment to meet resilience of climate change. This was carried out by the Institute of Water Modeling (IWM) using the same approach as the Bangladesh Coastal Embankment Implementation project Phase 1. The estimate is that to provide adequate allowance for increased sea level (from sea level rise and storm surge) and wave run up would require the raising of the crest of the coastal embankment by 1m in Polder 60 (which is set back from the sea) and about 5 meters for polder 61. It was concluded that these assessments need to be better verified by detailed modeling including the incorporation of new bathymetry data.

Key findings:

Projected changes under A1b scenario (Scenario assessed by Met Hadley Centre for 2100 from the 1960-1990 baseline averaged over 21 CMIP3 models)[2] Sea Level Rise and Storm Surge based on estimates by the CEIP 2013[3]

Temperature (^{o}C)	Precipitation (mm)	Sea Level Rise (masl):	Others: Storm Surge 10%
From: 22.0 To: 25.0 Average Annual	From: 3372 To: 3541	Increase by 0.3-0.5m by 2100 (Hadley study) CEIP assesses 0.5m by 2050	increase in wind speed of every cyclone (CEIP)

1. The projected increase of 5-10% in the precipitation will be generally beneficial and provide increased river flows for the during the post monsoon irrigation period: The Hadley studies however considered that the quality of the data was not considered good enough to quantify the climatic impacts. Changes in temperature and humidity would affect the evapotranspiration which may affect the crop water requirements.

2. Increased runoff will result increase the likelihood of flood flows and the need to improve the drainage. Greater variabilities including increased standard deviation in monsoon rainfall and greater extremes of the rainfall patterns will increase the frequency and extent of drought which will increase the requirements for access to irrigation throughout the year.

The Hadley center reviewed various studies on storm surge it is generally suggested that cyclones in the north Indian Ocean could decrease in frequency with global climate change, the uncertainties in the magnitude of this decrease and the sign of the response of cyclone intensities makes it extremely difficult to determine whether cyclone impacts in the coastal zone, Bangladesh could decrease or increase. This is particularly true given that the most intense; and hence rare cyclones cause the vast majority of damage[4] and could continue to do so in the future.

The Muhuri project is located at the apex of the Bay of Bengal with a large tidal range and is vulnerable to storm surges. The Institute of Water Modeling Dhaka (IWM) based on the same analysis used for the CEIP in the south west of Bangladesh estimated that sea level rise together with the projected 10% increase in wind speed during cyclones will result in significantly increased sea levels during cyclones from storm surge combined with sea level rise. Preliminary

[1] IWM Studies of Drainage in Polders in the South West of Bangladesh
[2] UK Met Office Hadley Centre Climate: Observations, projections and impacts for Bangladesh 2011.
[3] Bangladesh Water Development Board/ World Bank, Coastal Embankment Improvement Project (CEIP) Phase 1 2012.
[4] Mendelsohn, R., Emanuel, K. & Chonabayashi, S. 2011. The Impact of Climate Change on Global Tropical Cyclone Damages.

estimates by the IWM indicate these could be of the order of 1-3 meters which would require a significant raising and strengthening of the coastal embankment.

III. Climate Risk Management Response within the Project

The project will:

1. Increase the drainage design modulus from 1:10 year return period to 1:25year return period as a response the likely increase rainfall intensities.
2. Increase the irrigation efficiency by 39% by through the use of piped distribution and pre-paid meter systems. Together with a 15% diversification to non-rice crops will increase the irrigable area from 11,300ha to 17,000ha.
3. Provide access to irrigation on demand throughout the year for 17,000ha to help meet current and future climate uncertainties. Currently irrigation only available during period January to April.
4. The project will provide agricultural support services to promote the diversification from rice, water saving methods, training and extension to support the establishment of sustainable and climate resilient cropping systems.
5. Repair the coastal embankment to restore it to its original design section as an interim measure prior to the implementation of the 2nd Stage of the Coastal Embankment Improvement Project (CEIP) to be implemented by the Government as a follow on program under the CEIP1 project which is currently working in the western part of Bangladesh.
6. Investigate the potential for integrated surface and groundwater management as a means to increase the water supply as well as reducing risk of shortages from increased risk of drought or flow uncertainties.
7. Support capacity development for application of integrated water resources management to improve inter-sector management of water resources and as a front-line adaptation response.
8. Upgrade irrigation infrastructure including the use of piped water distribution and the excavation of the drains.
9. Contracting of a private sector irrigation management operator to develop improved irrigation management and to develop management strategies to meet impacts of climate change.
10. Capacity building of water users in efficient land and water management practices.

Figure 1: Location Map