REQUEST FOR PROJECT/PROGRAMME FUNDING FROM THE ADAPTATION FUND

The annexed form should be completed and transmitted to the Adaptation Fund Board Secretariat by email or fax.

Please type in the responses using the template provided. The instructions attached to the form provide guidance to filling out the template.

Please note that a project/programme must be fully prepared (i.e., fully appraised for feasibility) when the request is submitted. The final project/programme document resulting from the appraisal process should be attached to this request for funding.

Complete documentation should be sent to:

The Adaptation Fund Board Secretariat
1818 H Street NW
MSN P4-400
Washington, D.C., 20433
U.S.A
Fax: +1 (202) 522-3240/5
Email: afbsec@adaptation-fund.org

ADAPTATION FUND

PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT/PROGRAMME INFORMATION

Project/Programme Category:	Regular project
Country/ies:	Bangladesh
Title of Project/Programme:	Adaptation Initiative for Climate Vulnerable Offshore Small Islands and Riverine Charland in Bangladesh
Type of Implementing Entity:	MIE
Implementing Entity:	United Nations Development Programme
Executing Entity/ies:	Department of Environment, Ministry of Environment, Forest and Climate Change.
Amount of Financing Requested:	US$ 9,995,369

Project summary

Bangladesh has a low-lying topography extremely exposed to sea level rise (SLR), cyclones, tidal surges, salinity intrusion, erratic rainfall, drought and floods, causing it to be one of the world's most vulnerable countries to climate change. The vulnerable communities who live on chars — small alluvial islands in rivers and the Bay of Bengal are particularly at risk from climate change. These communities have already experienced a number of climate change impacts including frequent tidal surges, increasingly intense cyclones and salt water intrusion into fresh water and soil. Furthermore, climate change is projected to have an adverse impact on agriculture and other local livelihoods; fragile houses, access to drinking water and rural infrastructure, which includes existing cyclone protection embankments. The impacts of climate change also disproportionately affect the poor and are especially severe for women and children, who are forced to spend a greater portion of their time on livelihood and domestic activities. Current projections indicate, with a 2ºC increase in global temperatures,50-year floods in the country's three main river basins will become 40% more likely by 2025. The impacts of climate change on these islands are exacerbated by several baseline factors, including geographic remoteness, topographic position near sea-level, limited public and private infrastructure to withstand climate impacts, poverty of local communities and livelihood practices that are dependent on the availability of fresh water. On coastal chars (small offshore islands), the houses and livelihoods of communities are damaged by the increasingly frequent and intense cyclones, tidal floods and saline intrusion from climate change, with inadequate protection from the fragile embankment system. On the inland riverine islands (riverine *charland*), communities are experiencing increasingly erratic rainfall as a result of climate change, leading to changes in both floods and droughts that their current houses and livelihood practices are unable to withstand.

Resources sought from the Adaptation Fund (AF) will be invested in four components. Firstly, it will assist households to enhance the resilience of their houses and livelihoods to climate change-induced flooding, cyclones, saline intrusion and droughts. Secondly, it will improve

community-level infrastructure, including embankments with modern climate-resilient technology and effective local management practices. Thirdly, it will assist the Bangladesh Cyclone Preparedness Programme (CPP)[1] under Disaster Management Department, to enhance its activities in the remote coastal char targeted by the project, in order to provide timely early warnings and effective emergency response. This will be done by expanding the programme's coverage in the area, modernising its equipment, and making it fully gender-sensitive. Finally, the technology, approaches and knowledge generated by the project will be used to build the capacity of the local and national government; and communities to make climate-resilient investments and policies.

The US$ 10 million sought from the Adaptation Fund (AF) will address the knowledge technical, financial and institutional barriers to climate-resilient housing, infrastructure and livelihoods. The project interventions will benefit an estimated ~341,000 people (~31,000 direct beneficiaries[2] and 310,000 indirect beneficiaries) living on chars in the districts of Rangpur and Bhola. Spanning over five years, the project will be implemented by the Ministry of Environment, Forest and Climate Change following UNDP's National Implementation Modality.

The project will contribute towards the achievement of the Government of Bangladesh's national priorities as outlined in the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) and Nationally Determined Contribution (NDC). Six of the ten near-term areas of intervention identified by the first NDC will be addressed by the project, namely: i) food security, livelihood and health protection, including water security; ii) comprehensive disaster management; iii) coastal zone management, including saline intrusion control; iv) flood control and erosion protection; v) climate-resilient infrastructure; and vi) increased rural electrification. Furthermore, the project is directly aligned with seven of the fourteen broad adaptation actions prioritised by the first NDC, namely: i) improved early warning systems; ii) disaster preparedness and shelters; iii) protection against tropical cyclones and storm surges; iv) provision of climate-resilient infrastructure and communication; v) provision of climate-resilient housing; vi) stress-tolerant crop variety improvement and cultivation; and vii) capacity building at individual and institutional level to plan and implement adaptation programmes and projects.

This project has been developed through extensive stakeholder consultations, including with communities in the selected islands, civil society and with the GoB (see Annex C). The design of the project has been reviewed as per the Government of Bangladesh's internal process, led by the Adaptation Fund Designated Authority and involving relevant government ministries.

Project / Programme Background and Context:

Provide brief information on the problem the proposed project/programme is aiming to solve. Outline the economic social, development and environmental context in which the project would operate.

Geographic context

Bangladesh is a small and densely populated country with an extensive coastline of ~720 km to the south. Its land area is ~147,570km^2, consisting largely of flat, low-lying deltaic terrain. There are discrete elevated regions in the northwest and southeast, but approximately two-thirds of the country is less than 6m above mean sea level. The deltaic terrain of Bangladesh has been formed by the deposition of alluvial discharges from the Ganges (also known locally

[1]The Bangladesh Cyclone Preparedness Programme is the world's largest volunteer-based early warning dissemination and emergency response organisation.

[2]31,000 is 100% of the population at the project's target sites.

as the Padma), Brahmaputra (also known as the Jamuna), and Meghna Rivers (GBM)[3]; map in Figure 1 below. This depositional process has created an extensive network of islands and bars. These islands and bars are referred to locally as small coastal islands (coastal chars) or riverine char islands (riverine chars), depending on their proximity to the Indian Ocean[4][5].

Bangladesh is rated as one of the most susceptible nations to the impacts of both slow- and rapid-onset natural disasters because of its geographical location, major rivers and low-lying topography. These include climate-related disasters such as cyclones, storm surges, floods, extreme heat and droughts,as well as other disasters such as earthquakes. Climate-related disasters have accounted for ~95% of all major disasters in Bangladesh since 1990[6], and are becoming both more frequent and intense. This is because of increased ocean temperatures as well as a more variable and intense seasonal precipitation.

Socio-economic context

With a population of ~160 million, the small country of Bangladesh is one of the most densely populated nations in the world. The majority of this population is rural (~64%), but there is a strong urbanising trend and the rate of change from rural to urban is approximately 3% annually. Urbanisation has supported the rapid development of Bangladesh's economy, which has grown at ~6% per year since 2008. In line with this rapid economic growth, Bangladesh has made concurrent improvements in its Human Development Index score. HDI. These improvements are evident in the country's reduction in poverty from 48% of the population in 2000 to only24% in 2016[7]. The development of industry as a result of urbanisation has also shifted the country away from its past economic reliance on agriculture. Major sectors currently contributing to GDP include services (~56%), industry (~29%) and agriculture (~14%). Despite no longer being the dominant sector in terms of GDP, agriculture in Bangladesh still provides employment to over 43% of the country's workforce and 60% of all employed women. Furthermore, rural communities, who are disproportionately affected by poverty, still rely on agriculture as a primary livelihood[8].

Bangladesh has also made significant strides in reducing inequality[9] and promoting gender equality, however, gender disparities continue to exist as a result of: i) traditional gender norms; ii) patrilineal and patriarchal kinship systems; iii) adherence to personal (religious) law; and iv) weak enforcement of laws protecting women[10]. One domain where women have substantial representation in Bangladesh is in politics[11]. Outside of politics, however, women are generally afforded lower access to healthcare, lower wages and fewer employment opportunities than men[12].

[3] Together these three rivers are referred to as the GBM system

[4]Sarker, M. H., Huque, I., Alam, M., &Koudstaal, R. (2003). Rivers, chars and char dwellers of Bangladesh. International Journal of River Basin Management, 1(1), 61-80.

[5] (EGIS, 2000)

[6]EM-DAT: The OFDA/CRED - International Disaster Database www.emdat.be Universitécatholique de Louvain Brussels - Belgium.

[7] Asian Development Bank, 2018. Available at: https://www.adb.org/countries/bangladesh/poverty

[8] IFAD, 2018

[9] Inequality in Bangladesh, as defined by the Gini coefficient, has remained constant at ~32 since 2000.

[10]UNICEF. (2011). A perspective on gender equality in Bangladesh. *From young girl to adolescent: What is lost in transition*.

[11] The last two prime ministers in Bangladesh have been women, and one sixth of all parliamentary seats are reserved for women.

[12]UNICEF. (2011). A perspective on gender equality in Bangladesh. *From young girl to adolescent: What is lost in transition*.

Figure 1. Map of Bangladesh, with the capitals of project target areas circled[13].

Climate profile

Bangladesh has a subtropical monsoon climate, with high levels of humidity and moderately warm temperatures ranging between 18°C and 28°C. The country experiences wide seasonal variations in precipitation, which can exceed 2000mm annually in most parts of the country. There are four meteorologically recognisable seasons, namely the: i) hot and humid pre-monsoon between March and May; ii) rainy and humid monsoon between June and September; iii) hot and dry post-monsoon between October and November; and iv) cool and dry winter between December and February. The monsoon season is the dominant climatic feature in Bangladesh and accounts for ~75% of the annual precipitation. Thereis also significant variability in the onset, amount and duration of precipitation during the monsoon season. This variability has profound impacts on water resources, electricity generation, agriculture, economics, ecosystems, and livelihoods in Bangladesh.

[13]United Nations Map of Bangladesh. Source: https://en.wikipedia.org/wiki/Portal:Bangladesh/Map

Current climate change vulnerability and impacts

Bangladesh is among the countries most vulnerable to future climate change[14]. This extreme vulnerability is a result of: i) the country's exposure to current and predicted climate change; ii) the economic impacts of climate-related natural disasters; iii) local dependency on agricultural livelihoods; and iv) low adaptive capacity within the government and population[15]. These aspects of the country's vulnerability are discussed in more detail below. For current climate change impacts, Bangladesh has been ranked as the fifth most affected country in the world when incorporating the impacts of slow and rapid onset climate-related natural disasters[16]. These slow and rapid onset disasters[17] are becoming both more frequent and more intense as a result of increased oceanic temperatures and greater variability and intensity of seasonal precipitation.

On average, climate-related natural disasters affect 5 million people annually in Bangladesh through loss of life, loss of livelihood, displacement and damage to property[18]. Between 2006 and 2016 there were over 54 disaster-level events in the country (Figure 3). Combined, these events claimed more than 7,000 lives and caused more than US$29 billion in damages[19]. The most destructive single event during this period was Cyclone Sidr in 2007, which claimed an estimated 3,500 lives, negatively impacted more than 2.5 million households and caused damage to property and assets in excess of US$ 1.7 billion[20].Historically, the deadliest tropical cyclone disaster ever recorded occurred in Bangladesh – the Bhola cyclone of 1970. At least 500,000 people lost their lives in this storm, primarily as a result of the storm surge that flooded much of the low-lying islands of the Ganges Delta[21].

The impacts of increasingly severe climate-related disasters are already affecting the livelihoods and health of the population of Bangladesh. For example, the drought in 2014 in northern Bangladesh and record flooding in 2017[22]both resulted in decreased food production across the country[23]. These events significantly impacted the livelihoods of rural communities who depend on agriculture by increasing: i) costs of staple foods such as rice and wheat; ii) strain on the government grain surplus; and iii) migration out of affected areas[24] as households that lost their land could no service their existing debts.

Women and children are disproportionately affected by climate-related disasters[25]. For example, during the 1991 cyclone[26] in Bangladesh, 90% of the 140,000 fatalities were women,

[14]Maplecroft, V. (2013). Climate Change Vulnerability Index 2014. Climate Change and Environmental Risk Atlas.
[15] Ibid.
[16] (IFRC, 2016.).
[17] E.g. floods, river bank erosion, erratic precipitation, cyclones, heat waves, waterlogging, drought and salinity intrusion
[18]Jahan, S., *et al.* (2015). Human development report 2015: Work for human development. UNDP: New York, USA.
[19] EM-DAT. 2016. Country Profile. EM-DAT: The International Disaster Database. Available at:http://www.emdat.be/country_profile/index.html
[20]Dastagir, M. R. (2015). Modeling recent climate change induced extreme events in Bangladesh: a review. Weather ClimExtrem 7: 49–60.
[21] Ganges-Brahmaputra delta cyclone. Available at: https://www.britannica.com/event/Ganges-Brahmaputra-delta-cyclone
[22]Reliefweb. 2014. Drought, food insecurity and radicalism in Northern Bangladesh. Available at: https://reliefweb.int/report/bangladesh/drought-food-insecurity-and-radicalism-northern-bangladesh
[23]Reliefweb. 2017. Bangladesh: Flood situation. Available at: https://reliefweb.int/report/bangladesh/bangladesh-flood-situation-august-22-2017
[24] Displacement is the single greatest impact of climate change in Bangladesh and will affect 1 out of every 7 people (~15% of the population), according to Comprehensive Disaster Management Programme's 2012 mid-term review.
[25]Neumayer, E., &Plümper, T. 2007. The gendered nature of natural disasters: The impact of catastrophic events on the gender gap in life expectancy, 1981–2002. *Annals of the Association of American Geographers*, *97*(3), 551-566.
[26] Until 2004, tropical cyclones were not named in the north Indian Ocean.IMD designation: BOB 01.

and during Cyclone Sidr in 2007,women still accounted for more than 80% of all fatalities[27]. The effects of food shortages and disruptions in food production brought about by these events are also most keenly felt by young children and rural women. This is because women are the primary caregivers in Bangladesh and a significant proportion of Bangladeshi women rely exclusively on agriculture for their livelihoods[28]. Overall, the increased vulnerability of women to natural disasters in Bangladesh is attributed to multiple factors including: i)family responsibilities – such as caring for children and the elderly; ii) less inclusion in decision-making practices; iii) lower levels of education and iv) a prevailing fear of harassment in storm shelters, which leads many women to avoid seeking shelter during disaster events[29,30]. Furthermore, women who are displaced or lose family members during natural disasters experience a much greater risk of abuse, harassment, trafficking or indentureship as they seek to recover or re-establish themselves in post-disaster settings[31].

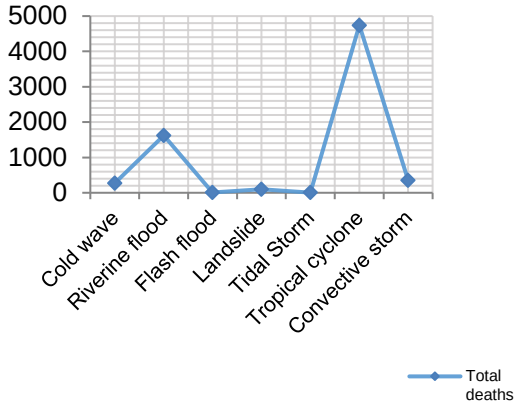


Figure 2. Total deaths due to climate-related natural disasters in Bangladesh between 2006 and 2016.

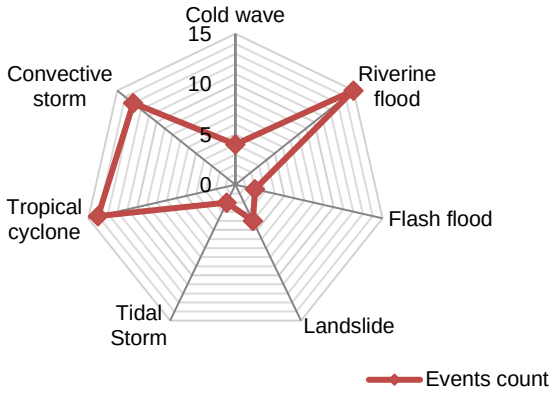


Figure 3. Frequency of climate-related natural disasters in Bangladesh from 2006 to 2016.

Climate change projections

South Asia will experience significant climate change in the next century under all emissions scenarios[32]. The expected climate change for the region is outlined in Table 1 below. In Bangladesh, increasing trends in precipitation and temperature are projected. The occurrence and severity of extreme precipitation events and extreme temperatures arealso predicted to increase[33].

[27]Ikeda, K. 1995. Gender differences in human loss and vulnerability in natural disasters: A case study from Bangladesh. *Bulletin (Centre for Women's Development Studies)*, *2*(2), 171-193.
[28] agriculture accounts for over 60% of female employment in Bangladesh
[29] Bureau for Crisis Prevention and Recovery. 2010. Gender and Disasters. United Nations Development Programme
[30]Neumayer, E., &Plümper, T. 2007. The gendered nature of natural disasters: The impact of catastrophic events on the gender gap in life expectancy, 1981–2002. *Annals of the Association of American Geographers*, *97*(3), 551-566.
[31]Fisher, S. (2010). Violence against women and natural disasters: Findings from post-tsunami Sri Lanka. *Violence Against Women*, *16*(8), 902-918.
[32] Field, C. B., *et al*. (2014). Summary for policymakers. In Climate change 2014: impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 1-32). Cambridge University Press
[33]Dastagir, M. R. (2015). Modeling recent climate change induced extreme events in Bangladesh: a review. Weather ClimExtrem 7: 49–60.

Table 1. Future Climate Trends for South Asia[34]

Precipitation	Temperature	Sea Level Rise
Increased rainfall under high emissions scenario by 2050	Increase by >2°C by 2050 under high emission scenario	26–55cmglobally under low-emissions scenario by 2080–2100
Increased rainfall at high latitudes under low emissions scenario by 2050, but no significant changes at low latitudes	Increase by >3°C by 2100 under high emissions scenario	45–82cmglobally under high-emissions scenario by 2080–2100
Increased extreme rainfall events associated with monsoons	Increase by >2°C by 2100 under low emissions scenario	
Increased extreme rainfall associated with cyclones making landfall	Increased frequency of hot days	

Future climate change impacts and vulnerability

Future climate change scenarios project that Bangladesh will be exposed to a wide range of impacts by 2050, including increased: i) sea level rise and shoreline/soil salinity; ii) variability of seasonal precipitation; and iii) frequency and severity of cyclones that make landfall.

Floods, land loss, salinity and droughts

Flooding within the Bangladesh delta is predicted to increase in frequency because of climate change[35]. Modelling of precipitation patterns and peak flow periods in the Ganges, Brahmaputra and Meghna rivers indicates that, with a 2°Cincrease in global temperatures, the current 20-year floods will likely occur at intervals of 13, 15 and 5.5 years respectively[36,37]. Similarly, the extreme 50-year floods are also likely to increase in frequency, with the recurrence interval for these floods decreasing to 30 years by 2025 and to 15 years by 2050[38].

[34] IPCC, 2014. Fifth assessment report, South Asia summary. Available at: https://cdkn.org/wp-content/uploads/2014/04/CDKN-IPCC-Whats-in-it-for-South-Asia-AR5.pdf
[35] Mirza, M. M. Q., *et al*. (2001). Are floods getting worse in the Ganges, Brahmaputra and Meghna basins? Global Environmental Change Part B: Environmental Hazards, 3(2), 37-48.
[36]The range of flooded area is predicted to be between 50,000 and 57,000 km^2 and result in inundation of 34% – 38.5% of the total area of Bangladesh, as classified by Mirza (2001)
[37] For the A2 scenario (temperature increase of 6ºC), the return period of the same frequency flood event will decrease ~3.4 times, ~2.3 times and ~8.5timesfor the three rivers respectively.
[38] Mirza, M. M. Q., *et al*. (2001). Are floods getting worse in the Ganges, Brahmaputra and Meghna basins? Global Environmental Change Part B: Environmental Hazards, 3(2), 37-48.

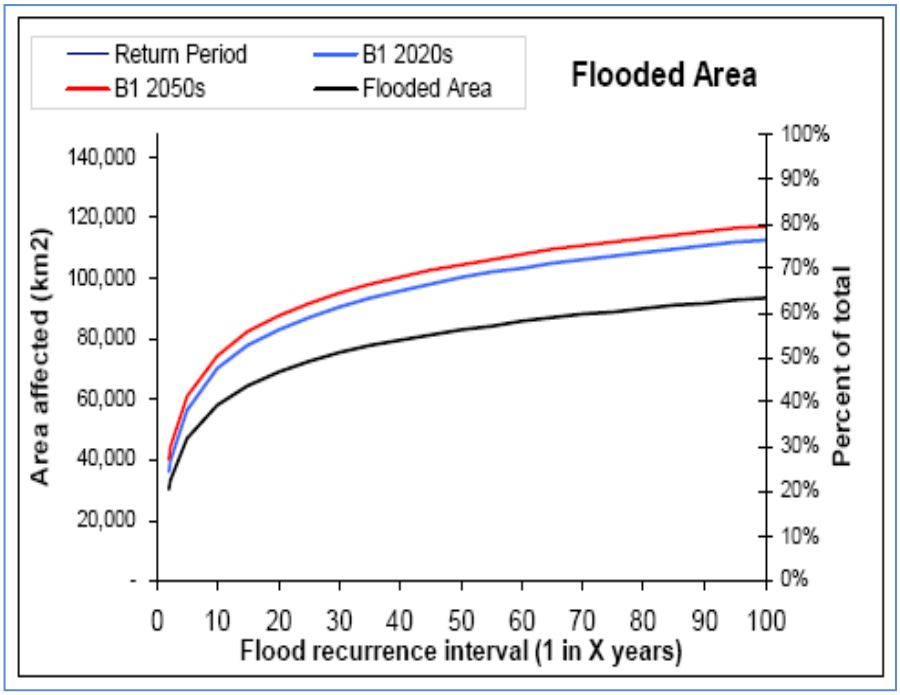


Figure 4. Increase in area and percentage of Bangladesh affected by floods. Black line = current situation, blue line = 2020s and red line = 2050s.

The frequency of droughts in the southwest and northwest regions of Bangladesh is predicted to increase under climate change. In particular the western parts of the country will be at greater risk of droughts during the pre-Kharif and Kharif seasons (July – October)[39]. This is expected to result in a decline in rice production by ~27% and wheat production by ~39%[40] under a moderate climate change scenario. Under a severe climate change scenario, the area severely affected by drought in the Rabi season (October – March)[41] is predicted to increase from 4,000 km^2 to 12,000 km^2, or approximately 15% of Bangladesh's total arable land[42].

Projections indicate that drainage congestion in the southern region of Bangladesh will be impacted by rising sea levels, which will result in increased shoreline and soil salinity. Observed sea level rise (SLR) over the last 30 years in Bangladesh has ranged from 6 to 21 mm/year[43]; SLR is expected to accelerate in accordance with global projections (Table 1). This projected SLR will result in approximately 4,700 km^{2}ofBangladesh's coastline being lost through inundation by the year 2080 under a severe climate change scenario[44,45], disproportionately affecting offshore islands and areas without polders. Furthermore, the predicted increase in precipitation combined with SLR will reduce the land area of Bangladesh by a further ~55,000 km^2 during the monsoon period.

[39]Dastagir, M. R. (2015). Modeling recent climate change induced extreme events in Bangladesh: a review. Weather ClimExtrem 7: 49–60.
[40]Karim, Z., Hussain, S. G., & Ahmed, A. U. (1999). Climate change vulnerability of crop agriculture. In Vulnerability and adaptation to climate change for Bangladesh (pp. 39-54). Springer Netherlands.
[41]The Rabi season is the normal 'dry season' in Bangladesh.
[42]Huq, S. U., Ahmed, A. U., &Koudstaal, R. (1996). Vulnerability of Bangladesh to climate change and sea level rise. In Climate change and world food security (pp. 347-379). Springer Berlin Heidelberg.
[43] Assessment of Sea Level Rise on the Bangladesh Coast through Trend Analysis published by the Government of Bangladesh
[44] A2 scenario - sea level rise of 62 cm.
[45]WARPO, 2005. Living in the Coast, Series 4: Urbanization, available at:http://www.warpo.gov.bd/rep/liv/living4.pdf

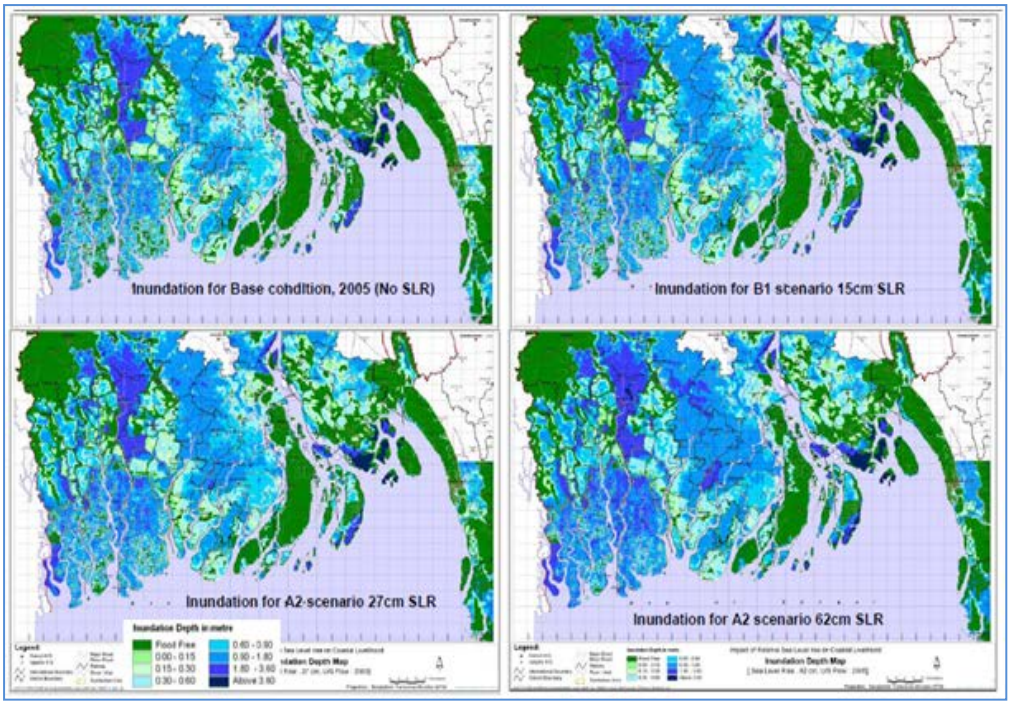


Figure 5. Inundation of the coastal region of Bangladesh for sea level rise of 15cm (B1 scenario), 27cm (A1 scenario) and 62cm (A2 scenario) during the monsoon season.

Shoreline and soil salinity in the southwest region are predicted to increase in inland areas of the delta as a result of climate change, with the most marked change in salinity associated with the dry season. The change in shoreline salinity will cause significant variations in the freshwater and brackish water zones within the delta, with negative impacts on agriculture, biodiversity and the provision of drinking water[46]. Models accounting for salinity threshold values in relation to agriculture, drinking water and biodiversity predict increases in salinity in both the dry and monsoon seasons. During the dry season, salinity will increase by 6% for the A1 scenario and 9% for the A2 scenario. In the monsoon season, salinity will increase by 2% under the A1 scenario and by 6% under the A2 scenario. Saline intrusion is also predicted to extend far into the country's interior under both B1 and A2 scenarios (Figure 6).

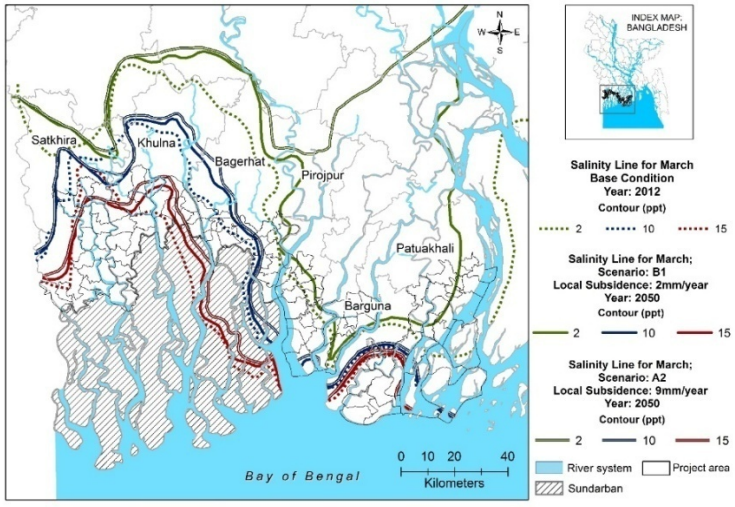


Figure 6: Projected river salinity in 2050 under two different climate change scenarios (A2 and B1)[47]

[46]Kroeker, K. J., *et al.* (2013). Impacts of ocean acidification on marine organisms: quantifying sensitivities and interaction with warming. Global change biology, 19(6), 1884-1896.

[47] UNDP, 2017. GCF Funding Proposal: Enhancing adaptive capacities of coastal communities, especially women, to cope with climate change induced salinity.

Cyclones and storm surges

Between 1961 and 2013, a total of 61 cyclones struck Bangladesh. The south-western zone was affected by 28% of these cyclones[48]. Storm surge flooding caused by cyclones is penetrating deeper inland after hitting the coastal islands and causing more extensive damage than previously. Historically, cyclones have had associated storm surges ranging from 1.5 to 10m in height[49]. However, under a climate change scenario, projected increases in sea surface temperatures are expected to increase the intensity of tropical cyclones, which will result in greater wind speeds and higher storm surges. The overall frequency of tropical cyclones in Bangladesh is not likely to increase as a result of climate change, but the number of intense cyclones is expected to increase[50]. Dynamic and regional climate models[51,52] project increased intensity of tropical storms by 2100 for the North Indian Ocean and increased frequency of the highest storm surges across the Bay of Bengal. Combined with SLR, Bangladesh is expected to face increasing tidal surge and inundation of coastal areas. By 2050, an additional 15% of the coastal area of Bangladesh is projected to be inundated by storm surges during cyclones. Storm surges from a 10-year return period cyclone (such as Sidr) could inundate an area 80% greater than what would be flooded presently. This would expose 9.7 million people to severe inundation (>3m), compared with 3.5 million in the no-climate-change scenario[53].

Site-specific vulnerabilities

The national climate change vulnerabilities described in the preceding sub-sections are more pronounced in both the coastal and riverine chars than on the mainland[54]. This increased vulnerability is partly as a result of: i) limited capacity within local government; ii) poor infrastructure; iii) the specific geographic context[55]; iv) environmental degradation; and v) socio-economic development deficits[56,57].

A high level of exposure to natural disasters combined with limited access to the mainland contributes to char inhabitants lacking access to the majority of basic services. Although they have productive farmlands, char populations are often unable to access mainland markets[58],have poor access to basic water and sanitation, limited transportation services and

[48] Quadir, D.A. and Iqbal, M.A., (2008. Tropical cyclones: impact on coastal livelihoods: investigation of the coastal inhabitants of Bangladesh. IUCN Bangladesh Country Office; Joint Typhoon Warning Centre) and JTWC Best Track tropical cyclone data.

[49]Brammer, H., 2014. Bangladesh's dynamic coastal regions and sea-level rise. Climate Risk Management, 1, pp.51-62.

[50] This prediction is supported by the latest models of cyclones in the Bay of Bengal: Gupta S. et al.., Jain I., Johari P., Lal M. 2019 Impact of Climate Change on Tropical Cyclones Frequency and Intensity on Indian Coasts. In: Rao P. et al..., Rao K., Kubo S. (eds) Proceedings of International Conference on Remote Sensing for Disaster Management. Springer Series in Geomechanics and Geoengineering. Springer, Cham

[51]Unnikrishnan, A.S., Kumar, M.R. and Sindhu, B., 2011. Tropical cyclones in the Bay of Bengal and extreme sea-level projections along the east coast of India in a future climate scenario. Current Science, pp.327-331.

[52] Emanuel, K., 2005. Increasing destructiveness of tropical cyclones over the past 30 years. Nature, 436(7051), p.686.Unnikrishnan et al. 2006, Emmanuel (2005)

[53] World Bank 2010, Vulnerability of Bangladesh to Cyclones in a Changing Climate: Potential Damages and Adaptation Cost. Policy research working paper 5280, The World Bank, Washington, D.C

[54]General Economics Division (GED) of the Bangladesh Planning Commission (BPC), 2017. Available at: http://www.deltacoalition.net/wp-content/uploads/2016/04/BDP-Brochure-Final-september-2015.pdf.

[55] These include the dynamic formational processes normal to the GBM delta as well as extreme remoteness.

[56]EGIS – (Environmental and Geographical Information System), (2000). Environmental baseline of Gorai river restoration project, EGIS-II. Bangladesh Water Development Board, Ministry of Water Resources, Government of Bangladesh. Delft, the Netherlands 150 pp.

[57] Mia, A. H., & Islam, M. R. (2005). Coastal land uses and indicative land zones. Program Development Office for Integrated Coastal Zone Management Plan. Dhaka.

[58]and are therefore unable to secure competitive prices for their agricultural produce

low standards of living. There are few alternative livelihood opportunities and limited infrastructure has resulted in both education and skills deficits. This has brought about economic stagnation and a disproportionate dependence on climate-sensitive livelihoods such as agriculture. Char communities are, therefore, increasingly restricted in their ability to adapt to the adverse effects of climate change, including to both climate induced slow and rapid onset disaster events.

Riverine chars

Most inland riverine chars (islands)are exposed to severe levels of erosion and experience flooding at least once a year[59]. This inherent geo-morphological vulnerability and exposure to climate impacts, combined with very limited livelihood opportunities[60],results in char communities being extremely vulnerable to climate change. The small size and geomorphological instability of the riverine chars further affects local adaptive capacity as ecosystem services are more easily disrupted and slower to recover after disruptions than in mainland areas.

Climate change is already impacting on riverine char communities in Bangladesh and these impacts are projected to increase in severity in the future. The main climate change factors impacting people on riverine chars are the increasing frequency and intensity of floods and droughts. Increasing temperatures combined with more erratic rainfall are increasing periodic water stress on riverine chars. In addition, the increasing frequency of floods will result in greater damage to assets and infrastructure and will reduce the interval period in which communities can recover from and prepare for subsequent disasters. The impacts of climate-induced disasters on riverine chars are exacerbated by the fact that, compared to coastal regions, riverine chars have been relatively neglected in post-disaster periods.The majority of government resources and aidhas been prioritised for rehabilitating coastal infrastructure and reinforcing coastal buffer zones, as opposed to supporting recovery efforts within the inland river areas where many riverine chars are located.

Coastal chars

Coastal chars (small offshore islands) are well known in Bangladesh for epitomising vulnerability to climate change, including rising sea levels, an increase in the number and intensity of cyclones, as well as ocean warming, acidification and saline intrusion[61]. The extreme vulnerability of the coastal chars is because of a combination of social and geographical features.

When compared with inland regions at higher elevations, coastal chars are more sensitive to climate-related disasters. There are fewer natural buffers in coastal areas to reduce the climate change impacts of intensifying cyclones, storm surge, elevated water levels and soil salinity[62]. Coastal chars also face development constraints as a result of their small size and geographical remoteness. They have low levels of institutional development, which has negatively impacted on the provisioning of educational and social support systems. Economic development has also been limited by these factors, and there are few economies of scale, which affects both economic competitiveness and household income levels. The adaptive

[59] In this respect they differ considerably from permanent charland which are not subject to much erosion.
[60] Which include strong dependency on subsistence activities that are influenced greatly by local environmental conditions, poor access to basic water and sanitation and transportation services and low standard of living.
[61]Gattuso, J. P., *et al.*(2015). Contrasting futures for ocean and society from different anthropogenic CO2 emissions scenarios. Science, 349(6243).
[62] Although the function of mangroves as buffers against storm surges and cyclones is generally well-known in Bangladesh, mangrove forests on chars are often removed as populations expand, require wood and seek to increase their access to arable land.

capacity of coastal char communities is, therefore, significantly lower when compared with mainland populations that are in a similar socio-economic bracket or rely on similar livelihoods.

The vulnerability of the coastal and riverine chars of Bangladesh has been documented through initiatives like the Integrated Coastal Zone Management Plan (ICZMP) and the Char Development Settlement Project (CDSP) (these initiatives are described in Part II Section E). Many of the chars have, however, been neglected with regards to an adaptation needs assessment. The adaptive capacity of the char inhabitants and their ability to anticipate, absorb and develop adequate response strategies to the impacts of climate change has, similarly, not been evaluated.

Site selection criteria and process

A riverine char and a coastal char were selected as the target areas for the proposed project through a process involving remote sensing analysis using GIS, combined with vulnerability and hazard indexing. The first stage assessment of chars considered the following criteria: i) size; ii) connectivity to administrative centres; iii) existence of polders or embankments; iv) detachedness from the mainland; v) degree of vegetation coverage; vi) number of settlements and; vii) degree of agricultural development[63].This assessment was used to confirm that sites chosen for the second-stage assessment had both the greatest climate risk and supported populations with a low adaptive capacity.

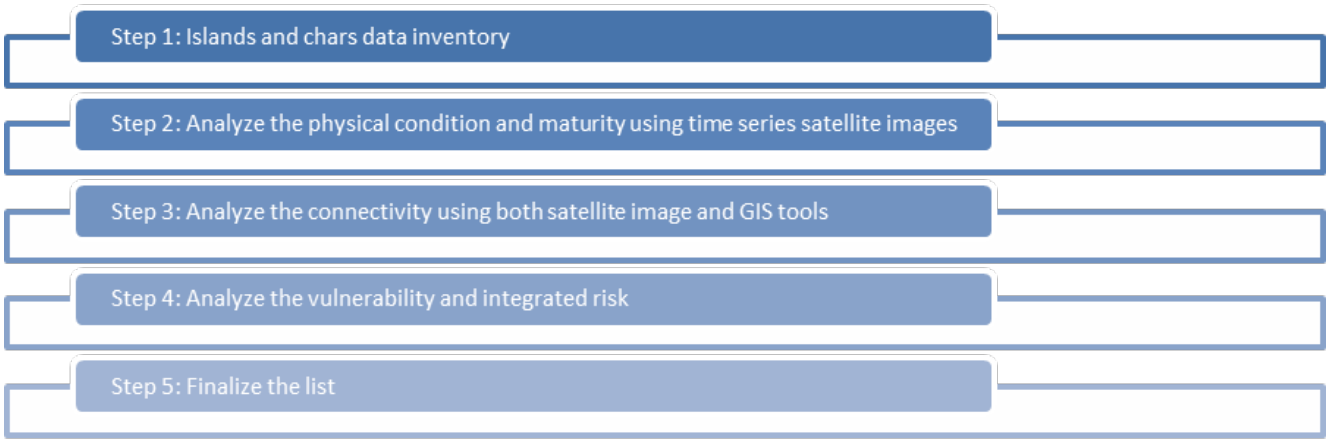


Figure 7. Site selection process

The multi-criteria GIS analysis prioritised chars of a medium size. To be eligible for selection, chars were also required to be: i) relatively remote from administrative centres; ii) detached from the mainland and have limited accessibility; and iii) populated by communities practicing agriculture-based livelihoods.

The complete list of chars that met these criteria[64]was then assessed against a risk database, which combined broad-level socio-economic vulnerability, climate change vulnerability and hazardexposure data. This multi-criteria risk assessment identified the Mujibnagar Union on Char Fasson as having the highest integrated risk index of any of the chars that met the inclusion criteria. Selecting a riverine char required extra consideration as the risk indices returned similar results based on the inclusion criteria. Char Lakshmitari was ultimately selected as it met all the necessary criteria, had a high vulnerability index, and was determined to be representative of the general risk index displayed by all riverine chars.

[63] Not all of these categories resulted in exclusion, but all were weighted and assessed to determine where interventions could achieve substantial results.
[64]A complete list of eligible chars is provided inAnnex F

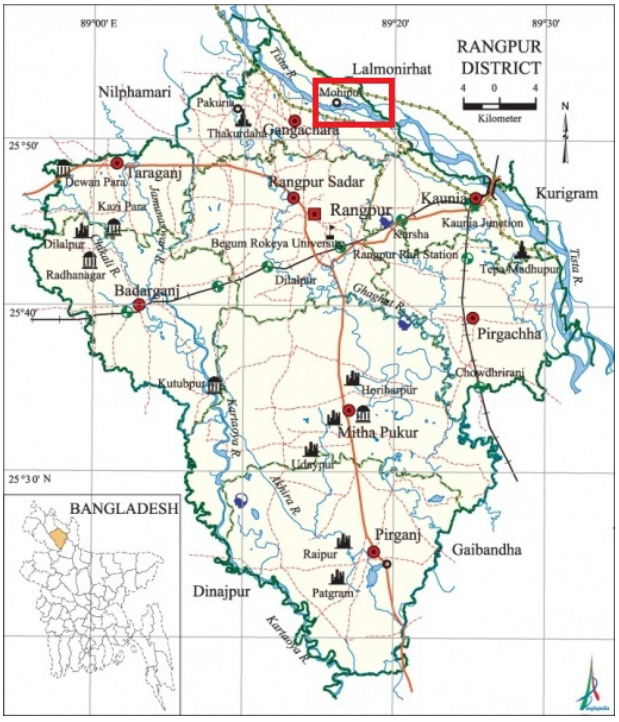
Field assessments for both of the target sites were then carried out. These assessments included broad-level: i) needs assessments; ii) hazard mapping; and iii) climate change modelling. The results of these assessments were then analysed, and a suite of appropriate intervention options was developed to effectively improve the adaptive capacity of the communities in the target sites. The assessment methodology and selection criteria are available in full in AnnexH and AnnexF, respectively.

Project Target Areas

Lakshmitari Union

Background context

The Lakshmitari Union[65] is located in the northwest of Bangladesh. It is an inhabited char in the Teesta River basin and is one of the most disaster-prone unions of Gangachara Upazila[66,67]. The union is situated on broadly flat terrain and is intersected by the rain- and snowmelt-fed Teesta River. Local temperatures in Lakshmitari range between 11°C and 32°C[68] and average annual precipitation in the region amounts to ~2,900mm, 80% of which occurs during the monsoon season. The union covers an area of ~2,700 ha and is governed under the regional administration of the Rangpur district, which is the most poverty afflicted district in Bangladesh. Lakshmitari's total population is ~21,000, which comprises 2,128 households distributed over eight Mauzas[69] and five villages, with a population density of 785 people per km^2. The literacy rate is ~47% and the majority religion is Islam[70].



[65] A union is the smallest public administrative structure in Bangladesh and is governed under a Union Parishad, or council, comprised of 12 members (3 reserved for women) and led by a publicly elected Chairman.
[66]An upazila is a sub-district in the administrative structure of Bangladesh.
[67] According to the multi-hazard/risk modelling compiled by national consultants at C3ER
[68] Based on data from the Rangpur meteorological station
[69] These are Buridangi, Char Isorkul, Char Ichli, JoyramOjha, KismatDukhia, Mahipur, MandrainPurbapara and Sankardaha.
[70] Bangladesh Bureau of Statistics. 2011.

Figure 8. Map of Rangpur district, Bangladesh (with location of Lakshmitari Union indicated)[71]

In Lakshmitari, there has been limited development of both publicly and privately funded infrastructure for: i) water supply; ii) sanitation; iii) health; and iv) transport. Approximately95% of the population relies on tube wells for water collection, with the remaining 5% utilising informal and unsafe water sources[72]. In addition to limited water supply infrastructure, more than 55% of the population lacks access to any form of sanitation, including sealed and unsealed latrines. During flood events, both tube wells and unsealed latrines become inundated, which leads to the increased prevalence of water-borne diseases such as cholera and diarrhoea amongst the local population[73]. Medical services are not readily available. There are only two community clinics for the provision of such services and only one NGO clinic to service the needs of the entire population. These clinics are open for two days each week and are staffed by two paramedic doctors. Transportation infrastructure is also limited on the char, where the majority of the local roads are unpaved (40 km of 43 km) and passage between the char and the mainland is only via 1 permanent bridge, 10 bailey bridges and 20 paved culverts.

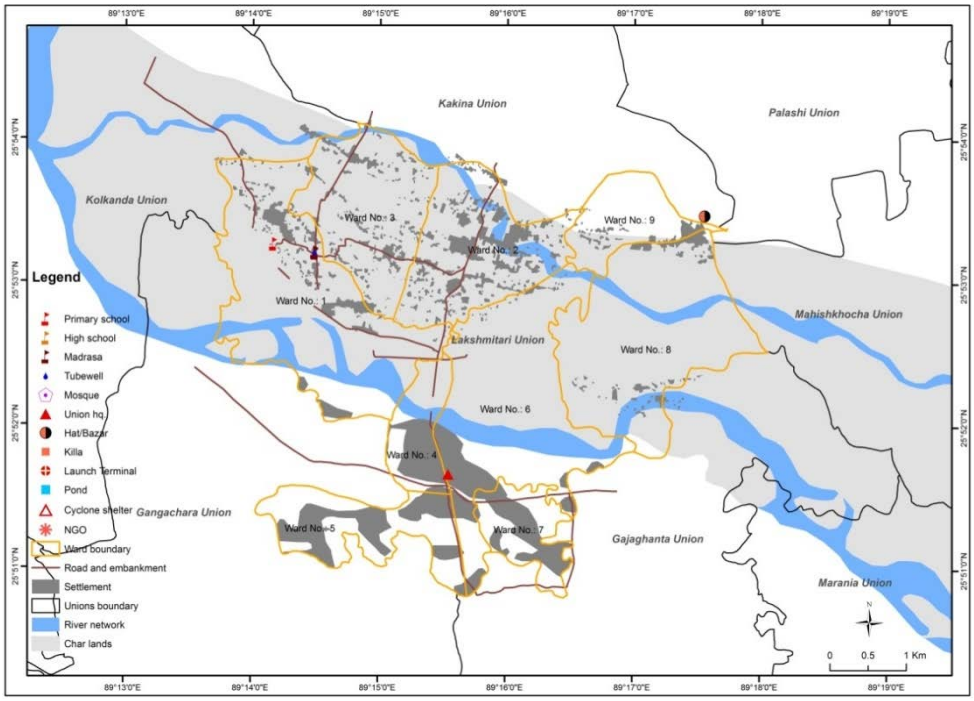


Figure 9. Map of Lakshmitari Union[74]

Agriculture is the dominant economic activity in Lakshmitari and the arable land currently covers 2,340 ha. The agricultural produce includes ayush, amon, boro[75], wheat, potatoes, corn and nuts. There are ~4,900 farmers, of which ~50% are tenants. Each household also maintains its own livestock, which includescows, buffaloes, goats and sheep. There are very few livelihood opportunities outside of agriculture and only ~6,000 people are employed on a permanent basis (~28%)[76].

[71]Banglapedia: the National Encyclopedia of Bangladesh. Available at: http://en.banglapedia.org/index.php?title=Main_Page

[72]Including ponds, canals, and rivers

[73] These diseases are particularly dangerous during disaster events, when access to the mainland and medical support is severely limited.

[74]Map drawn by Centre for Climate Change and Environmental ResearchC3ER, BRAC University, Bangladesh,. 2017.

[75]Ayush, amon and boro are seasonal rice varieties.

[76] Bangladesh Bureau of Statistics. census 2011

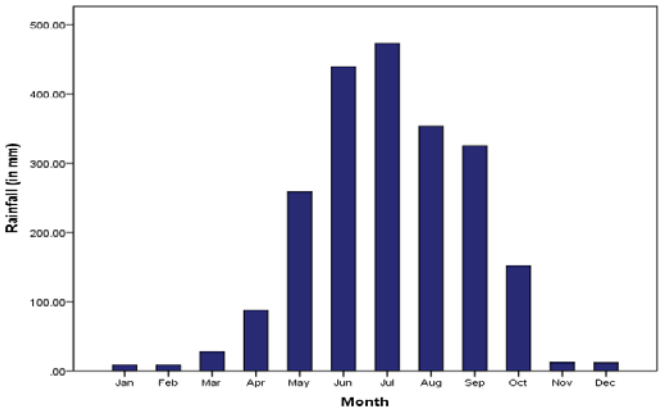


Figure 10. Mean monthly precipitation of Gangachara weather station (number 10208) in Lakshmitarifor 1948–2002[77].

Climate change and hazard exposure for Lakshmitari

Hydro-meteorological modelling has demonstrated that shifts in the spatial and temporal distribution of rainfall are occurring (and are expected to continue occurring) in Lakshmitari. These shifts include: i) an increase in seasonal monsoon precipitation, with a greater frequency and intensity of extreme precipitation events; ii) a decrease in precipitation for all other seasons; and iii) increasing seasonal drought during the dry season.

Currently, the drought risk in Lakshmitari is considered to be relatively low[78]. However, this risk is projected to increase under future climate change scenarios because of the increasing variability of rainfall patterns[79].In addition to causing an increase in seasonal monsoon precipitation (as discussed above), such variability has resulted in a decrease in precipitation during the dry season. As a result of this decrease, there has already been a re-designation of the Rangpur district from a dry sub-humid zone to an arid zone[80,81]. In addition, the rural and predominantly agrarian economy is being affected by the increasing intensity of short duration heavy precipitation events during the monsoon, and conversely by water stress during the Rabi season[82].Future climate change scenarios suggest that the Rangpur district will experience: i)prolonged water-stressed periods; ii) reduced surface water supplies; iii) reduced groundwater replenishment; and iv) increased saltwater intrusion into groundwater supplies.

The increasing trend in extreme rainfall events will also increase the flood exposure of Lakshmitari. Most areas in the union are currently considered low risk with regards to flooding. These areas experience seasonal flooding that is rated between F0 (with flood levels of 0.3 m) and F1 (0.9 m). By 2050, the area affected by F1 flooding is expected to increase to encompass the entire union. The densely populated settlement in Ward 2 is predicted to

[77] Annex H – Climate change and risk and vulnerability assessment.
[78]C3ER. "Upazila Climatic Risk Atlas." Comprehensive Disaster Management Programme (CDMP II). Ministry of Disaster Management and Relief, Oct. 2015. Web. 24 Jan. 2017.
[79]Haque, M. E., &Tasnuva, A. (2016). Evaluation of Climate Change Impact And Groundwater Vulnerability Assessment In Rangpur District, Bangladesh. IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
[80] Based on moisture index and humidity.
[81]Haque, M. E., &Tasnuva, A. (2016). Evaluation of Climate Change Impact And Groundwater Vulnerability Assessment In Rangpur District, Bangladesh. IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
[82]Ibid.

experience a higher incidence of F2 (1.8m) floods by 2050. The increase from F1 to F2 flooding is expected to result in increased damage to households and loss of personal assets within Ward 2, specifically because these structures are not designed to withstand flooding of such a magnitude. In addition, the increased height and duration of floods is expected to result in greatly increased impacts on human health, because of the local prevalence of unsealed latrines and dependence on unsealed tube wells.

Overall, the integrated risk scenario for the Lakshmitari Union shows that the entire union is currently considered a high-risk region (Figure 10). The projections for 2050 indicate that this risk is expected to increase for some areas within the union and decrease for others. Notably, the impacts of climate change are expected to shift the risk indicators in Wards 8 and 9 from high-risk exposure to very high-risk exposure[83].

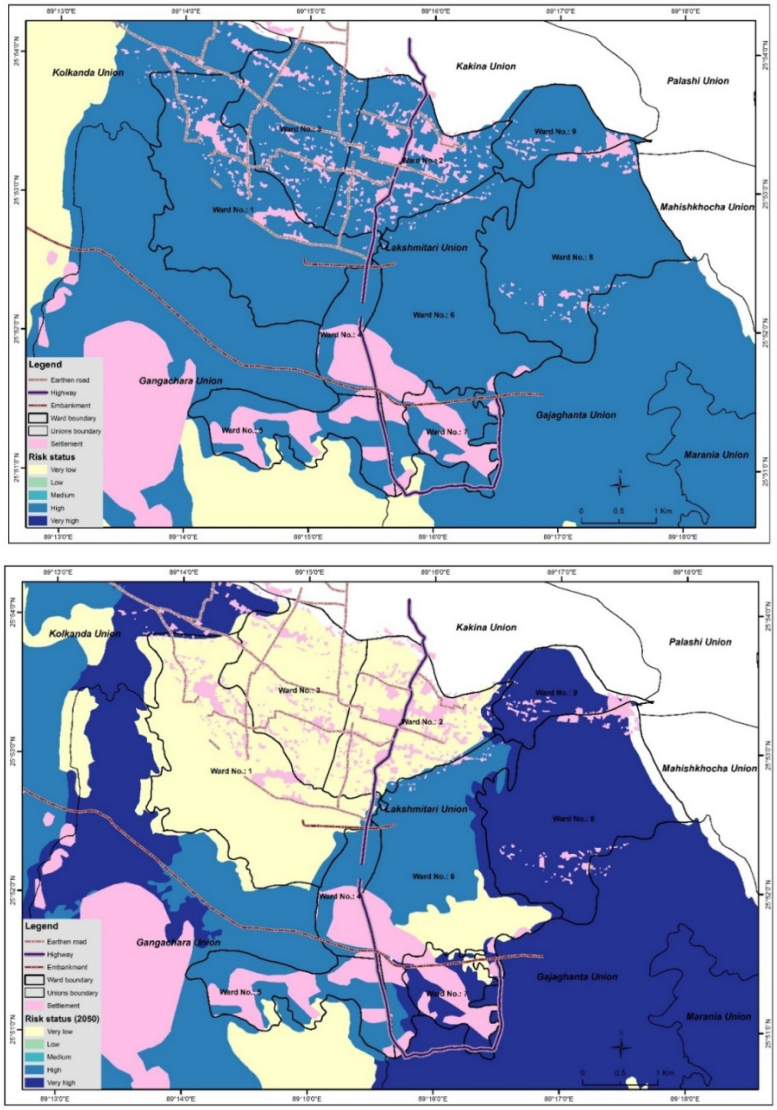


Figure 11. Top panel: Integrated Risk Exposure Map for Lakshmitari Union (Baseline), Bottom panel: Integrated Risk Exposure Map for Lakshmitari Union (2050). Larger versions of these figures are provided in Annex H.

The decrease in food security, economic productivity, health and personal safety associated with droughts and floods in Lakshmitari will reduce the resilience and adaptive capacity of local communities. Without interventions to increase the climate resilience and adaptive

[83] Further climate risk maps of Lakshmitari are available in Annex H

capacity of these communities, they will be forced to act reactively to the impacts of climate change, as opposed to having the capacity to act proactively to protect and prepare for the increased risks brought about by a shifting climate.

Mujibnagar Union

Background context

Mujibnagar is a union of Char Fasson, which is an upazila of the Bhola District. The union is situated within the Bay of Bengal (Figure 11) and consists of four mauzas[84],which collectively occupy an area of 2,605 ha[85]. Mujibnagar is positioned on the western bank of the Bura Gauranga River, which links with the Tentulia River and accounts for 15% of water discharge from the GBM system (Figure 12). The union has a population of ~10,500 with a population density of ~400 people/km^2 distributed amongst ~2,000 households. Literacy levels are low, at only 22%, and the majority religion is Islam.

Figure 12. Map of Bhola District (location of Mujibnagar Union demarcated by red box)[86]

Much like Lakshmitari Union, Mujibnagarhas limited infrastructure development for: i) water supply; ii) sanitation; iii) health; iv) transport; and v) energy. The existing traditional drinking water – ponds and shallow tube-wells – are affected by salinity, resulting in the majority of the population having to rely on informal and often polluted water sources such as canals and rivers. Sanitation infrastructure is also limited –only 16% of the population has access to traditional pit latrines, with the remainder practising open defecation. This limitation in sanitation infrastructure, when combined with the local dependence on open water storage (ponds and dams), poses a significant risk to human health during high water periods such as cyclone storm surges, monsoon floods or tidal floods. This is because open water storage facilities become contaminated with human waste during these climate events. Such

[84] These are Char Lewllin, Char Manohar, Char Motahar and Char Sikder
[85] Bangladesh Bureau of Statistics, 2011.
[86]Banglapedia: the National Encyclopedia of Bangladesh. Available at: http://en.banglapedia.org/index.php?title=Main_Page

contamination reduces the availability of clean water and increases the incidence of water-borne diseases.

In Mujibnagar, health and communication infrastructure is severely limited. There is only a single community clinic in the union, in which nine paramedic doctors provide emergency treatment and advice to inhabitants. In addition to water supply, sanitation and health, Mujibnagar is also limited in its transport infrastructure. The majority of the union's transport network is unpaved (46 km of 50 km) and there are no bridges to the mainland, which can only be reached by boat. A further development deficit in Mujibnagar is electrification. Although the union was included in the rural electrification scheme in 2011, field surveys have indicated that few households in Mujibnagar have access to electricity.

As in Lakshmitari, agriculture is the dominant economic activity in Mujibnagar. There is currently ~2,400 ha of arable land available for farming in the union, of which approximately 2,200 ha is irrigated. Major crops produced include rice, wheat, potato and watermelon. Approximately 60% of currently farmed land is occupied by tenants, and landowners occupy the remaining 40%. Field surveys did not identify any livestock farms in Mujibnagar, but rather that individual families keep their own livestock. Alternative livelihood opportunities to agriculture are even more scarce in Mujibnagarthan in Lakshmitari, and only ~2,200 inhabitants (~22%)are reported to be formally employed.

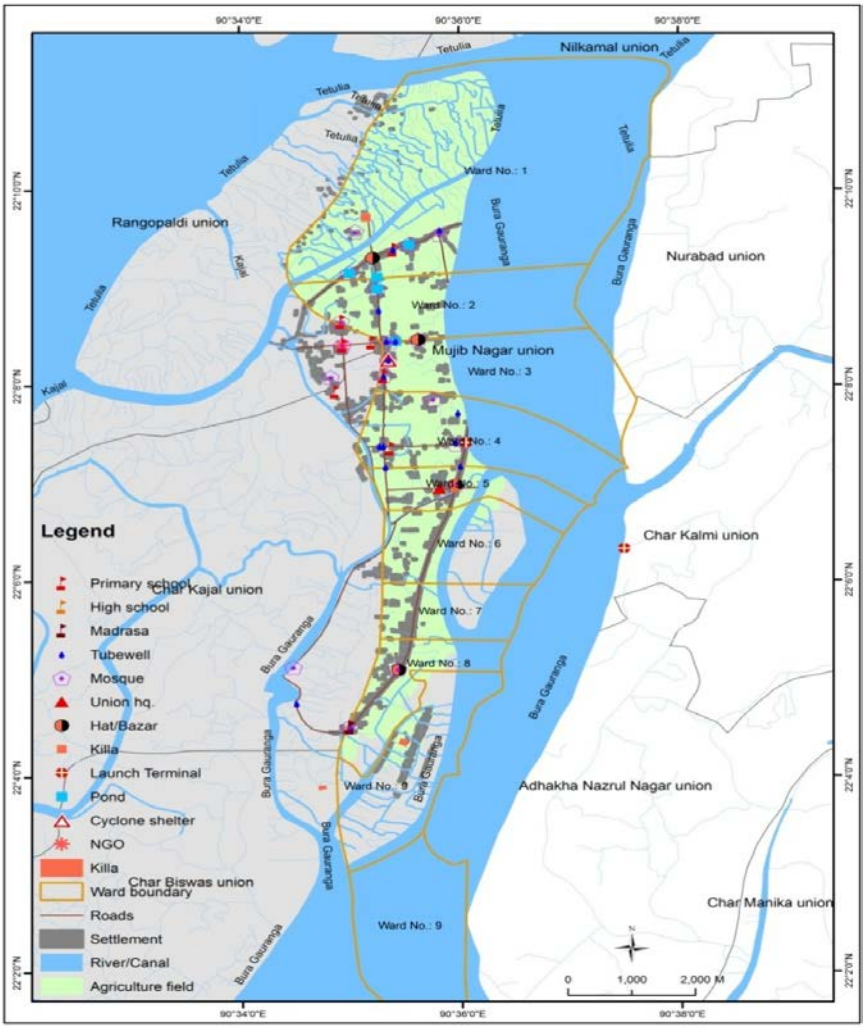


Figure 13. Map of Mujibnagar Union[87]

Climate change and hazard exposure for Mujibnagar

Changes have already been observed in the local climate of Char Fasson, on which Mujibnagar is located. The mean annual temperature in the area showed an increasing trend from 1970 to 2010(Figure 13) and mean annual precipitation also increased over this period (Figure 14). In line with the rest of coastal Bangladesh, Mujibnagar's climate is expected to continue to change in the following ways: i) average annual temperature will increase; ii) seasonal precipitation will become more variable; iii) mean annual precipitation will increase; iv) floods will increase in frequency and intensity; v) cyclones will become more intense; and vi) salinization of groundwater will increase as a result of sea level rise.

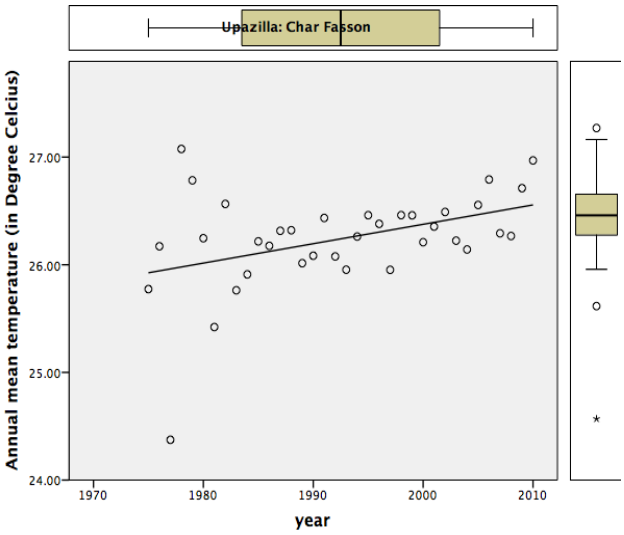


Figure 14. Historical trends in the mean annual temperature for Char Fasson

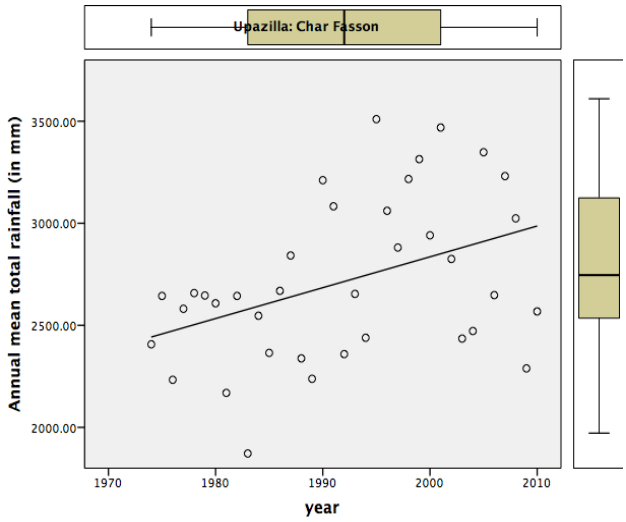


Figure 15. Historical trends in the mean annual precipitation for Char Fasson

[87]Map drawn by Centre for Climate Change and Environmental Research, C3ER. 2017. BRAC University, Bangladesh, 2017.

Risk assessment

According to data obtained from the Upazila Climate Risk Atlas[88],Mujibnagar has a high integrated risk score(46)[89]. This represents the highest integrated risk score for any union in Char Fasson[90], as well as for any char assessed in the scoping report (see Annex F). In addition, Mujibnagar's hazard exposure score[91](27) is projected to increase to 41with climate change. Disaggregated by hazard, and under the climate change scenario, Mujibnagar is projected to become increasingly exposed to: i) floods – where the number of inhabitants exposed to flood hazards is projected to increase to ~3,500 (34% of the current population) from 2,600 (25% of the current population); ii) storm surges –where the storm surge exposure score (69 km^2) under a baseline scenario is projected to increase to 77 km^2 under the climate change scenario, resulting in more than 80% of the population (~8,200 people) being exposed to storm surges; and iii) soil salinization – where the soil salinity exposure score for Mujibnagar (41.7)is the highest of the chars assessed in the scoping report, and is projected to double as a result of climate change. A shift in soil salinity of this magnitude is predicted to affect almost the entire population (~98%) of Mujibnagar.

Taken together, the climate change hazards of increasingly severe floods, cyclone storm surges and salinization will have considerable impacts on the communities of Mujibnagar. In the absence of effective interventions to increase the resilience and adaptive capacity of these communities, climate change will have extremely negative impacts on *inter alia* food security, economic productivity, health and personal safety.

Problem that the proposed project will address

Vulnerable char communities in Lakshmitari and Mujibnagarhave limited capacity to adapt to the climate change impacts of increasing floods, erosion, cyclones, saline intrusion and water stress. To address this problem, the proposed project will focus on addressing the following challenges:

- limited access of communities to information about future climate change impacts, with awareness mostly of existing disaster risks;
- limited coverage and effectiveness of disaster preparedness programmes and early warning systems on chars;
- inadequate protection of life, livelihoods and assets against cyclones and floods because of fragile houses, limited number of disaster shelters and fragile embankment systems;
- limited knowledge and technical capacity/options among char communities to adapt livelihood practices to climate change;
- limited access to safe drinking water, sanitation and electricity, and the climate vulnerability of these services; and
- limited knowledge and capacity of local government for climate risk-informed planning.

Project Objectives:

The objective of the project is to enhance the climate resilience of vulnerable communities who live on coastal islands and riverine chars in Bangladesh. This objective will be achieved through the following four project outcomes:

[88]C3ER. "Upazila Climatic Risk Atlas." Comprehensive Disaster Management Programme (CDMP II). Ministry of Disaster Management and Relief, Oct. 2015. Web. 24 Jan. 2017.
[89] For further details, see Annex F.
[90]C3ER. "Upazila Climatic Risk Atlas." Comprehensive Disaster Management Programme (CDMP II). Ministry of Disaster Management and Relief, Oct. 2015. Web. 24 Jan. 2017.
[91] For further details, see Annex F.

1) enhanced resilience of households through climate resilient housing, renewable sources of electrification and the provisioning of safe drinking water;
2) increased climate resilience of communities through climate risk mapping, cyclone and flood preparedness that leaves no one behind and basic infrastructure that is resilient to cyclones and floods;
3) improved income and food security of vulnerable households by innovating and introducing locally appropriate climate-resilient livelihoods practices; and
4) enhanced knowledge and capacity of communities, government and policymakers to promote climate resilient development on riverine and offshore islands.

Project / Programme Components and Financing:

Fill in the table presenting the relationships among project components, activities, expected concrete outputs, and the corresponding budgets. If necessary, please refer to the attached instructions for a detailed description of each term.

For the case of a programme, individual components are likely to refer to specific sub-sets of stakeholders, regions and/or sectors that can be addressed through a set of well-defined interventions / projects.

Table 2. Project components, outputs, outcomes and financing.

Project/Programme Components	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
Component 1. Enhanced climate resilience of households through climate-resilient housing, electrification and climate-proof water provisioning	**Output 1.1.** Cyclone and flood resilient houses for the most vulnerable households are supported. ($1,551,000) **Output 1.2.** Community-level nano-grids installed for electrification to enhance adaptive capacity. ($174,828) **Output 1.3.** Locally appropriate rainwater harvesting systems forsafe drinking water and home-garden irrigation installed.($282,000)	Community infrastructure improved and adaptive capacity increased for vulnerable small island and riverine char communities to manage and plan for climate change impacts.	2,007,828
Component 2. Increased climate resilience of communities through climate-resilient infrastructure, climate risk mapping and inclusive cyclone preparedness.	**Outcome 2.** **Output 2.1.** Climate-resilient infrastructure built to protect life and prevent asset loss. ($808,250) **Output 2.2.** Embankments repaired and innovative model for community embankment management introduced. ($656,300) **Output 2.3.** Climate-resilient investment on	Resilience of vulnerable small coastal island communities enhanced against climate-induced disasters through improved infrastructure, management practices and community-based	2,317,726

	chars promoted through climate hazard maps and expanded cyclone early warning systems. ($16,000) **Output 2.4.** Cyclone Preparedness Programme (CPP) modernised, made gender-responsive, and expanded to provide timely cyclone early-warning and response at scale. ($837,176)	emergency responses.	
Component 3: Improved income and food security of communities by innovating and providing assistance to selected households for climate-resilient livelihoods practices	**Output 3.1**Climate-resilient agriculture implemented and supported at a community level. ($942,068) **Output 3.2** Diversified livelihoods developed and supported for the most vulnerable households. ($2,455,000)	Adaptive capacity of vulnerable communities improved through the dissemination of climate-resilient agricultural practices and the development of diversified livelihoods.	3,397,068
Component 4. Enhanced knowledge and capacity of communities, government and policymakers to promote climate resilient development on chars.	**Outcome 4.** **Output 4.1.** Local government institutions are capable of climate risk-informed planning and implementation. ($37,500) **Output 4.2.** Knowledge and awareness generated to promote climate resilient approaches and strategies**.** ($577,200)	Increased awareness and availability of information on climate change impacts and adaptation options for vulnerable communities, local level government and policymakers	614,700
6. Project/Programme Execution cost			875,000
7. Total Project/Programme Cost			9,212,322
8. Project/Programme Cycle Management Fee charged by the Implementing Entity (if applicable)			783,047
Amount of Financing Requested			9,995,369

Projected Calendar:

Indicate the dates of the following milestones for the proposed project/programme

Milestones	Expected Dates
Start of Project Implementation	October 2019
Mid-term Review	April 2022
Project Closing	September 2024
Terminal Evaluation	December 2024

PART II: PROJECT/ PROGRAMMEJUSTIFICATION

Project / programme components

Describe the project / programme components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience. For the case of a programme, show how the combination of individual projects will contribute to the overall increase in resilience.

The project activities described in this section are built on lessons and best practices used in Bangladesh by various projects including those of UNDP. It has heavily used lessons from UNDP-MOEFCC implemented Coastal Afforestation project funded by GEF, Local Government Initiatives on Climate Change (LOGIC) of UNDP, Comprehensive Disaster Management Programme (CDMP) and Chars Livelihood Programme of DFID- Bangladesh.

Component 1. Enhanced climate resilience of households through climate-resilient housing, electrification and climate-proof water provisioning

Output 1.1. Cyclone- and flood-resilient houses for the most vulnerable households are supported.

Island households typically lack the financial and technical capacity to construct houses that are robust against the impacts of floods, cyclone winds and cyclone storm surges, all of which are becoming increasingly frequent and intense as a result of climate change. This output will assist the most vulnerable households in the char communities of Lakshmitari and Mujibnagar to retrofit their houses against these climate change impacts. Local construction workers will also be trained on climate-resilient building techniques for use in the broader community.

Activity 1.1.1. *Co-designing resilient houses that combine modern and traditional technology*

The 900 most vulnerable households in Mujibnagar and Lakshmitariwill be selected jointly by the project partner NGO, local government and community members, following a transparent beneficiary selection process that prioritises women-led households and poor people who are extremely vulnerable living close to or outside the embankments. For a description of the beneficiary selection process and criteria, see Annex B. The process will include identification of the hazards faced by each household and will prioritise identifying extremely vulnerable women- and poor led households. The specific needs for the retrofitting of each selected household will be assessed and this will determine the amount of assistance that will be provided to a household to enhance its resilience to cyclones/and or floods. In all cases, the design and construction will utilise no-fired bricks and materials with zero to low CO2 foot print, where appropriate. Assistance will be in the form of technical advice, labour, tools and materials facilitated by the project partner NGO, not as a direct financial grant to the household. The retrofitting will be owner-driven and will be supplemented by cash (where possible) and in-kind contributions from household members (e.g. labour and materials). Under this activity, household members will collaborate with the NGO technical advisers to design the most appropriate retrofitting interventions for each house, combining local techniques and appropriate materials with modern technical specifications. The retrofitting itself will be done under Activity 1.1.3. On the coastal char, the climate-resilient design features will include: i) cyclone resilient structural design, based on 100-year tidal surge and 215 km/hour wind safety measures; ii) provision for increased flood levels as a result of climate change; and iii) saline-resistant materials. On the inland riverine char, the design features will account for increased flood levels under climate change scenarios. Where local construction materials are used, they will meet the relevant technical standards.

Activity 1.1.2. *Training local construction workers on cyclone- and flood-resilient construction techniques.*

Local construction workers such as carpenters and masons will be trained to ensure the adoption of climate-resilient construction techniques and standards beyond the selected most vulnerable households. This training will be delivered through workshops held at the nearest existing vocational training institutions.

Activity 1.1.3. *Retrofitting houses against cyclone winds, storm surges and flooding.*

The NGO project partner will work with local construction workers and household members to retrofit houses, following the assessment and design under Activity 1.1.1. Retrofitting interventions will include raising houses on plinths to resist flooding and strengthening roofs against cyclone winds. The retrofitting interventions will meet climate-resilient design guidelines, as well as consider the specific local context, e.g. site conditions, locally available and appropriate materials. The NGO technical advisers will ensure that the retrofitting meets technical quality standards. In addition to the retrofitting, a part of the funds allocated to households will be used to provide or improve the sanitation and hygiene facilities of each house, in order to reduce water-borne diseases spread by climate change-induced flooding. Landless people will be assisted by the NGO to secure *khas* land (government-owned vacant land) for their houses, in consultation with the community to avoid land-use conflicts.

Output 1.2. Community-level nano-grids installed for electrification to enhance adaptive capacity

The communities in the chars of Lakshmitari and Mujibnagar have no, or very limited, access to electricity and are not connected to the national grid. This impedes socio-economic development in these communities, which in turn limits their capacity to adapt to climate change. Moreover, limited access to electricity also hampers communication, e.g. via mobile phone and radio, before, during and after climate-related disasters. The activities under this output will, therefore, increase electricity access in these communities by implementing decentralised nano-grids which are robust against floods and cyclones.

Activity 1.2.1. *Assessing electricity demand and designing nano-grids powered by solar or wind energy.*

The electricity need of households will be assessed, and nano-grids will be designed to provide electricity to small groups of houses. These nano-grids will each generate and distribute ~1.5–2 kW. The groups of houses that will have non-grids installed will be selected based on their vulnerability by the partner NGO, local government and community members, according to the beneficiary selection criteria described in Annex B.

Activity 1.2.2. *Establishing community groups to operate and maintain renewable energy nano-grid infrastructure.*

Community groups will be established from among the beneficiary households. These groups will be trained and equipped to operate and maintain the nano-grids. The participating households will pay a small fee to the community groups that will be used to cover some of the operation and maintenance costs. The remainder will be covered by project financing and by the local government once the project ends.

Activity 1.2.3. *Installing nano-grid infrastructure to provide electricity to households*[92]*.*

[92]Groh, S., *et al.* (2015). *Decentralized Solutions for Developing Economies*. Springer International Publishing: Imprint: Springer.

Nano-grids will be installed for30 small clusters of houses. Each nano-grid will serve 15–20 households within a radius of 60–70 m, will be powered by a photovoltaic facility or wind turbine, and will include battery storage. The rooftops of one or two houses will be used for photovoltaic installation. An appropriate photovoltaic system may generate ~1.5–2 kW. The photovoltaic panels and the battery will be connected in series in such a way that the grid voltage is 220 V DC (nominal) to supply households with this voltage. The nano-grid systems will include a device in each household to manage the allocation of electricity to each household.

Output 1.3. Locally appropriate rainwater harvesting systems for safe drinking water and home-garden irrigation.

Local communities on chars have very limited access to safe drinking water. On Lakshmitari char they depend on tube wells that are often contaminated by flood waters during the monsoon season. In Mujibnagar, communities depend on unsafe surface water sources which are polluted by tidal floods and storm surges. In addition, saline intrusion also threatens the water resources of coastal chars[93]. These factors lead to the spread of water-borne diseases and limit the water available for the irrigation of home gardens during the dry season. Household rainwater harvesting has been shown to be a feasible, cost-effective solution to these problems in Bangladesh[94,95]. Under this output, rainwater harvesting systems will be installed, with all cyclone and flood resistant features, in Lakshmitari and Mujibnagar. These systems will provide safe drinking water for households, as well as providing water for the irrigation of home-gardens to enhance food security of women and young children in particular. (Further details on the specific technologies used to clean and filter the water is available in Annex G.)

Activity 1.3.1. *Assessing water demand and designing locally appropriate rainwater harvesting systems for households.*

The water need of households will be assessed through surveys by the project partner NGO. Based on this need, rainwater harvesting systems will be designed with sufficient capacity to supply year-round household needs. The project partner NGO will provide the necessary technical expertise. The design will be based on international best practices and locally appropriate specifications (see Annex G). It will include provision for the increasingly erratic rainfall patterns as a result of climate change in the north-west of Bangladesh, where Lakshmitari is located, as well as for increasing saline intrusion in coastal areas[96]. In addition, rainwater harvesting systems will be designed to withstand floods and cyclones. Lastly, the quality of the water from storage tanks will be ensured by installing two-filter systems, which will avoid the contamination problems sometimes experienced with stored rainwater[97].

Activity 1.3.2. *Establishing community-based water-user groups for surface water preservation and distribution in water-stressed areas*

Community members will be supported to establish water-user groups. These groups will be trained to: i) manage the preservation and distribution of surface water in areas that experience water stress during the dry season and/or because of saline intrusion; and ii) assist

[93] Clarke, D., *et al*. (2015). Projections of on-farm salinity in coastal Bangladesh. Environmental Science: Processes & Impacts, 17(6), 1127-1136.
[94] Islam, K. Z., *et al*. (2014). Low cost rainwater harvesting: an alternate solution to salinity affected coastal region of Bangladesh. American Journal of Water Resources, 2(6), 141–148.
[95] Ferdausi, S. A., &Bolkland, M. W. (2000). Rainwater harvesting for application in rural Bangladesh. In WEDC Conference (Vol. 26, pp. 16-19).
[96] Design specifications for saline intrusion will consider both the necessary capacity of storage tanks, as well as the corrosion of certain construction materials under saline conditions.
[97]Centre for Climate Change and Environmental Research.Personal communication, Nandan Mukherjee, C3ER. BRAC University, July 2018.

community members with the maintenance of rainwater harvesting systems. The training will be provided by the project partner NGO and will ensure that the water-user groups are capacitated to be self-sufficient before the end of the project period.

Activity 1.3.3. *Installing home-based rainwater harvesting systems for drinking and gardening.*

The project partner NGO will install rainwater harvesting systems for 500 selected households, in collaboration with household members. Beneficiary households will be the same as for the house retrofitting activities above. Household members will be trained to operate and maintain their rainwater harvesting systems.

Component 2. Increased climate resilience of communities through infrastructure that is resilient to cyclones and floods, climate risk mapping and inclusive cyclone preparedness.

Output 2.1. Climate-resilient infrastructure built to protect life and prevent asset loss. Char communities are extremely exposed to cyclones and flooding, which are becoming increasingly frequent and intense because of climate change. In coastal areas, cyclone winds, storm surges and flooding cause loss of life and damage to livelihoods and assets. In inland chars, frequent and intense floods have similar negative impacts. The typical houses on chars are not able to withstand cyclone and flood disasters. For this reason, char communities require disaster shelters.

Activity 2.1.1. *Constructing cluster houses for particularly vulnerable households that will function as emergency shelters during flooding and cyclones.*

Twenty cluster houses (i.e. multiple houses in a single robust building) will be constructed by the project partner NGO[98]. The locations of cluster houses will be determined through consultation with the community and local government and will be informed by the climate hazard maps presented in this proposal (see Annex H) as well as the maps developed under Output 2.3. The households most vulnerable to disasters will be selected as beneficiaries, following a transparent, inclusive selection process (see Annexes A and C). Selection criteria will prioritise households that: i) are led by women; ii) have elderly household members; iii) have disabled household members; and iv) are landless. Each cluster house will accommodate four households in non-disaster periods. During flood and cyclone disasters, one cluster house will accommodate up to 100 people and their valuable moveable assets (e.g. documents, seeds, utensils). The elderly and disabled community members who live in the cluster houses during non-disaster periods will already be in a safe space when disasters occur, rather than having to move to a distant shelter. The location of various cluster houses in different locations in the chars will also reduce the distance that particularly vulnerable people (i.e. the disabled and the elderly who are not residing in the cluster houses) have to travel to reach shelter. The cluster houses will be designed to be women- and children friendly, will include water, sanitation and hygiene (WASH) facilities, and will have solar lighting. For further specifications and illustrations of the proposed cluster house design, see Annex A.

Output 2.2.Embankments repaired and innovative model for community embankment management introduced.

Char lands need to be protected against monsoon floods, tidal flooding and cyclone storm surges, all of which are exacerbated by climate change-induced sea level rise. The existing embankments that should protect char lands against these climate impacts are lacking in places and fragile overall. In Lakshmitari, settlements and farmland are also threatened by river bank erosion. Activities 2.2.1 and 2.2.2 will repair damaged embankments, as well as

[98] For specifications of cluster houses, see Annex A.

strengthen embankments and river banks through a combination of grey and ecosystem-based adaptation measures. The fragility of and damage to embankments is in part because of inadequate maintenance and management of the embankments. Activity 2.2.3. will develop an innovative community-centred approach to embankment management that will serve as a model for upscaling by the government to other parts of Bangladesh.

Activity 2.2.1. *Repairing damaged embankments in Mujibnagar.*

Embankments around chars are a vital line of defence against floods and storm surges. In the target char in Mujibnagar14.5 km of embankment (including 1 km of breached embankment) will be repaired in collaboration with the Bangladesh Water Development Board (BWDB).Separate from this Adaptation Fund project, the Government of Bangladesh, through the BWDB, will construct a new embankment of 3.5 km in Lakshmitari to protect the area from floods. For the location of these embankments and the technical specifications of the repair work, see Annex G.

Activity 2.2.2. *Strengthening embankments in Mujibnagar and riverbanks in Lakshmitari through the installation of geotextile and EbA measures such as planting mangroves, other trees and vetiver grass.*

In Mujibnagar, 10 km of degraded embankments will be strengthened with a combination of geotextiles and the planting of vetiver grass[99] and mangrove trees where appropriate. In Lakshmitari, 2 km of vulnerable riverbank will be strengthened with a combination of geotextiles and vetiver grass. Where required, trees will be used to further strengthen the degraded riverbanks. Embankments will be strengthened according to the established best practices in Bangladesh[100]. The 3.5 km of new embankment constructed by the GoB will also be strengthened in this way. This activity will be conducted by the Bangladesh Water Development Board in collaboration with social forestry programmes and the community embankment management groups that will be established in the following activity.

Activity 2.2.3. *Forming community embankment management groups with locally appropriate incentives.*

The maintenance of embankments will be improved by increasing the involvement of local communities. This will be achieved by creating incentives for community involvement, such as fish farms or social forestry next to embankments. The community-based embankment management approach will serve as a model with the potential for up-scaling by the government.

Output 2.3. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.

Many of the chars in Bangladesh are greatly affected by climate-induced disasters such as cyclones. This is because chars often lack the communication infrastructure that is commonly used to warn people about impending cyclones making landfall. These chars are also at a further disadvantage because they have not been mapped on a fine enough scale in terms of climate hazards and vulnerability. Without such maps, investments in infrastructure, housing and livelihood activities cannot be practiced in locations that have less exposure to climate hazards. Furthermore, without these maps communities do not understand the variable risk associated with different areas of their land and cannot, therefore, identify areas that would be safe during disaster events. This output will address this gap by developing a cyclone early warning system for Mujibnagarand the necessary maps for selected chars.

[99] *Chrysopogonzizanioides*

[100] UNDP, 2017. Technical innovation in disaster risk reduction: Results from four studies. Dhaka.

Activity 2.3.1. *Developing climate hazard and vulnerability maps for selected chars in the Bay of Bengal and the Ganges-Brahmaputra-Meghna (GBM) basin.*

Fine-scale climate hazard maps will be produced for ten selected chars. The hazard maps will be based on existing data from various sources, including from the Ministry of Environment and Forests (MoEF), Ministry of Water Resource (MoWR), Ministry of Agriculture (MoA), Ministry of Health and Family Welfare (MoHFW), Planning Commission, Ministry of Fisheries and Livestock (MoFL), Ministry of Disaster Management and Relief (MoDMR)and NGOs. The maps will be produced by combining socio-economic vulnerability assessments with climate hazard maps. The resulting maps will focus in particular on flooding, storm damage, and river erosion, as well as socio-economic characteristics, infrastructure, basic services and natural ecosystems that buffer against climate disasters. The vulnerability assessments will drawon studies by the BMD and other independent research institutes and non-governmental organisations and will also incorporate data from semi-structured interviews with community members in hazard-prone areas. The comprehensive risk and vulnerability atlas project of the CDMP[101]will serve as a basis for this activity. The climate vulnerability maps will improve the understanding of local perceptions of hazards, community resources to cope with extreme events, and strategies and courses of action adopted by the communities during disasters. These maps will be shared with local government officials, displayed in local public buildings and shared with communities during training events, including with farmer groups and water user groups. In this way, the maps will support the decision-making of communities, local government and other actors and promote climate-resilient investments. This will assist communities, the government and NGOs to make appropriate plans and decisions about disaster risk reduction and disaster responses. In this way the loss of life and assets from climate disasters will be decreased. By producing and disseminating climate vulnerability maps of other chars in addition to Mujibnagar and Lakshmitari, the project will facilitate the upscaling of its climate-resilient char development approach by the government in future.

Activity 2.3.2. *Establishingan effective and inclusivecyclone early warning system*

An enhanced cyclone early warning system will be established in Mujibnagar. This system will be operated through mobile phone networksto provide information to all inhabitants in the form of periodictext messageupdates[102]. By providing periodic updates, char inhabitants will have a better understanding of how the cyclone risk is developing over time and will, therefore, be better equipped to respond. This will allow char inhabitants to receive advice and make an informed decision on whether they have time to evacuate, or whether they should stay in their own houses[103].

Output 2.4. Cyclone Preparedness Programme (CPP) modernised, made gender-responsive, and expanded to provide timely cyclone early-warning and response at scale.

The Cyclone Preparedness Programme currently does not provide sufficient coverage for the char communities in Mujibnagar. The activities under this output will consequently modernise and expand the CPP in this area to provide timely early warning of cyclones and adequate on-site responses at the necessary scale. This will include tailoring early warnings and cyclone preparedness to local requirements and using the local language. Additionally, the project will

[101] Comprehensive Disaster Management Programme (CDMP II) of Ministry of Disaster Management and Relief

[102]Early warning systems in Bangladesh have often failed to be effective because communities are distrustful of the accuracy of forecast data, and therefore do act as appropriate in the time between receiving a warning and the point at which a cyclone makes landfall.

[103]Roy, C., *et al* (2015). The current cyclone early warning system in Bangladesh: Providers' and receivers' views. *International journal of Disaster Risk Reduction*, *12*, 285-299. Available at: https://www.diva-portal.org/smash/get/diva2:812210/FULLTEXT01.pdf

extend CPP activities, including the training of volunteers and provisioning of CPP equipment to a further six vulnerable small coastal island unions[104].

Activity 2.4.1. *Engaging community members in the CPP multi-hazard volunteer programme.*

Community members will be engaged in the CPP volunteer training programme on Mujibnagar and in the six additional unions. The training programmes will include search and rescue, water rescue, first aid and the use of light rescue equipment, and will incorporate gender, psycho-social and disability considerations. These CPP training programmes will seek to increase the representation of women in the volunteer corps by a further 25%. In addition to the above training, CPP volunteers will also be trained to assist with embankment repair and strengthening.

Activity 2.4.2*Providing equipment for CPP volunteers and cyclone shelters.*

The CPP volunteers will be equipped with the necessary personal equipment, including protective clothing, torches and signal flags. Existing cyclone shelters and the cluster houses constructed by this project will be provided with full sets of modern cyclone preparedness equipment. A complete list of the CPP equipment, including costing and technical specifications is provided in Annex E.

Activity 2.4.3. *Providing and equipping a floating ambulance that is integrated with a mobile phone health system (M-health) to support stranded and critical patients during climate-induced disaster and post-disaster periods.*

During climate disaster periods, health services are often unable to reach char areas on time to assist vulnerable and critical patients, such as cyclone or flood casualties and women in labour. To address this need, a floating ambulance will be designed and implemented through a partnership between the Ministry of Health and Family Welfare and NGOs. This ambulance will be permanently stationed in Mujibnagar so that itis already present in the area when disasters occur. During normal times, the floating ambulance will provide both primary and emergency health services to communities. The floating ambulance will be approximately 23 feet long and 11 feet wide in order to fit patients comfortably. Metal beams will allow column-free spaces and the boat will have flexible wooden floors, high ceilings and waterproof roofs outfitted with solar panels. The ambulance will be designed to handle the increased water turbulence of cyclone events. It will be staffed by trained healthcare workers. The ambulance will be equipped with mobile phones and radio so that it can be called by anyone with access to a mobile phone, as well as through the CPP system. During non-disaster periods, health care workers on the floating ambulance will also communicate with patients via mobile phone, i.e. through a Mobile Health Support System (M-Health). This system will allow health care workers to maintain contact with patients that have critical or chronic conditions. The floating ambulance will be integrated with the existing healthcare infrastructure in the region, including the community clinic on Mujibnagar and other clinics on Char Fasson.

Component 3: Improved income and food security of communities by innovating and providing assistance to selected households for climate-resilient livelihoods practices.

Output 3.1 Climate-resilient agriculture implemented and supported at a community level

[104]The following unions have been prioritized to receive CPP support under the project: i) BhabanipurUnion and MadanpurUnion of DaulatkhanUpazila; ii)BadarpurUnion of LalmohanUpazila; iii)DakshinSakuchiaUnion of ManpuraUpazila; iv) Bara MalanchaUnion and Char JahiruddinUnion of TazumuddinUpazila under the Bhola District.

Communities living on small coastal islands and char lands in Bangladesh typically rely on agriculture as their primary form of livelihood. These livelihoods are being threatened by the increasingly severe impacts of water stress, flooding, saline intrusion and cyclone storm surges as a result of climate change. This output will support the development of climate-resilient agricultural practices, improved irrigation and cold storage facilities. In this wayit will increase agricultural productivity, food security and the economic potential of farmlands.

Activity 3.1.1. *Establishingfarmer field schools and training farmers for innovation and adoption of climate-resilient agricultural practices.*

A farmer field school will be established at each of the local innovation and knowledge centres which will be establishedunder Output 4.2.1.The project will thus establish two farmer field schools inMujibnagar and two in Lakshmitari. These farmer field schools will be run by the permanent staff employed by the project at the innovation and knowledge centres. The farmer field schools will include demonstration plots to host workshops for local farmers to learn about proven innovative food production techniques, including on the use of: i) hydroponics; ii) fish farms; iii) vertical gardens; iv) the selection and use of climate-resilient cultivars; and v) other climate-resilient agricultural practices. The information disseminated by the farmer field schools will be drawn from existing knowledge in Bangladesh that is underpinned by proven results. The farmer field schools will further function as hubs for research on climate-resilient agriculture and will host visits for farmers from other chars and for agricultural researchers from universities andresearch centres in Bangladesh. These farmer field schools will benefit the farmers living in Mujibnagar and Lakshmitari by fostering collaboration between farmers and increasing their awareness of different climate-resilient agricultural techniques.

Activity 3.1.2. *Establishing cold storage facilities for agricultural produce and fish*[105]*.*

Agriculture is the main livelihood in the target areas and impacted negatively by climate change, thus it is important to increase income from this livelihood in order to increase climate resilience. One of the ways to do this is to increase market access for farmers. To this end, two cold storage facilities will be established in Mujibnagar, as well as in Lakshmitari. The facilities will be located with the farmer field schools atthe local knowledge and innovation centres. This will ensure that staff from the innovation centres can monitor the management of the facilities, and that they arecentrally located andeasily accessible to community members. The cold storage facilities will be powered by small photovoltaic facilities or by small wind turbines[106]. These facilities will reduce the wastage of harvested crops and fish and will increase food security at a local level during climate-induced disaster events. The increased capacity to store crops and fish will also have a positive impact on the livelihoods of char communities, as they will be able to stockpile crops and fish to transport to the mainland for sale.

Activity 3.1.3.*Assessing irrigation needs and implementing solar irrigation systems in Lakshmitari to provide water during the dry season.*

An assessment will be conducted in partnership with the Parishad of the Lakshmitari Union by IDCOL, a locally established NGO to determine the irrigation needs of farmers in Lakshmitari. Findings from this assessment will be used to calculate the area of cultivated land that can be successfully irrigated during the Rabi (dry) season. The irrigation systems will draw water from existing tube wells in Lakshmitari and will be powered by independent PV systems or by the

[105] Cold storage for fish will be in the coastal area (Mujibnagar) only.
[106] Locally appropriate cold storage facilities made from shipping containers and powered by photovoltaic systems have been developed in Bangladesh, see: http://idcol.org/download/Solar%20PV-Diesel%20Hybrid%20Mini%20Cold%20Storage%20for%20Rural%20Offgrid%20Areas%20of%20Bang....pdf

nano-grids installed under Activity 1.2.3. The electrical water pump will be a 1.1kW unit, capable of pumping ~90,000 l per day. It is recommended that pumps only be used to irrigate non-rice crops (e.g. potatoes, vegetables, wheat) as it has been shown that applying solar irrigation to rice is not economically feasible. Each pump system will, therefore, be able to irrigate ~7 ha of wheat, or potentially ~15 ha of other vegetable crops[107].

Output 3.2 Diversified livelihoods developed and supported for the most vulnerable households

The communities living on small coastal islands and river char lands in Bangladesh are greatlydependent on climate senstive practices such as agriculture to support food securty and generate income. Both Lakshmitari and Mujibnagar have limited alternative livelihood options availabel for the majority of the population. This output will assist the most vulnerable households to develop alternative livelihoods by assessing opportunities and providing financial and technical assistance to develop new climate-resilient livelihoods. The livelihood approach will also include local enterprise development to make non-fired bricks, with technical assistance from Bangladesh the House Building Research Institute (HBRI).

Activity 3.2.1. *Providing technology, skills and materials to selected households for making their incomes resilient to flooding, cyclones and saline intrusion.*

Vulnerable households that will receive livelihood assistance will be identified through an assessment conducted in partnership with an established local NGO[108]. This assessment will include consultations with the local community and will prioritise woman-led households and those caring for the disabled and the elderly. The partner NGO, equipped with local experience and an understanding of alternative livelihood options on char lands, will support the selected households to determine feasible diversified livelihood options. The partner NGO will then provide support to these households in the form of technology, training and material provisioning. This support will benefit the most vulnerable inhabitants of the chars by assisting them to gain skills and access income generation opportunities, thereby improving their overall adaptive capacity. Preliminary site level scoping studies on the development of alternative livelihoods, that specifically focus on the most vulnerable populations (i.e. women-led households and the landless), have already been conducted (see Annex K and Annex L).

Component 4. Enhanced knowledge and capacity of communities, government and policymakers to promote climate resilient development on chars.

Output 4.1. Local government institutions are capable of climate risk-informed planning and implementation.

Many of the local government institutions currently have limited capacity to conduct planning in a manner that explicitly and comprehensively considers climate risks. These institutions also have insufficient capacity to implement their activities in a fully climate-resilient way. The activities under this output will build the capacity of local government institutions, in support of the overarching, long-term vision of the Bangladesh Delta Plan.

Activity 4.1.1.*Building the capacity of local government institutions, the Bangladesh Water Development Board and the Department of Agriculture extension service to promote climate-resilient approaches in char communities.*

Firstly, local government representatives and staff will be trained on the relevant ecosystem-based and community-based adaptation measures so that they can facilitate the uptake of these measures among char communities. Secondly, staff from the Bangladesh Water

[107]Groh, S., *et al.* (2015). *Decentralized Solutions for Developing Economies*. Springer International Publishing: Imprint: Springer.

[108]to be identified during the implementation phase

Development Board will be trained to incorporate the community-based approach to embankment management into their activities and to plan fully for the increasing risks of climate disasters. Thirdly, extension staff from the Department of Agriculture will be trained to support communities in the adoption of climate-resilient agricultural techniques.

Output 4.2. Knowledge and awareness generated to promote climate resilient approaches and strategies

Generating new knowledge about climate disaster risk reduction and other climate-resilient practices in chars and disseminating this knowledge to communities and decision-makers is vital for adapting to the increasing impacts of climate change.

Activity 4.2.1. *Establishing local innovation and knowledge centres to collect and disseminate innovative adaptation options.*

Two innovation and knowledge centres will be established in each target area (two in Mujibnagar and two in Lakshmitari) to collect local best practices and adaptation innovations, and to disseminate this knowledge across each target area. These centres will host the farmer field schools established under Activity 3.3.1 and will promote innovation in climate-resilient agriculture, household-level food production and other adaptation measures. The centres will also communicate national best practices to community members in the target areas. Lastly, the centres will support the establishment of outreach mechanisms by the project staff and project partners. These outreach mechanisms will include *inter alia:* i) radio programmes; ii) project websites; iii) brochures; and iv) public events. The outreach mechanisms will be supported through social media to effectively communicate project news and widely disseminate information about climate change and adaptation options.

Activity 4.2.2. *Collecting lessons learned and best practices on community-based and ecosystem-based adaptation interventions.*

Throughout the implementation of this project, the lessons learned from interventions will be collected by project staff and by all the project partners and used for adaptive management of the project activities. Best practices developed during the project will also be collected systematically by the local knowledge centres as well as by project staff in general. These best practices and lessons learned will be disseminated widely through the activity below.

Activity 4.2.3. *Disseminating information and knowledge products on a regular basis using arrange of modern and conventional media at local and national levels.*

The sharing of project experience will be achieved by: i) supporting local stakeholders to attend national climate change and disaster risk management forums; ii) presentations at regional forums and meetings; iii) the organization of exchange visits between the communities participating in the project; and iv) the development of manuals and training materials.

Activity 4.2.4. *Raising awareness about climate change among schoolchildren and other community members.*

Teachers and religious leaders will be trained to disseminate climate change information to schoolchildren and other community members through schools and community awareness programmes in Mujibnagar, Lakshmitari and the surrounding areas. This will include information on the nature of climate change, its impacts in Bangladesh and local adaptation options.

A. Economic, social and environmental benefits

Describe how the project / programme provides economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project / programme will avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

Through on-the-ground climate change adaptation interventions in Bangladesh, the proposed project will directly benefit ~32,000 people from two vulnerable island communities. This includes ~10,500 direct beneficiaries in Mujibnagar (~48% women) and ~21,000 direct beneficiaries in Lakshmitari (~49% women). Indirect beneficiaries of the proposed project will total ~310,200 and will include the entire populations of Mujibnagar and Lakshmitari, as well as the populations of islands mapped under Output 2.3. The specific economic, social and environmental benefits expected from the project are presented below.

Economic Benefits

The economic benefits of the project include increased income benefits, increased assets, job and enterprise creation through different climate resilient interventions, and benefits of enhanced productivity from improved health. Project support increases the economic assets of the women and their households and spurs enterprise-development in the communities. The support to value-chain and market development creates income enhancing opportunities for upstream and downstream market actors and provides opportunities for job creation across the value-chains. Investments in safe drinking water supply and rural electrification through nano grid infrastructure also contribute to community-managed asset creation, jobs (such as caretakers for O&M), increases opportunities for private sector engagement in drinking water provision, and improves the overall health and resilience of the beneficiary communities.

Shifting women's livelihoods to climate resilient options will reduce the likelihood of the need for social protection and social safety net pay outs. Provision of safe drinking water will reduce the potential costs of water-related illness, both for the household, and the country's health system. High salinity in drinking water leads to increased cardiovascular disease incidence and intensity. This places a distinct financial burden on Bangladesh's health system. By improving drinking water quality through rainwater harvesting systems, the incidence and intensity of cardiovascular disease in the targeted populations will decrease thus reducing the burden on the health system, freeing up government resources for other priority areas. Overall, climate resilient livelihoods, drainage facilities improvement along the embankment and drinking water interventions will improve the socio-economic status of the coastal communities and contribute to the local economies and long-term climate-resilient development of the country.

Flooding, cyclones, storm surges, saline intrusion and periods of water stress are increasing in frequency and intensity as a result of: i) increasing temperatures; ii) more erratic rainfall; and iii) more frequent extreme weather events. The livelihoods, assets and agricultural lands of char dwellers in Lakshmitari and Mujibnagar are vulnerable to such impacts, which are threatening their fragile homes, agricultural land, fish pond and livestock. By implementing climate change adaptation interventions in the Lakshmitari and Mujibnagar Unions, the climate resilience of some of the most vulnerable communities will be enhanced. This will be achieved by introducing the climate resilient agriculture and fisheries livelihoods, promoting alternative climate-independent proven traditional livelihoods and strengthening private and community-based infrastructure to protect assets and lives from increasingly extreme climate events.

The proposed project will generate economic benefits in several ways. Firstly, project activities will support the protection of primary household assets (Output 1.1), including homes, livestock and personal possessions. The development of hazard maps (Output 2.3) will assist households to plan for floods and cyclones, which will support the protection of lives and

assets. In Mujibnagar, a cyclone early warning system will also be established which will assist households to prepare for imminent cyclones.

Secondly, the project will rehabilitate embankments and riverbanks (Output 2.2) through a combination of grey and ecosystem-based adaptation (EbA) interventions, which will protect valuable agricultural land against extreme flooding, erosion, storm surges and saline intrusion. Engaging communities in the management of this protective infrastructure will provide additional economic benefits through the development of alternative livelihood opportunities such as fish farms, climate resilient agriculture and social forestry.

Thirdly, the interventions under Component 3 will improve agriculture, fisheries and livestock productivity, and thus the incomes of beneficiaries will significantly increase in all the project areas. In addition, due to promotion of climate resilient innovative and proven livelihood interventions, almost all the people living in the project areas will be benefitted adopting the technologies. Agriculture is the main economic activity in these unions, and local populations rely almost exclusively on agriculture for their livelihoods. Agricultural productivity and farmer incomes will be increased through:i) training on the use of climate-resilient cultivars and best agricultural practices; ii) the implementation of climate-proof irrigation systems in Lakshmitari, which will support agricultural production during the Rabi (dry season); and iv) the establishment of cold storage facilities in both Lakshmitari and Mujibnagar, which will improve economic competitiveness by allowing farmers to store crop surpluses, thereby increasing their market access and income.

Finally, to advance the economic development of the most vulnerable people within communities in Mujibnagar and Lakshimitari, the project will support the identification and development of additional climate-resilient livelihoods. The interventions under Component 3 will prioritise woman-led households and support the disabled, elderly and landless people, all of whom are currently largely excluded from participating in livelihood interventions.

Social Benefits

The proposed project activities will build the climate resilience of the vulnerable communities in both target areas by improving their living conditions. This will be achieved by: i) building cluster homes for particularly vulnerable households, with priority being given to woman-led and landless families (Output 2.1); ii) strengthening and climate-proofing the physical structure of existing houses (Output 1.1); and iii) providing electricity, sanitation and safe drinking water to particularly vulnerable households within the community (Outputs 1.1, 1.2 and 1.3). By providing access to sanitation and safe water, the occurrence of water-borne diseases that are common in the target areas during high-water events (e.g. flooding) will be reduced. Under Component 2, the project will also establish and equip a mobile floating medical unit. This will ensure that even during climate-induced disaster events, medical services will remain available to attend to medical emergencies.

Component 3 of the project will increase agricultural productivity, develop alternative livelihoods and establish cold storage facilities. The activities under this component will strengthen food security, providing vulnerable households with improved year-round nutrition and equip them to better manage and survive post-disaster periods. Component 3 will, in particular, support women through improving their food security and providing alternative livelihood options, which will enhance their self-sufficiency in the local communities. Since, the climate resilient livelihood intervention targets women it will increase their income and therefore their autonomy and empowerment. This increase in autonomy and income will allow women to allocate a greater portion of their income towards education and the health for their households.

Component 4 of the project will improve local knowledge on climate change through awareness raising programmes. This will provide the next generation with the knowledge and skills necessary to increase their adaptive capacity within the context of increasingly frequent and intense climate-induced disasters. The project will also promote capacity building at an institutional level under this component. This will improve the incorporation of climate change considerations into local planning, ensuring that future infrastructure is developed to be climate-resilient. By developing climate--proof infrastructure, disruptions in medical and education services will be reduced during and after disaster events.

Environmental benefits

Maladaptive livelihoods, in particular, the poorly regulated large-scale switch to shrimp farming in the coastal districts of Bangladesh has had serious impacts on mangrove integrity, which has further exacerbated the salinization of soil. The environmentally sustainable adaptation measures financed by the AF will have the added benefit of changing baseline practices for the better. Recognizing that these development pathways in response to changing environmental conditions must be regulated and controlled to maintain ecosystem integrity, the project takes a proactive approach to shifting livelihood strategies while also building community and institutional capacity in sustainable agricultural and aquaculture practices.

In addition to building the climate resilience of the vulnerable populations in the Lakshmitari and Mujibnagarunions, the proposed project will provide environmental benefits under Output 2.2. These benefits include: i) mitigating the environmental impacts of erosion and saline intrusion brought about by flooding and storm surges; ii) reducing environmental degradation through the application of EbA for strengthening the existing embankments; and iii) carbon sequestration and biodiversity benefits, which will be achieved through the planting of mangrove trees under the EbA interventions in Mujibnagar Union. The dissemination of knowledge on the economic, social and environmental benefits of maintaining mangrove forests will further support the long-term sustainability of these benefits amongst local communities.

Climate resilient Project interventions will also play direct and indirect roles to increase and conserve biodiversity, reduce emissions through the use of non-fire brick production and application of EbA to strengthen embankments. Additionally, the use of environment friendly infrastructure (climate-resilient housing and the improvement of drainage facilities along embankments) and awareness raising programmes regarding environmental degradation will contribute to greater awareness among the people of the project areas as whole.

B. Cost-effectiveness

Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.

The cost-effectiveness of the project will be supported by taking a proactive approach to disaster risk reduction at a community level and by supporting climate-resilient planning at an institutional level. Studies have shown that employing preventative and proactive, rather than reactive measures, greatly increases the avoided loss of assets from natural disasters[109]. Furthermore, combining climate resilience with disaster risk reduction and socio-economic development dramatically increases the benefits to countries and communities[110]. While a proactive approach to disaster risk reduction is well developed at an institutional level in

[109]Hallegatte, S. (2012). A Cost-Effective Solution to Reduce Disaster Losses in Developing Countries: Hydro-Meteorological Services, Early Warning, and Evacuation. Policy Research Working Paper; No. 6058. World Bank, Washington, DC. World Bank.

[110]Thomalla, F. *et al.* (2006). Reducing hazard vulnerability: towards a common approach between disaster risk reduction and climate adaptation. *Disasters*, *30*(1), 39-48. Available at: https://www.semanticscholar.org/paper/Reducing-hazard-vulnerability%3A-towards-a-common-and-Thomalla-Downing/652d129a706035054ce1b1b726ef9522874863ea

Bangladesh, communities generally lack the economic and technical capacity to take proactive measures to improve their climate and disaster resilience. Implementinga proactive approach of disaster preparedness at a community level will reduce the overall recovery time of affected communities resulting in further economic benefits through fewer disruptions to productivity. Climate-sensitive sectors like agriculture stand to benefit greatly from preventative measures. For example, once they have occurred certainclimate change impacts such as saline intrusion are reversible only through expensive, energy-intensive and time-consuming processes[111]. Overall, the project will develop a new model for climate-resilient planning and for engaging communities in the management of disaster protection infrastructure.

The cost-effectiveness of the project will be supported by improving local capacity to prevent the worst impacts of climate-induced disasters and developing preventative measures at an institutional level by incorporating climate change considerations into disaster risk reduction strategies. This will be achieved through: i) climate-proofing houses (Output 1.1.), which will protect personal assets; ii) rehabilitating protective infrastructure (Output 2.2.), which will reduce the damage caused to agricultural land and recovery time; iii) increasing local knowledge on risk-prone areas and predicted hazards (Output 2.3.), which will improve the resilience of future institutional and local development; and iv) improving early warning systems (Output 2.3.), which will increase the time communities have to prepare for imminent disasters and will assist the GoB to develop new disaster management strategies.

Furthermore, the project interventions have been designed in an integrated manner to include: i) protection of assets and livelihoods (Outputs 1.1., 2.1. and 2.2.); ii) increased economic productivity (Outputs 3.1 and 3.2.); iii) improved access to services including medical support, safe drinking water and electricity (Outputs 2.4., 1.3. and 1.2.); and iv) increased knowledge on the climate change projections and the associated impacts (Output 2.3., 4.1. and 4.2.). This integrated approach combines both protective and supportive interventions, promoting the cost-effectiveness of the interventions by providing both kinds of benefits to the target populations. These benefits will result in a cumulative increase in the adaptive capacity of beneficiaries. This suite of interventions will havea greater impact and be more cost-effective overall when compared to the implementation of any one single intervention.

The benefits accrued by the project are expected to be sustainable, to extend beyond the end of the project funding period, and to potentially indirectly benefit communities beyond the target populations through upscaling. Thiswill be achievedby promoting a paradigm shift from standard disaster risk reduction strategies to climate-resilient planning and investment through institutional capacity building (Output 4.1.), the development of climate risk maps for various chars (Output 2.3.), and the integration of the project with the large-scale Cyclone Preparedness Programme (Output 2.4.). This paradigm shift will be achieved in the following ways. Firstly, capacity building at an institutional level will support the paradigm shift towards climate resilient planning and improve the overall adaptive capacity of the region. It will also ensure that future development is implemented commensurate with the increased risks and hazards associated with climate change. Secondly, by expanding the climate riskmaps to encompass eightnon-target chars,an increased number of communities and institutions will benefit from increased knowledge about climate-specific hazards, thereby improving their ability to plan for and respond to climate-change-induced disasters. Thirdly, the integration of interventions under the project with the large-scale CP Programme will strengthen the CP Programme overall and ensure that the target populations continue to accrue benefits from increased disaster event support beyond the end of the project funding period. The combination of these three integrated approaches will support the overall cost-effectiveness of the project by ensuring that: i) benefits extend beyond the target populations; ii)communities

[111] Shrivastava, P., & Kumar, R. (2015). Soil salinity: a serious environmental issue and plant growth promoting bacteria as one of the tools for its alleviation. Saudi journal of biological sciences, 22(2), 123-131.

continue to benefit beyond the end of the project cycle; andiii) institutional bodies fully incorporate climate change considerations into future development and planning to reduce disaster risk.

C. Consistency with other strategies

Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist.

The proposed AF-financed project is aligned with several of Bangladesh's strategies, plans, programmes and reports, as described in the table below.

Table 3. Alignment with national strategies

National Priority	Alignment
Sustainable Development Goals (SDGs)[112]	The proposed project is aligned with and will contribute towards achieving: i) SDG 1 – No poverty; ii) SDG 3 – Good health and well-being; iii) SDG 5 – Gender equality; iv) SDG 6 – Clean water and sanitation; v) SDG 7 – Affordable and clean energy; vi) SDG 11 – Sustainable cities and communities; vii) SDG 13 – Climate action; and viii) SDG 15 – Life on land.
National Adaptation Programme of Action (NAPA)[113]	The project is aligned with and will therefore address several National Adaptation Programme of Action (NAPA) adaptation strategies, namely strategy: 2 – Providing drinking water to communities to combat the effects of climate change; 3 – Capacity building for integrating climate change into land-use planning, infrastructure design and conflict management; 4 – Disseminating climate change and adaptation information to vulnerable communities; 5 – Constructing flood shelters to cope with enhanced recurrent floods; 6 – Mainstreaming adaptation into policies and programmes in different sectors (focusing on disaster management, water, agriculture, health and industry); 8 – Enhancing resilience of urban infrastructure and industries to the impacts of climate change; 10 – Promoting research on drought, flood and climate-resilient crops to facilitate adaptation; 11 – Promotion of adaptation to coastal crop agriculture; and 15 – Exploring options for emergency preparedness measures to cope with enhanced climatic disasters.
Intended Nationally Determined Contribution (INDC)[114]	Through its activities, the project is aligned with the INDC's top five near-term priority areas[115], which are: i) improved food security, water security, and health and livelihood protection; ii) improved disaster management; iii) improved coastal zone management, including saline intrusion control; iv) improved flood control and erosion protection; and v) the development of climate resilient infrastructure. In addition, the project is directly aligned with five of the fourteen[116]broad adaptation

[112] UNDP, 2018. Available at:http://www.undp.org/content/undp/en/home/sustainable-development-goals.html.
[113] Ministry of Environment and Forest Government of the People's Republic of Bangladesh, 2005. National Adaptation Programme of Action (NAPA). Available at: https://unfccc.int/resource/docs/napa/ban01.pdf.
[114]UNFCCC, 2015. Intended Nationally Determined Contributions (INDC): Bangladesh. Available at: http://www4.unfccc.int/ndcregistry/PublishedDocuments/Bangladesh%20First/INDC_2015_of_Bangladesh.pdf.
[115]The remaining near-term priority areas are: 6) increased rural electrification, 7) enhanced urban resilience, 8) ecosystem-based adaptation (including forestry co-management), 9) community-based conservation of wetlands and coastal areas, and 10) policy and institutional capacity building.
[116] The remainingbroad adaptation actions are (in priority order): ii) disaster preparedness and construction of flood and cyclone shelters; iv) inland monsoon flood-proofing and protection; vi) climate resilient housing; vii) improvement of urban resilience through improvement of drainage system to address urban flooding; viii) river training and dredging (including excavation of water bodies, canals and drains); x) research and knowledge

	actions prioritised by the INDC: i) improved EWS; ii) supporting climate resilient infrastructure; iii) tropical cyclones and storm surge protection; iv) stress-tolerant variety improvement and cultivation; and v) capacity building at individual and institutional levels to plan and implement adaptation programmes and projects.
Bangladesh Environment and Climate-Resilient Sustainable Development (Vision 2021)[117]	Under the Bangladesh Environment and Climate-Resilient Sustainable Development (Vision 2021), it is anticipated that, by 2021, the livelihoods of Bangladesh's population will be self-sustaining through development that ensures a healthy environment and the welfare of future generations. Climate change is a specific focus of this vision, whereby the vision focuses on: i) climate change adaptation in the agriculture sector; and ii) mitigating the natural hazards and threats imposed by climate change. By improving the capacity for adaptation as well as providing mitigation co-benefits, the project is consistent with Vision 2021.
The 7th Five Year Plan (7th FYP) (2016-2020) of Bangladesh[118]	The 7th FYP outlines new strategies, institutions and policies, while strengthening the existing ones, to complete Bangladesh's agenda of achieving the social and economic outcomes of the country's Vision 2021. Several projects under the 7th FYP are consistent with the project and are specifically targeted to people living in chars. These projects include the: i) Char Livelihood Programme (CLP) – that has improved the livelihoods of people within the riverine areas of the Jamuna-Brahmaputra River in the northwest of Bangladesh; ii) Empowerment of the Poorest in Bangladesh (EEP) – that aims to improve the livelihoods of the poorest people in the country; and iii) Making Markets Work for the Jamuna, Padma and Teesta Chars (M4C) – that facilitates market access of agricultural products, improved business services and job creation.
Bangladesh Climate Change Strategy and Action Plan (BCCSAP)[119]	BCCSAP is a document that has been built upon Bangladesh's NAPA. It outlines nearly 50 programmes and projects to be implemented by the country over the short-, medium- and long-term. The AF project is tightly aligned with the seven strategic areas of the BCCSAP, because it aims to improve: i) food security; ii) social protection and health; iii) disaster management; iv) infrastructure; v) research and knowledge management; vi) low carbon development; and vii) capacity building and institutional strengthening.
National Plan for Disaster Management (NPDM) 2010 – 2015[120]	NPDM was developed to reduce the vulnerability of poor communities in Bangladesh to the effects of natural, environmental and human-induced hazards by: i) shifting disaster management practices away from being business-as-usual and towards incorporating climate change; and ii) strengthening the capacity of the government, relevant institutions and local communities in Bangladesh to respond to and recover from disasters. The AF project is aligned with the NPDM because its activities are targeted specifically at mainstreaming climate change into disaster risk responses as well as building the capacity of all stakeholders to implement such responses appropriately.

management; xi) adaptation on local-level perspectives, etc.; xii) adaptation to climate change impacts on health; xiii) biodiversity and ecosystem conservation and xiv) capacity building at individual and institutional level to plan and implement adaptation programmes and projects in the country.

[117]Bangladesh Environment and Climate-Resilient Sustainable Development: Vision 2021, 2010. Available at: http://ext.bd.undp.org/CCED/bgdp/BGDP%20Materials/Review%20Documents/Vision-2021.pdf.

[118]Government of Bangladesh, 2015. The 7th Five Year Plan (7th FYP) (2016-2020) of Bangladesh. Available at: http://www.lged.gov.bd/UploadedDocument/UnitPublication/1/361/7th_FYP_18_02_2016.pdf.

[119]Government of Bangladesh, 2009. Bangladesh Climate Change Strategy and Action Plan. Available at: http://www.bd.undp.org/content/bangladesh/en/home/operations/projects/environment_and_energy/inclusive-budgeting-and-financing-for-climate-resilience1/national-policies-and-strategies/bangladesh-climate-change-strategy-and-action-plan--bccsap--.html.

[120]Government of Bangladesh, 2010. National Plan for Disaster Management (NPDM) 2010 – 2015. Available at: http://extwprlegs1.fao.org/docs/pdf/bgd146945.pdf.

The Bangladesh Delta Plan 2100 Formulation Project (BDP 2100)[121]	BDP 2100 aims to integrate sectors from across the country to come to a long-term (50 to 100 years), holistic and unified plan for the governance of the Bangladesh Delta. This long-term vision – by considering uncertainties in future developments in climate change, socio-economics and regional cooperation – allows planning to be adaptive and dynamic. The AF project is aligned with BDP 2100 because it aims to *inter alia*: i) enhance good governance through its focus on institutional strengthening, policy reform, coordination and cooperation, capacity building and transparency; ii) supply safe drinking water and irrigation for food security; iii) develop climate hazard maps and risk scenarios to support community-based climate risk management and preparedness planning; and iv) modernise and expand climate change preparedness programmes to provide early warnings for cyclones and floods.

D. Project compliance with technical standards

Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.

The project will comply with Bangladesh's national technical standards (as outlined in its laws and regulations) as well as the Environmental and Social Policy of the Adaptation Fund.

Compliance with national technical standards

The protection and improvement of the environment and biodiversity are two fundamental principles of Bangladesh's State Policy. Indeed, it is the constitutional responsibility of the state to preserve and safeguard the country's natural resources – including its air and water resources, oceans, forests, and wildlife – for its present and future citizens. Consequently, the state is also responsible for monitoring environmental hazards and concerns that threaten such resources. To fulfil this responsibility, the GoB has developed and enforced several laws and regulations, each with their own technical standards, as outlined in the table below.

Table 4. Relevant environmental concerns, laws/regulations, enforcing agencies, and enforced/regulated items in Bangladesh.

Concern	Law/regulation	Enforcing agency/ies	Enforced/regulated item
Water pollution	• Environmental Conservation Act, 1995 • Environment Conservation Rules, 1997 • Environmental Court Act, 2000 • The Local Government Ordinance, 1983	MoEF/DoE UPs	• Promulgation of standards for water quality • Promulgation of discharge limits • Prosecution of offenders • Control of Environmental sanitation in rural areas
Air pollution	• Environmental Conservation Act, 1995 • Environment Conservation Rules, 1997	MoEF/DoE BRTA/Police	• Promulgation of standards for air quality • Promulgation of emission standards for Motor vehicles and industries • Prosecution of offenders

[121]General Economics Division (GED) of the Bangladesh Planning Commission (BPC), 2017. Available at: http://www.deltacoalition.net/wp-content/uploads/2016/04/BDP-Brochure-Final-september-2015.pdf.

Concern	Law/regulation	Enforcing agency/ies	Enforced/regulated item
	• Environmental Court Act, 2000 • Brick Burning Control Act, 1989 (amended 1992) • Motor Vehicle Act, 1983		• Prosecution of offending vehicles
Noise pollution	• Environmental Conservation Act, 1995 • Environment Conservation Rules, 1997	MoEF/DoE	• Promulgation of standards for noise levels
Toxic, solid or hazardous waste pollution	• Environmental Conservation Act, 1995 • Environment Conservation Rules, 1997 • Nuclear Safety and Radiation Protection Ordinance, 2000	MoEF/DoE BAEC	• Promulgation of standards and management rules. • Promulgation of standards and rules for themanagement of radioactive materials.
Marine pollution	• Environmental Conservation Act, 1995 • Environment Conservation Rules, 1997 • Environmental Court Act, 2000	MoEF/DoE	• Promulgation of standards for water quality • Enactment of discharge limits • Prosecution of offenders
Pollution of fisheries	• The Protection and Conservation of Fish Act, 1950	MoEF	• Promulgation of regulatory measures
Pesticides and fertilizers	• The Agricultural Pesticides Ordinance, 1971	DA	• Approval of permissible pesticides
Forest conservation	• Environmental Conservation Act, 1995 • Environment Conservation Rules, 1997 • The Forest Act, 1927	MoEF/DoE	• Declaration of Ecologically Critical Areas • Reserve Forest, protected Forest, Village Forest
Wildlife conservation and national parks	• Environmental Conservation Act, 1995 • Environment Conservation Rules, 1997 • The Wildlife Preservation Act, 1974	MoEF/DoE	• Declaration of Ecologically Critical Areas

In addition to considering the above concerns – as well as to abiding by the above laws and regulations – the project's activities have been validated by national partners, including *inter alia:*

- Department of Environment (DoE);
- Ministry of Environment, Forest and Climate Change (MoEFCC); and
- Ministry of Planning (which will be done during government's approval process of the project, which is done after a project is approved by donors);
- Bangladesh Forest Department
- Department of Agriculture Extension
- Department of Disaster Management
- Bangladesh Water Development Board

E. Project duplication

Describe if there is duplication of project / programme with other funding sources, if any.

There are several adaptation projects being implemented in char communities in Bangladesh, the objectives of which include improving livelihoods, reducing the impacts of flooding and erosion, and building the resilience of local communities to extreme climate events such as cyclones. Large chars in particular, such as Hatiya and Maheshkhali, benefit from development initiatives funded by donor and national agencies. In contrast, small offshore islands do not usually receive adaptation finance[122]. In addition, many development initiatives implemented among char populations do not incorporate climate change adaptation and may even result in an increase in local communities' vulnerability to extreme climate events. The proposed project will complement three existing adaptation-focused initiatives. These are:i) 'Piloting of Some Climate-resilient Development Initiatives at Char Kazal, Galachipa, Patuakhali: An Innovative Concept of Community-Based Adaptation to Climate Change'; ii) the 'Chars Livelihoods Programme'; and iii) the 'Char Development and Settlement Project'.

Brief outlines of these projects are provided below, as well as a description of a large coastal afforestation initiative undertaken by the Bangladesh Forest Department (BFD) to combat climate change-induced hazards. In addition to a brief overview of each project, justification is provided for why the proposed project will not be a duplication of the respective projects' efforts. During implementation of project activities, a team will work closely with representatives of the projects described to identify the best possible opportunities for enhancing coordination.

The **Piloting of Some Climate-resilient Development Initiatives at Char Kazal, Galachipa, Patuakhali: An Innovative Concept of Community-Based Adaptation to Climate Change**[123] project (January 2011–December 2012; budget: US$500,000) was developed by the Centre for Natural Resource Studies (CNRS). It aimed to enhance the capacity of local communities to adapt to future extreme climate events such as flooding and cyclones by implementing community-based adaptation approaches. The majority of land in Char Kazal is used for agricultural purposes, but the area is also extremely flood-prone, with more than half of the arable land degraded in the last 10–15 years because of sand carpeting and saline intrusion.

As the impacts of extreme climate events are predicted to worsen in Char Kazal, the project developed three specific objectives to help build the resilience of local communities to these impacts. These objectives were to: i) promote community-based adaptive capacity for communities in Char Kajal through piloting of adaptive agriculture practices; ii) renovate houses and boats to make them cyclone-resilient; and iii) conserve lands by promoting reforestation/afforestation of mangroves. The proposed project's activities will not be a

[122]Raza, W, Bhattacharjee, A and Das NC. 2011. Impact of char development and settlement project on improving the livelihood of char dwellers. RED Working Paper no. 17. Dhaka: BRAC.
[123] Center for Natural Resource Studies (CNRS). 2010. Piloting of Some Climate-Resilient Development Initiatives at Char Kazal, Galachipa, Patuakhali: An Innovative Concept of Community-Based Adaptation to Climate Change.

duplication of the efforts in Char Kazal as the project focuses on two other chars – one in Mujibnagar and the other in Lakshmitari. Lessons learned from the Char Kazal project, however, will inform activities of the proposed project with regards to the effectiveness of community-based adaptation interventions, developing climate-resilient livelihoods and constructing climate-proof houses.

The **Chars Livelihoods Programme**[124] (CLP) is a programme executed by the Rural Development and Cooperatives Division of the Ministry of Local Government, Rural Development and Cooperatives within the Government of Bangladesh (GoB). Ended in 2015, the CLP aimed to substantially reduce extreme poverty on the chars in north-western Bangladesh using a combination of *inter alia*: i) public works; ii) asset transfers (cash/in-kind); iii) livelihoods-related training; iv) market development; and v) social development training. It was implemented in two phases, the first of which (2004–2010; budget: US$79 million) targeted the chars of the Jamuna River in five districts. This first phase directly targeted 55,000 of the poorest households to receive core support and is estimated to have delivered benefits such as flood protection, tube wells, and access to savings and credit schemes to ~900,000 island char residents[125].

Phase two of the CLP, entitled **Alleviating Poverty on the Riverine Islands of North-west Bangladesh** (2010–2016; budget: US$129 million), continued activities in three of the districts covered under phase one, while expanding to five new districts. The activities under phase two are estimated to have directly reached 67,000 core households, with more than a million island char residents benefitting overall[126]. The CLP's main disaster and climate resilience features include: i) focusing on reducing flood risks; ii) creating innovative social safety net mechanisms; iii) providing post-disaster relief and recovery support; and iv) building direct measurement of climate resilience outcomes into the programme's monitoring and evaluation systems.

Duplication of the CLP's activities will be avoided because the proposed project activities focus specifically on building the resilience of char communities to the increased impacts of disasters due to climate change, rather than on decreasing poverty through asset transfer and market development. The proposed project's activities will, therefore, contribute to meeting the current need for post-disaster relief mechanisms characterised by the CLP. Lessons learned from the CLP, including the effectiveness of flood prevention techniques and social development training will, however, inform the activities of the proposed project.

The **Char Development and Settlement Project** (CDSP) is coordinated by the Bangladesh Water Development Board (BWDB) and consists of four phases, the last of which (CDSP IV) recently finished (2011–December 2018)[127]. The four phases represent a series of projects that have been supporting the development of newly-accreted land (chars) in Bangladesh for over two decades. This is an attempt to improve the economic situation and living condition of the population in the coastal areas of south-eastern Bangladesh, with a special focus on the poorest segment of the population. Underlying the broad objective of the project are activities divided into six specific components, namely: i) protection against climate change; ii) climate-resilient infrastructure; iii) land settlement and titling; iv) livelihood support; v) field level institutions; and vi) surveys and studies, operation and maintenance.

[124] Government of Bangladesh. 2004. Chars Livelihoods Programme: Reducing Extreme Poverty on the Riverine Islands of North West Bangladesh. Available at: http://clp-bangladesh.org/wp-content/uploads/2014/02/background-to-the-chars-livelihoods-programme-.pdf.
[125]World Bank. 2013. Bangladesh's Chars Livelihoods Program (CLP): Case Study (English). Washington DC, World Bank. Available at: http://documents.worldbank.org/curated/en/248441468013823819/Bangladeshs-Chars-Livelihoods-Program-CLP-case-study
[126]Ibid.
[127] Char Development and Settlement Project Phase IV. Available at: https://cdsp.org.bd/

Duplication of CDSP's activities will be avoided because the proposed project's activities will be implemented in different geographical areas and will have a very strong focus on the additional negative impacts climate change has, and will have, on the poor people living on chars. Lessons learned from the CDSP will be used to inform project activities, including whether measures such as the building of embankments and drainage sluices without other measures are effective in protecting vulnerable communities from frequent flooding.

In addition to the specific projects described above, the BFD has been implementing an **afforestation programme** in the coastal areas of Bangladesh since 1960[128]. By 2013, a number of projects under this afforestation programme had established a total of 192,395 ha of mangrove, 8,690 ha of non-mangrove, 2,873 ha of Nypa and 12,127 km of strip plantations in coastal areas[129]. These plantations have been created with the goal to establish sustainable buffer zones that act as shelterbelts, prevent erosion, trap sediment and reduce the potential loss of lives and properties during disaster events.

The proposed project's activities will complement this widespread afforestation initiative by developing climate hazard maps and risk scenarios which will highlight areas most at risk to the impacts of disaster events. Lessons learned from the coastal afforestation initiative will also be valuable for the proposed project. For example, the Plantation Trial Unit Division (PTUD) of the Bangladesh Forest Research Institute (BFRI) has been conducting research on coastal ecosystems in Bangladesh since 1985. This research includes determining the success of nursery and plantation techniques of different mangrove and non-mangrove species. Information such as this will contribute to activities under the proposed project which involve the repair and/or strengthening of degraded embankments.

F. Knowledge management

If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

Effective knowledge management – including the collection, generation and dissemination of information – is an important component of climate change adaptation. Access to current and detailed information on climate trends and adaptation techniques is essential for project stakeholders such as government agencies, agricultural extension services and local communities to effectively and sustainably implement prioritised adaptation interventions. Within the context of the proposed project, knowledge management will comprise an output under Component 4.

Knowledge will be generated, and information collected through *Activity 3.1.1. Establishing farmer field schools and training farmers for innovation and research on climate resilient agricultural practices* along with *Activity 4.2.1. Establishing local innovation and knowledge centres to collect and disseminate innovative adaptation options*. Under these activities, knowledge will be generated on both flood- and drought-resilient crop varieties as well as climate-resilient agricultural livelihood options. Such information will be collected through research and field trials.

Knowledge will be generated, collected, and disseminated through the activities in:
Output 4.2. Knowledge and awareness generated to promote climate resilient approaches and strategies. The activities under this output will build the capacity of:i) agricultural extension staff of the Bangladesh Water Development Board and the Department of Agriculture to promote climate-resilient agriculture in char land communities; and ii) local government

[128]Islam, SA & Rahman M. 2015. Coastal afforestation in Bangladesh to combat climate change induced hazards. Journal of Science, Technology & Environment Informatics 2:13–25.
[129]Hasan, DZ. 2013. Plants in mangroves and coastal afforestation in Bangladesh. Dewan House, Ukilpara, Naogaon-6500, Bangladesh, pp. 164.

representatives on the relevant ecosystem-based and community-based adaptation measures so that they can facilitate the uptake of these measures among char land communities. Lessons learned and best practices on community-based and ecosystem-based adaptation interventions will be collected and disseminated on a regular basis by the local knowledge centres established by the project, as well as by the project offices in each target area. Sharing of project experiences will be supported through: i) attendance of national and provincial climate change and disaster risk management forums; ii) presentations at regional forums and meetings; iii) the organisation of exchange site visits between participating communities; and iv) the development of manuals and training materials. Knowledge on climate change adaptation will be disseminated to schoolchildren and community members. This will be done by training religious leaders and school teachers to disseminate climate change information to schoolchildren and other community members through schools and community awareness programmes. School curricula will also be augmented to incorporate information on climate change. In addition, outreach mechanisms will be established, through *inter alia*: i) project websites; ii) brochures; and iii) public events. These outreach mechanisms will be supported through social media to effectively communicate project updates and disseminate information about climate change impacts and adaptation options.

To facilitate the dissemination of knowledge, there will be a broad range of knowledge products designed and developed, which are likely to include:

- local media news items, including TV, radio, online news websites;
- technical reports;
- briefing papers for policymakers;
- case studies, photo stories and short videos;
- booklets, posters and brochures;
- public and school presentations;
- climate hazard maps;
- evacuation mock drills to prepare for disaster scenarios;
- trainings, meetings, exchange visits and workshops for community members, community leaders, CBOs, and civil authorities regarding climate change and disaster risk reduction; and
- community briefs and guidelines on ecosystem-based adaptation options, rainwater harvesting mechanisms, solar irrigation systems, environmental awareness, and crop diversification.

G. Consultative process

Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

A wide range of stakeholders have been consulted during the development of this project proposal[130].Firstly, the proposed project's Executing Entity, the Ministry of Environment, Forest and Climate Change (MoEFCC) was consulted through the iterative process of refining the project design. Stakeholders that took part in the consultative process also included: i) Bangladesh Water Development Board (BWDB); ii) Housing and Building Research Institute (HBRI); iii) Local Government Engineering Department (LGED); iv) local-level Non-Governmental Organisations (NGOs); v) academic and research institutions; vi) relevant UN agencies; and vii) representatives from the private sector. There was a particular focus on consultation with communities in the target areas of Mujibnagar and Lakshmitari. These

[130]See Annex C for a comprehensive list of stakeholders consulted during site visits.

consultationsspecificallyincluded women and considered the voices of marginalised groups such as landless char dwellers (see Annex C for details of stakeholder consultations).

During the project preparation phase, consultations between national institutions proposing the project (see Annex C) and institutions and communities in the target areas of the project were carried out. Consultations were done through planning workshops, focus group sessions, and semi-structured interviews and meetings. The consulting process contributed to:i) clearly-identifying the roles and responsibilities of the principal participants in the project; ii) guaranteeing their full knowledge regarding the formulation of the project and its objectives; and iii) using the experience and input of participants in defining the project strategy and activities. The details of these consultations are further described below.

H. Justification for funding

Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

Component 1. Climate-resilient households

Baseline scenario (without AF resources)

Households in the char communities of Mujibnagar and Lakshmitari are extremely vulnerable to the climate change impacts of increasing cyclones, floods, saline intrusion and water-stress. This vulnerability is for a number of reasons. Firstly, most houses in these communities have not been constructed to withstand cyclones and floods. Secondly the char dwellers also lack the technical and financial capacity to strengthen their houses adequately. Thirdly, the majority of households do not have access to electricity, which: i) limits the economic opportunities available to char dwellers; and ii) hampers communication before and during climate disasters. These chars are not serviced by the national electrical grid and systemic poverty prevents people from obtaining off-grid solutions. Lastly, many households rely on unsafe drinking water sources, which are frequently contaminated during floods and storm surges as well as through saline intrusion. Overall, households in these char communities are likely to remain extremely vulnerable to climate change, unless they are assisted to make their households more climate resilient. Moreover, with the predicted increases in the impacts of climate change, these households will most likely become even more vulnerable in future.

Additionality (with AF resources)

Under the proposed project, AF resources will be used to assist the most vulnerable households in Mujibnagar and Lakshmitari to make their houses resilient against increasingly severe floods, cyclones, saline intrusion and water-stress. Households will receive technical and material support to strengthen their houses against cyclones and floods. In addition, AF resources will enable the installation of electricity for households from decentralised renewable energy sources, thereby increasing the general capacity of household members to adapt to various climate change impacts. Furthermore, rainwater harvesting systems will be installed to provide safe drinking water that cannot be contaminated by floods, as well as to irrigate home food gardens. For all these activities, AF resources will also be used to train community members to effectively maintain their houses, electricity supply and water systems, as well as to share their knowledge of these climate-resilient technologies and practices with other people in the community.

Component 2. Community-level adaptation interventions

Baseline scenario (without AF resources)

The communities who live on chars are highly exposed to increasingly frequent and intense cyclones and floods. However, there are not sufficiently large and robust shelters against cyclone and flood disasters, the embankments that should help to protect communities against flooding and storm surges are fragile, and the local cyclone preparedness programmes are inadequate in terms of local coverage. In addition, the spatial distribution of climate hazards and vulnerabilities on many chars has not been mapped and communities and local governments consequently do not have the necessary knowledge for climate-resilient planning. As a result, the char communities experience loss of life during cyclones and floods, with assets and livelihoods also impacted negatively. Extreme poverty and limited government capacity and resources means that the necessary infrastructure and services are not being implemented to address the vulnerability of communities to these climate disasters. Without these interventions, the char communities of Mujibnagar and Lakshmitari will remain greatly at risk of cyclones and floods, with the risks expected to increase further with future climate change.

Additionality (with AF resources)

Resources from the Adaptation Fund will be used to implement infrastructure and services that are critical for the reduction of cyclone and flood disaster impacts in Mujibnagar and Lakshmitari. Firstly, cluster houses that double as cyclone and flood shelters will be constructed. These cluster houses will provide permanent housing for the most disaster vulnerable households and will also provide shelter for many additional community members during major disasters. Secondly, AF resources will be used to repair and strengthen embankments and river banks, thereby protecting the char lands against floods, storm surges and river bank erosion. Embankment and river bank works will be combined with the development of a community-based approach to embankment management that can serve as a model for other parts of Bangladesh. Thirdly, comprehensive climate risk maps will be produced for the chars of Mujibnagar, Lakshmitari and six other selected chars/islands to inform climate change responsive planning by the government and communities. Lastly, the preparedness of communities in Mujibnagar for cyclone disasters will be enhanced through: i) the expansion and modernisation of the local Cyclone Preparedness Programme; and ii) implementing floating ambulances to rapidly reach critical patients during cyclones. Taken together, these AF-financed activities will greatly enhance the resilience of char communities against floods and cyclones under climate change conditions. Overall, the project will serve as a model for upscaling by the GoB by promoting a paradigm shift from standard disaster risk reduction to climate resilient development planning.

Component 3. Climate-resilient livelihoods

Baseline scenario (without AF resources)

Currently, char communities in Bangladesh are largely reliant on rain-fed agriculture for their livelihoods. These livelihoods are already vulnerable to water stress, flood events, storm surges and saline intrusion, all of which are predicted to increase in frequency and/or severity as a result of climate change. Communities do not currently have the capacity to implement climate-resilient agricultural practices, or to develop a more diversified livelihood base, because of lacking institutional support, limited local capacity and small economic resources. During climate-induced disaster events, institutional assistance is often limited because a large number of people are affected across the country. Lastly, the poor food security of the unions of Mujibnagar and Lakshmitari makes them extremely vulnerable during long-lasting climate disasters, and communities or individual households often have small food stores.

In Mujibnagar the current impacts of climate change include increased saline intrusion and inundation of agricultural land as a result of storm surges and rising sea levels. These impacts

are projected to increase in severity and scale as a result of climate change. Increased soil salinity as a result of saline intrusion caused by SLR negatively impacts agricultural productivity[131], which is reducing the food security and the income-generation potential of the already vulnerable local farmers[132].

In Lakshmitari Union the socio-economic conditions faced by the local populations are similar to those in Mujibnagar Union; however, the climate change impacts differ. Increasingly erratic rainfall patterns are impacting negatively on agricultural productivity by exacerbating periods of water stress during the Rabi (dry season). Farmers depend on rainfall for their agricultural livelihoods and disruptions to agricultural productivity impact negatively on food security and overall health[133]. This because of the existing vulnerability of these farmers, their small asset base and limited access to mainland markets. Local communities have neither the financial means nor the technical knowledge to establish irrigation systems. Moreover, these communities have limited access to electricity and any irrigation systems would need to be powered with diesel pumps.

As a result of low levels of education and limited financial and technical capacity, the populations of Mujibnagar and Lakshmitari are limited in their ability to adapt to climate change by developing climate-resilient agricultural practices or diversified climate-resilient livelihoods. Without addressing these problems, agricultural livelihoods, economic opportunities and food security will be increasingly affected by saline intrusion, storm surges and water stress under future climate change.

Additionality (with AF resources)

AF resources will be used to improve food security and economic productivity under climate change conditions by:i) developing climate-resilient agricultural practices in Mujibnagar and Lakshmitari through farm field schools that train farmers about climate-resilient cultivars and proven innovative agricultural practices; ii) implementing solar-powered irrigation systems in Lakshmitari; and iii) establishing cold storage facilities in Lakshmitari and Mujibnagar. This will improve both food security and economic productivity in the short-term, and better equip local populations with the knowledge, technical capacity and infrastructure required to maintain agricultural livelihoods as climate change impacts increase in scale and severity. AF resources will also be used to develop diversified livelihood options for particularly vulnerable community members, including those who are unable to engage in agricultural livelihoods because of physical disabilities, landlessness or age. By supporting the development of these livelihoods, AF resources will be used not only to develop the adaptive capacity of the most vulnerable community members but also to help develop alternative climate-resilient skills and industries that will improve the economic productivity of the Mujibnagar and Lakshmitari Unions as a whole.

Component 4. Knowledge management and learning

Baseline scenario (without AF resources)

Char communities have limited knowledge on climate change adaptation options, in particular with regards to the technical aspects of implementing such options. Local government and other agencies often have limited knowledge and capacity to train char communities on climate-resilient practices. These local governments also do not have sufficient knowledge

[131]Clarke, D., *et al*. (2015). Projections of on-farm salinity in coastal Bangladesh. *Environmental Science: Processes & Impacts*, *17*(6), 1127-1136.
[132]Szabo, S., *et al*. (2016). Soil salinity, household wealth and food insecurity in tropical deltas: evidence from south-west coast of Bangladesh. *Sustainability Science*, *11*(3), 411-421.
[133]Islam, A. R. M. T., *et al*. (2014). Drought in Northern Bangladesh: social, agroecological impact and local perception. *International Journal of Ecosystem*, *4*(3), 150-158.

and capacity to incorporate climate risks adequately into their plans and activities in char areas. Beyond the local level, knowledge of the best ways to help char communities adapt to the unique combination of climate vulnerabilities that confront them is also limited. If these knowledge deficits persist as the climate impacts on chars become more severe with future climate change, the responses of communities, government and other actors will become increasingly ineffective.

Additionality (with AF resources)

AF resources will be used for learning, capacity building and knowledge generation and dissemination in order to increase the climate resilience of char communities. This will include: i) building the capacity of local government institutions, the Bangladesh Water Development Board and the Department of Agriculture extension service; ii) establishing local knowledge and innovation centres and effective outreach mechanisms; iii) collecting lessons learned and best practices on community-based and ecosystem-based adaptation options; iv) disseminating knowledge products through a range of media; and v) raising awareness of climate change among school children and community members. Overall, char communities will be equipped with the knowledge to adapt effectively to climate change, and the government will be provided with the knowledge to upscale the approach developed by the project to other char areas.

I. Project Sustainability

Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project / programme.

The proposed project was designed through consultation with government agencies, NGOs, Community Based Organisation (CBOs), donor and partner agencies, and local communities, particularly targeting women and marginalized populations. Findings from household surveys, focus group discussions, key informant interviews, transect walks and participatory rapid appraisals (PRA) were combined with secondary research and analysis of past and ongoing efforts, best practices and lessons learned to inform project design. Based on this analytical groundwork and the pathways to replication and scale established by this project, GoB aims to sustain and scale the project impacts in other islands being targeted for hazard mapping under the project.

The sustainability of the proposed project will be supported by:i) emphasising the active participation of communities in the implementation and management of project interventions; ii) strengthening institutional and technical capacity at regional and community levels to ensure stakeholders have adequate knowledge and skills to maintain the benefits of the project interventions; iii) training communities extensively on climate-resilient agricultural techniques, rainwater harvesting, climate-resilient construction and locally appropriate climate-independent livelihood options; and iv) raising awareness on climate change and climate change adaptation amongst local community members, governments and other stakeholders.

Project interventions have been designed to incorporate both capacity building and physical interventions. All physical interventions have included considerations of sustainability beyond the end of the project funding cycle. Small-scale infrastructure development under the project has been designed to incorporate community-based organisations, which will be trained to maintain infrastructure within their communities. Large-scale infrastructure interventions (Activities 2.2.1, 2.2.2. and 2.4.2) also incorporate community-level management, but maintenance will be funded and supported through national level entities (e.g. BWDB), or through aligned projects (e.g. Cyclone Preparedness Programme).

Under Component 3, the dissemination of climate-resilient agricultural practices will be managed through farmer field schools. These field schools will operate continuously for the duration of the project. This will ensure that there will be scope for extensive training opportunities for the local communities and will support the continuous transfer of knowledge between trainers and farmers. It will also foster collaboration between local farmers attending the field schools, further supporting the transfer of knowledge and skills throughout local communities. To support the long-term sustainability of alternative livelihoods under this component, established local NGOs will be contracted to provide assessments and conduct training and skills development. Partnering with NGOs who have extensive experience working with the target communities will help ensure that the livelihoods are locally appropriate, thereby supporting their long-term sustainability.

To support the sustainability of improved adaptive capacity of the target communities, hazard risk maps will be produced under Component 2. The dissemination of these maps will help to inform communities on the hazards of specific areas. Under Component 4, capacity building activities (Output 4.1) will incorporate the hazard maps produced under Component 2 for increasing the knowledge base of local government on climate risk. In this way, both local communities and institutional bodies will have an improved understanding of the relevant climate hazards and on the areas that are at greatest risk. This will support the incorporation of climate risk factors into development planning and implementation at both institutional and local levels, thereby improving the adaptive capacity of the region as a whole. The project will also develop a strategy to augment local school curricula with climate-related topics. This will ensure that appropriate information on climate change is available for the youth, which will support a shift towards more climate-oriented thinking for subsequent generations of inhabitants within the project areas.

J. Overview of environmental and social impacts and risks

Provide an overview of the environmental and social impacts and risks identified as being relevant to the project / programme.

While the proposed project interventions do not involve large-scale infrastructure developments – such as the construction of sanitary landfills, large-scale wastewater treatment plants, or major highways – they do involve the development and implementation of water management interventions, such as flood control embankments and emergency flood shelters. Since only a few of these water management interventions will be engineered, they are likely to cause only minor to moderate social and environmental impacts. Such impacts will be subject to several stages of screening, using both national- and fund-level standards[134].

At the national level, screening for the design and implementation of development projects in Bangladesh is guided primarily by the country's Environment Conservation Rules (ECR, 1997). The ECR classifies projects into four groups, namely: i) green – the project is likely to have no significant impacts and the implementing agency is not required to submit an Initial Environmental Examination (IEE) or an Environmental and Social Impact Assessment (ESIA); ii) orange A – the project is likely to have low to medium impacts, which can largely be mitigated, and the implementing agency is required to submit a process flow diagram; iii) orange B – the project is likely to have low to medium impacts, which can largely be mitigated, and the implementing agency is required to submit an IEE report; and iv) red – the project is likely to have moderate to high impacts and the implementing agency is required to submit an ESIA report or management plan.

[134] For the social and environmental screening report, please see Annex D.

The Adaptation Fund categorises projects into three major classes: i) A – the project is likely to have significant impacts and the implementing agency is required to submit an ESIA report or management plan; ii) B – the project is likely to have site-specific impacts, that can be readily mitigated, and the implementing agency is required to submit an IEE; and iii) C – the project is likely to have minimal or no adverse impacts and the implementing agency is not required to submit any supplemental examinations or assessments (Figure 16).

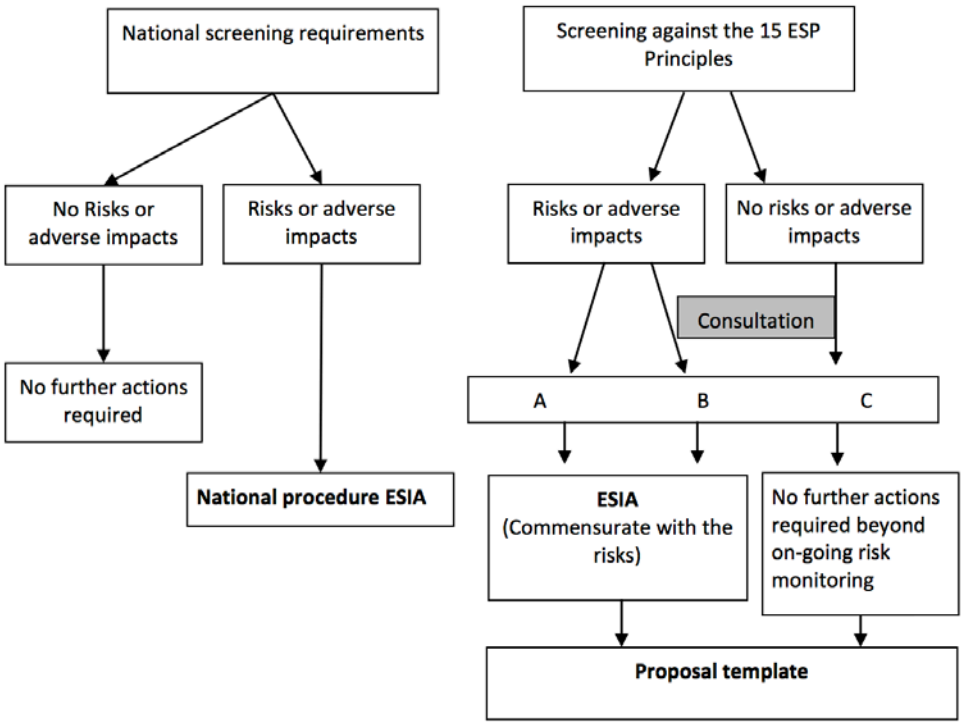


Figure 16. Categorisation of development projects based on environmental and social impacts (Source: Adaptation Fund Board).

Using Adaptation Fund and national criteria, an initial assessment of the project impacts is provided below in Tables 5 and 6. The social and environmental screening report is provided in Annex D, and the Initial Environmental Assessment (IEE) is provided in Annex J.

Following the UNDP Social and Environmental Screening Procedure, the project was assessed as Category B (Moderate), based on the aspects identified in the last column of the Checklist Table below. An Environment and Social Management Framework (ESMF) has been prepared to ensure that all risks are managed appropriately and therefore mitigated (the ESMF is presented in Annex J). A summary of the risks and the potential impacts for each item in the Checklist Table is provided in Section C.

Table 5. Initial screening criteria and assessment.

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law	X	
Access and Equity	X	

Marginalized and Vulnerable Groups		X
Human Rights	X	
Gender Equity and Women's Empowerment	X	
Core Labour Rights	X	
Indigenous Peoples	X	
Involuntary Resettlement		X
Protection of Natural Habitats	X	
Conservation of Biological Diversity	X	
Climate Change	X	
Pollution Prevention and Resource Efficiency	X	
Public Health	X	
Physical and Cultural Heritage	X	
Lands and Soil Conservation		X

PART III: IMPLEMENTATION ARRANGEMENTS

A. Implementation arrangements

Describe the arrangements for project / programme implementation.

The project will be implementing following UNDP's National Implementation Modality (NIM).

As Multilateral Implementing Entity, UNDP will be responsible for independent project oversight and implementation support through specialized technical support services and quality assurance throughout the project funding cycle. Details of services covered by the MIE fee are listed in Annex N. UNDP provides a three-tier oversight and quality assurance roles, which will include: i) day-to-day oversight of project quality, timeliness and safeguard standards; ii) oversight of project completion; and iii) oversight of project accounting and reporting. This will ensure that appropriate project management milestones are managed and completed. Such oversight will be carried out by the UNDP Country Office in Bangladesh, the UNDP Global Environmental Finance Unit in the Bangkok Regional Hub, and the UNDP Headquarters in New York.

The **Executing Entity** for this project will be Bangladesh's Department of Environment (DoE) under the Ministry of Environment, Forest and Climate Change (MoEFCC). The project will be executed in compliance with Government of Bangladesh and UNDP rules and regulations, policies and procedures, following the NIM/NEX guidelines/modalities. DoE under the MoEFCC will be responsible and accountable for the execution of the project, including ensuring that the objectives and components of the project are delivered, and for the effective use of project resources.

To assist with successfully delivering project outcomes and components, the following **Responsible Parties** will enter into agreements with DoE, MoEFCC:

Table 6. The Responsible Parties for each project component.

Components	Responsible Parties	Modality
Resilient housing	NGO/Firm	The National Project Director (NPD) in consultation with UNDP will award a contract to a competent NGO or Firm using Public Procurement Rules (PPR), 2006.
Nano-grid installation, solar storage and irrigation	NGO/ Firm	The National Project Director (NPD) in consultation with UNDP will award a contract to a competent NGO or Firm using Public Procurement Rules (PPR), 2006.
Rainwater Harvesting	NGO/Firm	The National Project Director (NPD) in consultation with UNDP will award a contract to a competent NGO or Firm using Public Procurement Rules (PPR), 2006.
Climate-resilient infrastructure/cyclone shelters	NGO/Firm	The National Project Director (NPD) in consultation with UNDP will award a contract to a competent NGO or Firm using Public Procurement Rules (PPR), 2006.
Embankments and local management arrangement	BWDB	DoE will enter into an LoA with BWDB and a community-based organisation.
Expansion of early warning	CPP/DDM	DoE will enter into an LoA with DDM.
Climate-resilient livelihoods including skills and technology	NGOs with support from LGIs	A committee will be formed under the NPD with representatives from MoEFCC, DoE, UNDP, DLS, DAE, LGIs and UNDP. NPD will award contract on the basis of the recommendation of the committee NPD will award a contract to a competent NGO following government rules and regulations.
Solar irrigation pumps, community level nano-grids	Firm	NPD will procure goods and services on the basis of public procurement rule (PPR), 2006 and/or UNDP's procurement policy
Capacity of LGIs, BWDB, DAE	BWDB, DAE and National Institute of Local Government	Capacity-building/training will be provided by the NPD in consultation with PIC

NGO/Firm selection committee: A NGO/Firm selection committee will be formed, which will be headed by the NPD with representation from MoEFCC, BFD, BWDB, DDM, DAE, DLS, relevant local government institutions, experts and UNDP.

The project implementation will be governed by a **National Project Steering Committee** (NPSC) or National Steering Committee (NSC), which will consist of a group of representatives responsible for making consensus-based strategic, policy and management decisions for the project. The NPSC will oversee the project implementation, review compliance with the GoB, UNDP and AF requirements, and ensure the implementation of the management plan for the risks identified. Every six months – and/or earlier if an urgent strategic decision is to be made – the PSC will meet to discuss project progress and stakeholder performance. The NPSC will be comprised of (Figure 17) relevant stakeholders with following due procedures of the Government of Bangladesh.

- Secretary, Ministry of Environment, Forest and Climate Change will chair the National Project Steering Committee (NPSC) who will provide overall policy guidance regarding the implementation of the project.

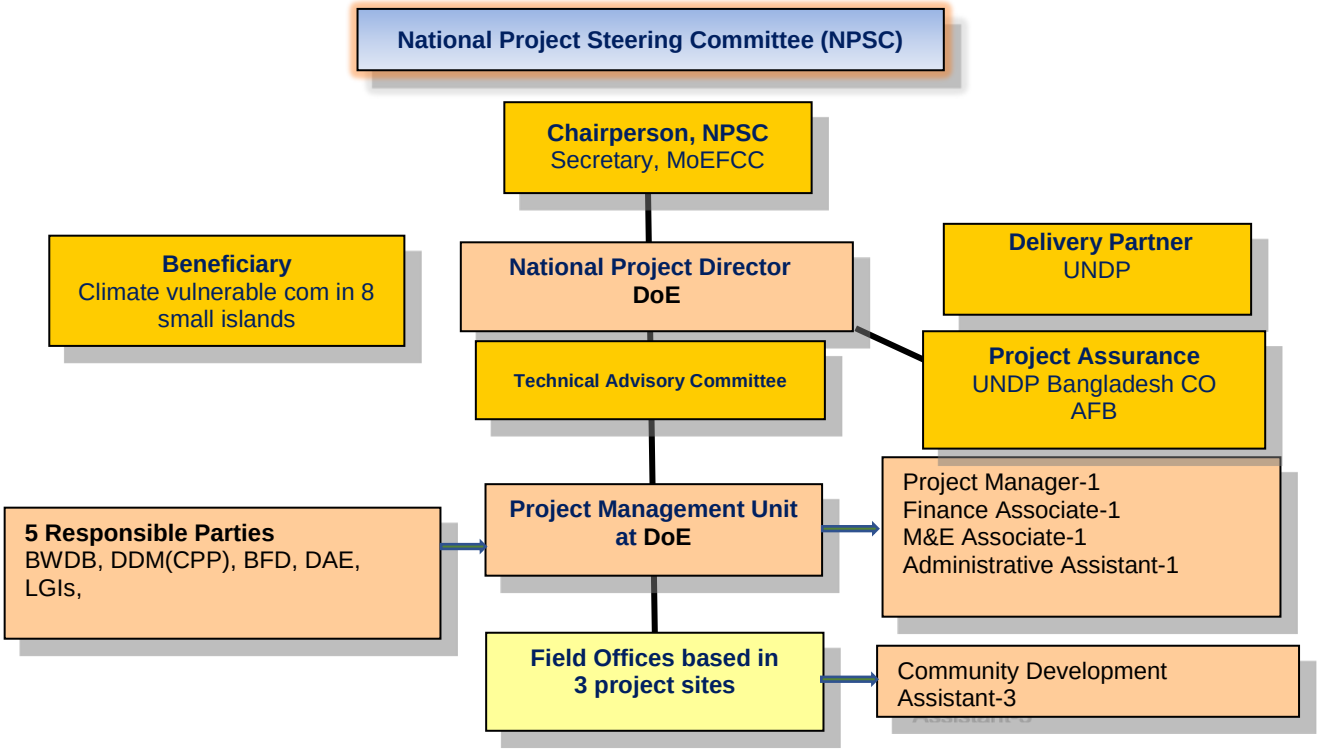
- **Responsible Parties** will be the key partners of the govt who will support delivery of project components. Five key responsible parties will be (i) Bangladesh Water Development Board (BWDB), (ii) Cyclone Preparedness Programme(CPP) under Department of Disaster Management (DDM),(iii) Bangladesh Forest Department(BFD), (iv) Department of Agriculture Extension(DAE), and (v) Local Government

Institutions(LGIs). They will ensure the realisation of project benefits and sustainability from the perspective of project beneficiaries.

- A **Delivery Partner** representative who will provide guidance regarding the technical feasibility of the project, compliance with development partners requirements and rules pertaining to the use of project resources. This role will be fulfilled by UNDP.
- A **Project Assurance Team** that will provide project guidance and oversight. This role will be fulfilled by MOEFCC and UNDP.
- **Technical Advisory Committee** will provide technical support to the National Project Steering Committee to ensure technical specification and quality of project's development intervention. This committee will be headed by Director General, Department of Environment.
- **Project Beneficiaries** will be the beneficiaries of eight islands and they will be benefitted from the project intervention.
- A **Project Management Unit** (PMU) that will be responsible for the development and implementation of all the components of the project. The PMU will consist of:
    - A National Project Director, will be nominated from DoE by MoEFCC, who will be responsible for the overall direction, strategic guidance and timely delivery of project outputs;
    - A Project Manager, recruited by UNDP in consultation with NPD, who will manage the implementation and day-to-day operation of the project under the direct supervision of NPD and will be accountable to UNDP;
    - A Technical Team, recruited by UNDP in consultation with NPD, that will: i) develop programme standards; ii) provide technical support and guidance; iii) implement the policy research, dialogue and advocacy components of the project; iv) guide the implementation of social, gender, and environmental safeguards plans; v) implement capacity-building, knowledge management and communications activities; and vi) monitor project progress and support project M&E.
    - An Operations Team, recruited by UNDP in consultation with NPD, that will manage finance, general administration, procurement, internal auditing and risk management functions of the project. This role involves: i) managing funds; ii) programme quality assurance; iii) fiduciary risk management; iv) procurement; and v) the timely delivery of financial and programme reports to AF.

- **Other Representatives** which will include representatives from: i) Local Government Division; ii) Rural Development and Cooperatives Division; iii) Ministry of Agriculture; iv) Ministry of Fisheries and Livestock; v) Ministry of Planning; vi) Ministry of Finance; vii) Implementation, Monitoring and Evaluation Division; viii) Bangladesh Forest Research Institute; ix) Local Government Engineering Department; ix) Universities and Research Institutes, and x) NGO/private sector representatives.

Figure17. The National Project Steering Committee.



B. Financial and project risk management

Describe the measures for financial and project / programme risk management.

Financial and project management will be conducted according to UNDP's Programme and Operations Policies and Procedures to ensure that financial and project risks are mitigated. In addition, the Government of Bangladesh's strong commitment to supporting the implementation of project interventions will limit the risks of the proposed project. However, there are several underlying project assumptions which, if not met, may contribute to the limited achievement of the project's objectives. These assumptions are presented below.

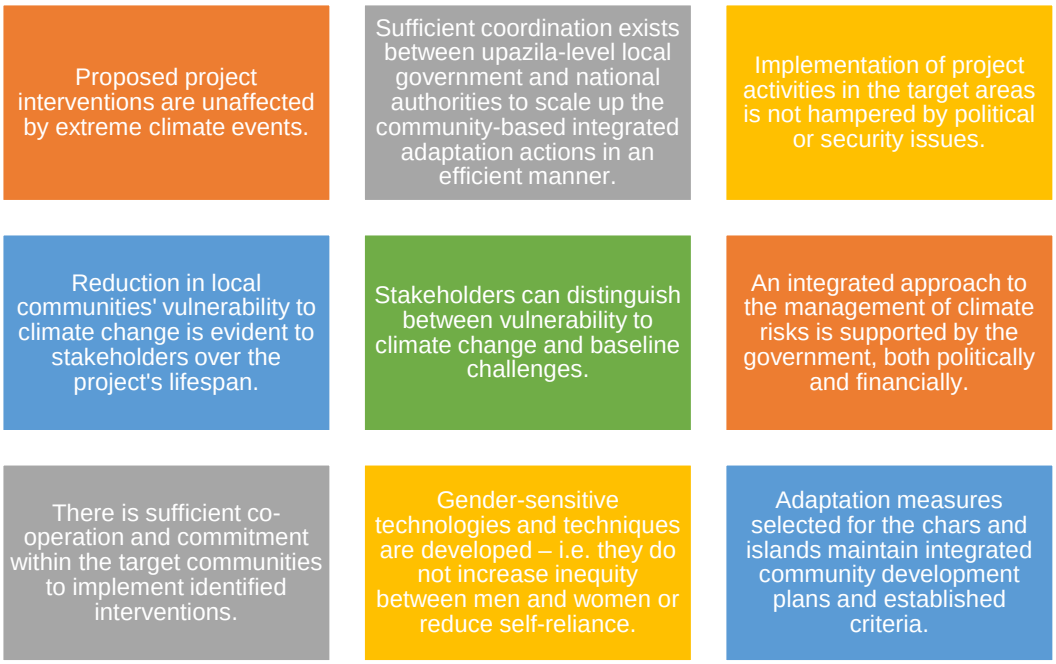


Figure 18. Underlying assumptions that must be met for successful achievement of the project objective.

Detailed financial and project risks related to the above-mentioned assumptions, as well as associated mitigation strategies identified, are outlined in Table 7 below. During regular project review meetings, in which UNDP will be an active participant, all risks and mitigation measures will be reviewed and updated as per established practices.

Table 1. Financial and project risk management measures for the proposed project, including risk ratings.

Risk no.	Identified risk	Type	Risk rating	Mitigation measures
1.	Identifying climate-resilient livelihood options that are suitable to the condition of the vulnerable people.	Programme Management	Medium	Success of the assignment will depend mostly on the identification of innovative livelihood options that will be suitable considering local, social, economic, ecological and climatic conditions and will be accepted by the local communities. Capacity of the vulnerable people will be carefully assessed and lessons from other projects will be reviewed and made available to the people to select from a range of options.
2.	Uncertainty regarding the intensity of climatic events that may affect the project interventions, including housing and infrastructure.	Strategic	Medium	The project will utilise all climate scenarios and invest in down-scaling them for the islands in the Bay of Bengal. The risk information will be used to design the interventions, especially for infrastructure and houses. Communities will be trained to switch their livelihoods depending on the changing climate. Local government and extension officials will also be trained.
3.	Current and predicted climate variability and/or extreme climate events negatively	Operational	Medium	• The project will integrate the two outputs focusing on hazard risk scenarios and early warning communication to enable strong preparedness planning.

	impact timeline of the project.			• Activities under relevant outputs will be implemented early in the project's lifespan so that the potential impacts of extreme climate events are minimised. A business continuity plan will be in place.
5.	Influence of government and local political leaders in selection of beneficiaries.	Political	Medium	• In the project preparation phase, extensive consultation sessions have been conducted with government officials, including high-level officials of the ministries in Dhaka, confirming their commitment to the successful implementation of the project. • Continuing stakeholder consultation and involvement will be undertaken to ensure that government agencies maintain their commitment to project implementation. • Government will issue a guideline on selection criteria and a Grievance Redressal Mechanism will be established.
6.	Capacity constraints of local communities and other stakeholders may limit the ability to undertake the implementation of proposed interventions.	Institutional	Medium	• The proposed project focuses on a community-based and participatory approach. • Human resource capacity will be developed in all targeted areas. • Local adaptation measures will be specifically tailored to the communities which will implement them.

C. Environmental and social risk management

Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy of the Adaptation Fund.

Environmental and social impacts and risks have been identified for the proposed project (Part II: J). The table below describes risks and impacts management for the proposed project in accordance with the Environmental and Social Principles of the AF.

Table 8. Environmental and social risk management.

Checklist of environmental and social principles	Potential impacts and risks	Mitigation measures
Compliance with the Law	No appreciable risk	The involvement of government entities in the selection of adaptation interventions and technical design will ensure that all relevant laws will be considered during project implementation. Once implemented, the monitoring of adaptation interventions will provide a means of tracking their alignment with national laws for the duration of the project.

Checklist of environmental and social principles	Potential impacts and risks	Mitigation measures
Access and Equity	The beneficiaries of the proposed project are poor people in vulnerable communities who are often not integrated into decision-making processes. There is, therefore, a risk that certain community members may benefit more than others. This may result in both intra- and inter-community conflicts.	This risk will be mitigated through the beneficiary selection approach (Annex B), and the incorporation of community consultation for all interventions that do not achieve complete coverage of the target populations. Furthermore, both beneficiary and non-beneficiary communities will be sensitised towards the approach of prioritising the support from the proposed project to the most vulnerable communities. A grievance mechanism (see Annex J) has also been developed to support any community members who feel they are experiencing discrimination.
Marginalised and Vulnerable Groups	There is a risk that vulnerable and marginalised groups will be excluded during the implementation of project activities and have insufficient access to the associated benefits.	The proposed project has been designed to ensure that marginalised and vulnerable groups – especially women and people living with disabilities – will not be adversely affected by, but will instead benefit from, relevant climate change adaptation activities. Community consultations have been incorporated for all activities that do not achieve complete coverage of the target population. This will allow for the identification of marginalised and vulnerable households.
Human Rights	No activities are, or will be, included in the design of the proposed project that are not in line with established international human rights. Moreover, the proposed project will promote the fundamental human rights of access to food, water and information.	The project seeks to ensure that benefits of the project are shared broadly in a non-discriminatory, equitable manner through participatory processes and transparent selection criteria. Extensive stakeholder consultations were held during project preparation (Annex C) and will be continued throughout project implementation.
Gender Equity and Women's Empowerment	The proposed project is targeting communities where men occupy the majority of the leadership positions. There is, therefore, a risk that women will not benefit equitably from the proposed project's climate change adaptation and capacity-building interventions.	Gender equity and women's empowerment were considered across all relevant design aspects of the proposed project and gender equity will be adhered to throughout the implementation period. To this end, a gender assessment was conducted during the development of the proposal to ensure that gender considerations were fully considered during project design (see Annex I). In particular, equal rights, responsibilities, opportunities and access of women to the benefits of climate change adaptation have been considered. For example, project activities that target the most vulnerable community members (Activities 2.1.1. and 3.2.1.) are prioritised towards women-led households. For technical assessments, as well as capacity-building activities, women will be strongly encouraged to participate.

Checklist of environmental and social principles	Potential impacts and risks	Mitigation measures
Core Labour Rights	Local communities will be involved in the implementation and maintenance of climate change adaptation interventions. Therefore, local community members may be exposed to the risk of accidents while implementing the proposed project's climate change adaptation interventions.	During implementation, the National Project Steering Committee and Management Units will ensure respect for international and national labour laws and codes, for any work that may be carried out in relation to the project. This includes the eight International Labour Organisation Convention (ILO) core labour standards related to fundamental principles and rights of workers, as well as ILO Convention No. 169, which concerns rights of indigenous and tribal peoples. Prioritisation of women participation may be used to provide fair and equal opportunity for women to seek employment as labourers. All forms of negative discrimination in respect of employment and occupation will be eliminated. The proposed project will not engage in child labour in any of its activities. All forms of forced or compulsory labour will be eliminated.
Indigenous Peoples	No appreciable risk	No mitigation necessary.
Involuntary Resettlement	There is a low risk that houses have been constructed in areas that conflict with the infrastructure interventions under Component 2 (Specifically Output 2.1). This may result in temporary resettlement while infrastructure interventions are completed.	The project will ensure that in-depth consultations are conducted with any households that may be at risk of requiring resettlement. The possibility of involuntary resettlement has been considered for the repair of embankments and a resettlement policy has been prepared for this possibility (see Annex K). Any involuntary relocation or resettlement will only be conducted after extensive community consultation and negotiation with any affected households. Benefits including reimbursement for the cost of the house, further livelihood support and provisioning of new land will all be included in any negotiated package. A grievance mechanism has also been developed (see Annex J) and will be in place to address any concerns of affected community members.
Protection of Natural Habitats	On-the-ground adaptation interventions (specifically EbA) will include the planting of species for enrichment and/or restoration of ecosystems. This could lead to long-term alteration of natural habitats in terms of species assemblages and structure, which may result in various disturbances and negative environmental impacts.	The promotion of EbA interventions through the proposed project is more likely to result in the restoration, improved management and protection of natural habitats, as well as the strengthened supply of ecosystem goods and services. To ensure that this principle is adhered to, the consultation with and inclusion of relevant stakeholders (community and authority level) during project design and implementation is prioritised. All necessary impact assessments will be conducted before the implementation of interventions. Furthermore, all national environmental laws will be respected during the selection and implementation of adaptation interventions.

Checklist of environmental and social principles	Potential impacts and risks	Mitigation measures
	Adaptation interventions involving hard infrastructure will also be constructed – for example, the rehabilitation of damaged embankments (Activity 2.1.2.). Such interventions may result in the disturbance of small areas of natural habitat.	
Conservation of Biological Diversity	There is a low risk that adaptation interventions involving the construction of hard infrastructure – for example, the rehabilitation of damaged embankments (Activity 2.1.2.) could negatively impact biodiversity.	The project will ensure the conservation and sustainable use of biological diversity factors are considered in the process of finalising adaptation interventions. Adaptation intervention sites (specifically under Activity 2.1.1.) will be selected using a participatory approach and input from an environmental expert to ensure that activities do not cause significant loss of biological diversity.
Climate Change	No appreciable risk	No mitigation measures necessary
Pollution Prevention and Resource Efficiency	No appreciable risk	No mitigation measures necessary
Public Health	No appreciable risk	No mitigation measures necessary
Physical and Cultural Heritage	No appreciable risk	No mitigation measures necessary
Lands and Soil Conservation	Risks have been identified that are associated with the grey infrastructure interventions (Output 2.2.). These interventions include raising houses on plinths, repairing flood protection embankments and the construction of dual-purpose cluster house/storm shelters.	The project will ensure that all relevant environmental codes and standards will be followed during the design and construction of the grey infrastructure interventions. To comply with both national legislation and the Environmental and Social Principles of the Adaptation Fund, it is recommended that a comprehensive ESIA is undertaken at selected sites and an EMP commensurate with the identified impacts is developed prior to the construction of any greyinfrastructure.

Where required, an Environmental Management Plan for some of the project's on-the-ground activities will be developed and implemented (see Part II Section J and Annex J). Appraisal of the project activities will be based on a detailed quality programming checklist – formulated and approved by national stakeholders – to ensure that all necessary, country-specific safeguards are addressed and incorporated into the project design.

Compliance with the Environmental and Social Policy of the Adaptation Fund

The project will comply with the Environmental and Social Policy of the Adaptation Fund as described in Part II: Section J. As the Adaptation Fund-accredited Implementing Agency, UNDP – together with the relevant national partners – will ensure that the project follows the procedures outlined in the Environment and Social Policy of the Fund. This includes, for example, the requirement that all project activities reflect local circumstances and needs and draw upon national actors and capabilities. The proposal has been screened according to the UNDP Social and Environmental Safeguards Procedure to ensure that necessary safeguards are incorporated into the project design. This includes quality assessment and social and environmental safeguards.

D. Monitoring and evaluation arrangements

Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

A comprehensive Monitoring and Evaluation (M&E) plan will be developed, which will be distributed and presented to all stakeholders during the Inception Workshop. To manage the M&E plan, anM&E Associate will be appointed in the Project Management Unit.The M&E plan will consist of four different elements of M&E which are outlined below:

- **Impact M&E.** Through impact M&E, information will be gathered as per Result and Impact Management System (RIMS) indicators, which include *inter alia*: i) increases in household assets; ii) enhanced food security; and iii) reduced malnutrition among children less than 5 years. RIMS surveys will be conducted three times –at the beginning of the project, in the mid-term review, and for the terminal evaluation.
- **Outcome M&E.** This monitoring and evaluation will gather information on log-frame indicators that are not covered sufficiently in the RIMS survey. This type of M&E is specifically aimed at collecting evidence of an effective 'results chain' that shows improvements in the physical environment after project implementation. Such improvements may include, for example: i) reduced flooding; ii) reduced soil salinity; iii) increased soil nutrients; and iv) improved access to and use of technologies, which together could result in:i) increased crop yields; ii) increased agricultural sales; iii) improved food security; and ultimately iv) reduced poverty.
- **Process M&E.** Through Process M&E, a system of participatory monitoring and evaluation (PME) will be developed to generate feedback from project beneficiaries. Such feedback will provide the project management team with valuable information on the efficacy of the implementation of project activities and the delivery of project outputs. This process monitoring will also include an assessment on the effectiveness of the project's training and capacity-building efforts. Such an assessment will be executed through Knowledge, Attitude and Practices (KAP) surveys.
- **Activity M&E.** To assess the efficacy of each activity, the project management unit will produce progress reports. These reports will be based on all available information on project activities, which will be recorded regularly in a computerised MIS System. Every six months, a progress report will outline physical and financial progress against the project targets. An Annual Project Progress Review (PPR) will be prepared to monitor progress made since the project's start.

Activity M&E shall include followings:

Project start:

A Project Inception Workshop will be held within the first 2 months of project start with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and programme advisors as well as other

stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

The Inception Workshop should address a number of key issues including:

a) Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis à vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.

b) Based on the project results framework, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.

c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.

d) Discuss financial reporting procedures and obligations, and arrangements for annual audit.

e) Plan and schedule Project Board meetings or National Steering Committee meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 12 months following the inception workshop.

An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly:

The following will be undertaken on a quarterly basis:

- Progress made shall be monitored in the UNDP Enhanced Results Based Management Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP AF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).
- Based on the information recorded in Atlas, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs can be used to monitor issues, lessons learned etc. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annually:

The project is required to submit a Project Performance Report (PPR) to the donor on an annual basis, one year after the start of project implementation (date of inception workshop) and the last such report should be submitted six months after project completion

The PPR completed template should be submitted to the secretariat in English and that all financial figures provided in the template should be in US dollars (USD). There are 8 sections in the template, as follows:

1. Overview
2. Financial information
3. Procurement data
4. Risk assessment
5. Ratings
6. Project indicators
7. Lessons learned
8. Adaptation Fund results tracker

Periodic Monitoring through site visits:

UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no later than one month after the visit to the project team and Project Board members.

Mid-term of project cycle

The project will undergo an independent Mid-Term Evaluation at the mid-point (in the third year) of project implementation. The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; it will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-EEG. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC).

End of Project:

An independent Final Terminal Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and AF guidelines. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of adaptation benefits. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-EEG

The Final Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC).

During the last three months, the project team will prepare the Project Final Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Audit

The audit would be performed under the UNDP financial regulations and rules applicable to audit policies on UNDP projects.

Learning and knowledge sharing:

Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.

The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.

Finally, there will be a two-way flow of information between this project and other projects of a similar focus.

Communications and visibility requirements:

The AF logo should appear on all relevant publications of the Project, included within other logos, project equipment and other acquisitions with AF funds. Any citation in publications regarding projects funded by the AF should give recognition to the AF. The logos of the implementing agencies and enforcement agencies will also appear on all publications. Full compliance is required with UNDP's Branding Guidelines. These can be accessed at http://intra.undp.org/coa/branding.shtml, and specific guidelines on UNDP logo use can be accessed at: http://intra.undp.org/branding/useOfLogo.html.

The M&E activities will make use of the Adaptation Tracking and Measuring Framework (ATM)developed by UNDP for theLoGIC project in Bangladesh[135]. Periodic monitoring will be conducted through visits to the intervention sites undertaken by relevant staff from UNDP. Visits will be jointly conducted based on the agreed schedule to assess project progress first hand.

A summary of the M&E costs is provided in Table 9 below.

Table 9. Monitoring and evaluation costs of the proposed project. Note: The costs indicated here do not include the costs associated with UNDP staff.Such costs will be covered by the MIE fee.

Type of M&E activity	Responsible parties	Budget US$ (excluding project team time)	Total Cost US$	Timeframe
Direct Project Monitoring and Quality Assurance including progress and financial reporting, project revisions, technical	Project Managers Finance cum Admin Associate UNDP	(supported from staff costs included in Project execution, and from IE fee)		Quarterly, half-yearly and annually and as needed

[135]LoGIC is a multi-donor collaborative initiative of GoB, UNDP, UNCDF, EU and SIDA. See http://www.bd.undp.org/content/bangladesh/en/home/operations/projects/environment_and_energy/local-government-initiatives-on-climate-change.html

assistance and risk management	External consultants – CTA			
Evaluations, assessments including terminal evaluation	Project Managers UNDP External consultants	90,000	90,000	During and end of project implementation
Terminal Report (Collection of lessons learned from the mid-term and terminal evaluations to be compiled in a report and disseminated to local-and-national-level government and policymakers)	Project Managers UNDP External consultants	10,000	10,000	At end of project implementation
NIM Audit as per UNDP audit policies	Project managers UNDP	Project site 1: 12,500 (2,500 annually) Project site 2: 12,500 (2,500 annually)	12,500 12,500	Annually at year end
Inception meeting, field visits and steering committee meetings	Project managers UNDP	Project site 1: 12,500 (2,500 annually) Project site 2: 12,500 (2,500 annually)	12,500 12,500	Inception meeting within first 2 months and bi-annual PSC meetings
TOTAL indicative cost Excluding project team staff time and UNDP staff and travel expenses		**US$ 150,000**	**150,000**	

E. Results Framework

Include a results framework for the project proposal, including milestones, targets and indicators.

Expected outcome/outputs	Output indicator	Baseline	Target	Sources of verification	Assumptions
Output 1.1. Cyclone and flood resilient houses for the most vulnerable households.	Number of houses made resilient against climate disasters (cyclones and floods)	0	900 houses retrofitted in Mujibnagar and Lakshmitari	Registers of project beneficiaries at each site, site visits, household surveys and project reports.	Community preference and resilient technical design is within the project's budget limit, and no significant increase of price of materials.
Output 1.2. Community-level nano-grids installed for electrification to enhance adaptive capacity	Number of nano-grids installed and operational.	0	30 nano-grids installed and made operational to provide electricity to 300 – 450 houses.	Registers of project beneficiaries at each site, site visits, household surveys and project reports.	Collaboration between communities, project partner NGOs, local government and other stakeholders. Community groups trained by project successfully operate and maintain the nano-grids.
Output 1.3. Locally appropriate rainwater harvesting systems forsafe drinking water.	Number of household rainwater harvesting systems installed and operational. Number of water user groups established and trained.	0	500 households provided with functioning and climate-resilient rainwater harvesting systems 10 water user groups established and trained	Registers of project beneficiaries at each site, site visits, household surveys and project reports.	Water user groups and household members trained by project successfully operate and maintain the rainwater harvesting systems.
Output 2.1. Climate-resilient mini-disaster shelter/cluster houses built to protect life and prevent asset loss.	Number of dual-purpose cluster house/disaster shelters constructed and in use.	0	16 dual-purpose cluster house/disaster shelters constructed and in use. (Minimum 50% of beneficiaries will be women-led households)	Registers of project beneficiaries at each site, site visits, and project reports. Project reports and site visits.	When Khas land is not available, community is willing to allocate the land.

Expected outcome/outputs	Output indicator	Baseline	Target	Sources of verification	Assumptions
Output 2.2. Embankments repaired and innovative model for community embankment management introduced.	Km of damaged embankments repaired/ strengthened. Km of riverbank strengthened. Number of community embankment management groups established	0	12.5 km of embankments repaired/strengthened in Mujibnagar 14.5 km of riverbank strengthened in Lakshmitari 1 community embankment management group established at each project site.	Project reports and site visits.	The lessons from the community management practices of embankment are well documented and owned by Ministry of Water Resources for change in practice.
Output 2.3. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.	Km^2 of char areas mapped Number of householdsin Mujibnagar receiving periodic updates during cyclone risk periods	0	8 climate hazard and vulnerability maps covering selected islands in the Bay of Bengal Every household in Mujibnagarhas at least one member receiving periodic early cyclone warnings during cyclone risk periods.	Registers of project beneficiaries at each site, site visits, and project reports.	The community risk assessment and risk reduction plans are within the capacity of the local government to integrate into their plans and budget.
Output 2.4. Cyclone Preparedness Programme (CPP) modernised and expanded to provide timely cyclone early warning and response at scale.	Number of CPP volunteers trained Existing cyclone shelters in Mujibnagar provisioned with CPP equipment	0	~2,500 CPP volunteers trained in Mujibnagar (increase female representation in CPP by at least 25%) 10,000 CPP volunteers trained on six additional islands 7 existing cyclone shelters and 16 cluster houses provisioned with CPP equipment in Mujibnagar.	Project reports and site visits.	Community engages in CPP and community members volunteer for the programme.

Expected outcome/outputs	Output indicator	Baseline	Target	Sources of verification	Assumptions
			~2,500 CPP volunteers provided with personal cyclone preparedness equipment 8 mobile floating medical unit procured and provisioned 6 additional islands equipped with CPP Equipment		
Output 3.1 Climate-resilient agriculture implemented	Number of field schools held Number of people trained in climate-resilient agricultural practices Number of cold storage units installed and operational Hectares of agricultural land irrigated	0	Quarterly field school trainings held in Mujibnagar and Lakshmitari for a total of 64 field school trainings. (include at least 25% female representation, but aim is for minimum of 50%) ~7,500 farmers trained on climate-resilient agricultural practices. 2 cold storage units installed in Mujibnagar and 2 cold storage units installed in Lakshmitari 80 hectares of land irrigated in Lakshmitari	Registers of project beneficiaries at each site, site visits, household surveys and project reports.	Collaboration between communities, project partner NGOs, local government and other stakeholders.
Output 3.2 Diversified livelihoods supported at the village level.	Number of people provided with technology, skills and materials to make their livelihoods climate resilient.		~6,500 people provided with technology, skills and materials to make their livelihood climate resilient. (minimum 50% female beneficiaries)		Collaboration between women cooperatives, communities, project partner NGOs, local

Expected outcome/outputs	Output indicator	Baseline	Target	Sources of verification	Assumptions
					government and other stakeholders.
Output 4.1. Local government institutions are capable of climate risk-informed planning and implementation.	Number of staff from local government institutions, Bangladesh Water Board and Department of Agriculture trained.	0	250 staff from local government institutions, Bangladesh Water Board and Department of Agriculture trained to incorporate climate risk into their decisions and activities.	Project reports	
Output 4.2. Knowledge and awareness generated to promote climate resilient approaches and strategies	Number of adaptation innovation centres established Number of people reached by awareness raising campaigns Number of knowledge products developed	0	2 Adaptation innovation centres established in each of the project locations 75% of the population in the target areas reached by awareness campaigns (minimum 50% women) 10 manuals and brochures developed.	Project reports. School visits, site visits and household surveys and national newspaper.	

F. Alignment with Adaptation Fund Results Framework

Demonstrate how the project / programme aligns with the Results Framework of the Adaptation Fund

Project Objective(s)[136]	Project Objective Indicator(s)	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
To enhance the climate resilience of vulnerable communities who live on coastal and riverine chars in Bangladesh.	Enhanced climate resilience of vulnerable communities in the Mujibnagar and Lakshmitari Unions.	**Outcome 1:** Reduced exposure to climate-related hazards and threats	**1.** Relevant threat and hazard information generated and disseminated to stakeholders on a timely basis	9,995,369
		Outcome 4: Increased adaptive capacity within relevant development sector services and infrastructure assets	**4.2.** Physical infrastructure improved to withstand climate change and variability-induced stress	
		Outcome 6: Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas	**6.2.** Percentage of targeted population with sustained climate-resilient alternative livelihoods	
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**
Outcome 1. Enhanced climate resilience of households through climate-resilient housing, electrification and climate-proof water provisioning	Number of households with increased resilience through strengthened houses, electrification and water provisioning.	***Output 4:*** Vulnerable development sector services and infrastructure assets strengthened in response to climate change impacts, including variability	**4.1.2.** No. of physical assets strengthened or constructed to withstand conditions resulting from climate variability and change (by sector and scale)	2,007,828
Outcome 2. Increased climate resilience of communities through infrastructure that is resilient to cyclones and floods, climate risk mapping and inclusive	Number of people with increased resilience through strengthened disaster infrastructure.	***Output 1.2:*** Targeted population groups covered by adequate risk reduction systems	**1.2.1.** Percentage of target population covered by adequate risk-reduction systems	2,317,726

[136] The AF utilized OECD/DAC terminology for its results framework. Project proponents may use different terminology, but the overall principle should still apply.

cyclone preparedness				
Outcome 3. Improvedincome and food security of communities by innovating and providing assistance to selected households for climate-resilient livelihoods practices	Number of people with provided with improved climate resilient livelihoods	***Output 6:*** Targeted individual and community livelihood strategies strengthened in relation to climate change impacts, including variability	**6.1.1**.No. and type of adaptation assets (tangible and intangible) created or strengthened in support of individual or community livelihood strategies	3,397,068
Outcome 4. Enhanced knowledge and capacity of communities, government and policymakers to promote climate resilient development on chars.	Number of people reached by knowledge products and awareness raising	***Output 3***: Targeted population groups participating in adaptation and risk reduction awareness activities	**3.1** No. of news outlets in the local press and media that have covered the topic	614,700

G. Detailed budget

Include a detailed budget with budget notes, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

Award ID:	TBA					**Project ID:**	TBA					
Award Title:	ADAPTATION INITIATIVE FOR CLIMATE VULNERABLE OFFSHORE SMALL ISLAND AND RIVERINE CHARLAND IN BANGLADESH											
Business Unit:	BGD 10											
Project Title:	ADAPTATION INITIATIVE FOR CLIMATE VULNERABLE OFFSHORE SMALL ISLAND AND RIVERINE CHARLAND IN BANGLADESH											
PIMS no.	6172											
Implementing Partner (Executing Agency)	Ministry of Environment, Forest and Climate Change (MoEFCC)											
Outcome	**Responsible Party/ Implementing Agency**	**Fund ID**	**Donor Name**	**Budget Account Code**	**Budget Account Description**	**Amount Year 1**	**Amount Year 2**	**Amount Year 3**	**Amount Year 4**	**Amount Year 5**	**Total**	**Budget note**
						USD	**USD**	**USD**	**USD**	**USD**	**USD**	
Outcome 1. Enhanced climate resilience of households through disaster-resilient housing, electrification and climate-proof water provisioning	UNDP	62040	AF	71300	Local/National Consultants	26,500	13,000	10,500	3,000	2,000	55,000	1C; 1E; 1G; 1J; 1L
				72100	Contractual Services-Companies	131,566	135,631	135,631	0	0	402,828	1D; 1I
				72300	Materials and Goods	612,000	459,000	459,000	0	0	1,530,000	1A
	MoEFCC			75700	Training, Workshops and Conferences	8,000	4,000	4,000	2,000	2,000	20,000	1B; 1F; 1K
	Total Outcome 1					**778,066**	**611,631**	**609,131**	**5,000**	**4,000**	**2,007,828**	
Outcome 2. Increased climate resilience of communities through disaster-resilient infrastructure, climate risk mapping and inclusive cyclone preparedness.	UNDP	62040	AF	71300	Local Consultant	10,500	7,250	7,250	5,250	5,000	35,250	2B; 2F; 2G; 2M
	MoEFCC			72100	Contractual Services-Companies	352,040	566,420	508,040	8,400	2,400	1,437,300	2A;2C;2D;2H;2I
	UNDP			72300	Materials and Goods	119,435	119,435	119,435	119,435	119,435	597,176	2K;2N
	MoEFCC& LGI			75700	Training, Workshops and Conferences	49,500	49,500	51,500	51,500	46,000	248,000	2C; 2E
	Total Outcome 2					**531,475**	**742,605**	**686,225**	**184,585**	**172,835**	**2,317,726**	
Outcome 3. Improved income and food	UNDP	62040	AF	71300	Local Consultant	32,500	38,000	38,000	38,000	38,000	184,500	3B; 3E; 3G

security of communities by innovating and providing assistance to selected households for climate-resilient livelihoods practices	UNDP			71400	Contractual Services-Individuals	47,427	40,285	40,285	40,285	40,285	208,568	3A; 3J
	MoEFCC			72100	Contractual Services-Companies	-	356,500	356,500	-	-	713,000	3C; 3D
	MoEFCC			72300	Materials and Goods	455,000	455,000	455,000	455,000	455,000	2,275,000	3I
	MoEFCC& LGI			75700	Training, Workshops and Conferences	-	4,000	4,000	4,000	4,000	16,000	3F; 3H
	Total Outcome 3					**534,927**	**893,785**	**893,785**	**537,285**	**537,285**	**3,397,068**	
Outcome 4. Enhanced knowledge and capacity of communities, government and policymakers to promote climate resilient development on chars.	UNDP	62040	AF	71400	Contractual Services-Individuals	18,400	47,200	47,200	47,200	47,200	207,200	4F; 4H; 4I
	MoEFCC& UNDP			71600	Travel	6,400	6,400	6,400	6,400	6,400	32,000	4E
	MoEFCC			72100	Contractual Services-Companies	72,000	27,000	27,000	27,000	27,000	180,000	4B
	UNDP &MoEFCC			74200	Audio Visual&Print Prod Costs	39,600	14,850	14,850	14,850	14,850	99,000	4C
	MoEFCC& LGI			75700	Training, Workshops and Conferences	15,000	31,750	22,375	18,375	9,000	96,500	4A; 4D; 4G
	Total Outcome 4					**151,400**	**127,200**	**117,825**	**113,825**	**104,450**	**614,700**	
Project Management	UNDP	62040	AF	71400	Contractual Services-Individuals	118,200	118,200	118,200	118,200	118,200	591,000	PM1; PM2; PM3; PM4; PM5
	UNDP			71600	Travel	10,000	10,000	10,000	10,000	10,000	50,000	PM6
	MoEFCC			72100	Contractual Services-Companies	5,000	5,000	45,000	5,000	65,000	125,000	PM12
	UNDP			72400	Communic& Audio Visual Equip	5,000	5,000	5,000	5,000	5,000	25,000	PM10
	UNDP			72500	Supplies	12,000	2,000	2,000	2,000	2,000	20,000	PM7
	MoEFCC			72800	Information Technology Equipmt	8,400	1,400	1,400	1,400	1,400	14,000	PM8
	UNDP			74100	Professional services	5,000	5,000	5,000	5,000	5,000	25,000	PM11
	UNDP			74500	Miscellaneous	5,000	5,000	5,000	5,000	5,000	25,000	PM9
	9212322Total PMC					**168,600**	**151,600**	**191,600**	**151,600**	**211,600**	**875,000**	
	Project Total					**2,164,468**	**2,526,822**	**2,498,567**	**992,295**	**1,030,170**	**9,212,322**	
	Grant Total (Project Total + IE Fee)										**9,995,369**	

Budget notes:

NOTE	Output	Budget code	Nature of Expense	Amount	Description
1A	Output 1.1. Cyclone and flood resilient houses for the most vulnerable households.	72300	Materials and Goods	1,530,000	Retrofitting of 900 vulnerable char houses @ US$1,700 per unit
1B		75700	Training	10,000	- Training workshops to train construction workers on climate/cyclone resilient approaches:10 workshops @ US$1000 per workshop (TS)
1C		71300	Local Consultant	11,000	- National consultants or technical specialists to conduct training workshops: 44 days @ US$250 per day (TS)
			Total Output 1.1:	**1,551,000**	
1D	Output 1.2. Community-level nano-grids installed for electrification to enhance adaptive capacity	72100	Contractual Services-Companies	147,828	- 30 Solar Units + installation @ US$4,927 per unit
1E		71300	Local/National Consultants	11,000	- National consultants to conduct assessment of electricity needs: 44 days @ US$250 per day (TS)
1F		75700	Training	5,000	- Workshops to train community maintenance groups on maintaining solar units: 10 workshops @ US$500 per workshop (TS)
1G		71300	Local/National Consultants	11,000	- National consultants or specialists to conduct training workshops: 44 days @ US$250 per day (TS)
1H			**Total Output 1.2:**	**174,828**	
1I	Output 1.3. Locally appropriate rainwater harvesting systems for safe drinking water and home-garden irrigation.	72100	Contractual Services-Companies	255,000	500 rainwater harvesting units + installation @ US$510 per unit
1J		71300	Local Consultant	11,000	- Assessment of water demand - national consultant: 44 days @ US$250 per day (TS)
1K		75700	Training	5,000	- Workshops to train community-based water-user groups 10 workshops @ US$500 per workshop (TS)

1L		71300	Local Consultant	11,000	- National consultants to conduct training workshops 44 days @ US$250 per day (TS)
			Total Output 1.3:	**282,000**	
2A	Output 2.1. Climate resilient infrastructure built to protect life and prevent asset loss	72100	Contractual Services-Companies	800,000	- Cluster house construction materials + labour @ US$40,000 per unit
2B		71300	Local Consultant	8,250	- Engineer to provide support/assessments for location and construction of cluster houses 33 days @ US$250 per day (TS)
			Total Output 2.1:	**808,250**	
2C	Output 2.2. Embankments repaired and innovative model for community embankment management introduced.	72100	Contractual Services-Companies	375,000	- Embankment repair @ US$30,000 per km (further information on technical details on the embankment repair are provided in annex G)
2D		72100	Contractual Services-Companies	208,800	- Embankment strengthening through EbA @ US$14,400 per km
2E		75700	Training	24,000	- Workshops to train community embankment management groups 12 workshops @ US$2,000 per workshop (TS)
2F		71300	Local Consultant	5,500	- National consultant to train communities on community management of embankments 22 days @ US$250 per day (TS)
2G		71300	Local Consultant	5,500	- National consultant or specialist to assess and develop livelihoods to be connected to embankment management and conduct trainings 22 days @ US$250 per day (permanent staff employed under output 3.1)
2H		72100	Contractual Services-Companies	37,500	Environmental management plan and environmental monitoring
			Total Output 2.2	**656,300**	
2I	Output 2.3. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.	72100	Contractual Services-Companies	16,000	Contract company to develop/produce hazard maps for vulnerable char islands: 8 chars @ US$2000 per char

2J			**Total Output 2.3:**	**16,000**	
2K	Output 2.4. Cyclone Preparedness Programme (CPP) modernised and expanded to provide timely cyclone early warning and response at scale.	72300	Materials and Goods	385,000	- CPP Equipment: 7 packs @ US$55,000 per pack
2L		75700	Training	224,000	- CPP volunteer training workshops: 64 workshops @ US$3,500 per workshop (TS)
2M		71300	Local Consultant	16,000	- National consultant or CPP representative to conduct training workshops: 64 days @ US$250 per day (TS)
2N		72300	Materials and Goods	212,176	- Cost to procureand equip mobile ambulances: 8 ambulances @ US$26,522 per ambulance
			Total Output 2.4:	**837,176**	
3A	Output 3.1. Climate-resilient agriculture implemented and supported at a community level	71400	Contractual Services-Individual	28,568	- Establish and maintain demonstration plots: 4 demonstration plots @ US$3,571 per plot
3B		71300	Local Consultant	162,500	- Farmer fieldschools: 65 workshopss @ US$2,500 per workshop
3C		72100	Contractual Services-Companies	200,000	- Cold storage facilities + installation: 4 facilities @ US$50,000 per unit
3D		72100	Contractual Services-Companies	513,000	- Solar powered pump and associated equipment (e.g. piping, drip irrigation systems): 6 units @ US$85,500 per unit
3E		71300	Local Consultant	11,000	- National consultants to assess water needs for irrigation in Lakshmitari 44 days @ US$250 per day (TS)
3F		75700	Training	8,000	- Workshops to train communities on maintenance of cold storage units 8 workshops @ US$1,000 per workshop (TS)
3G		71300	Local Consultant	11,000	- National consultants or specialists to conduct training workshops for cold storage units 44 days @ US$250 per day (TS)
3H		75700	Training	8,000	- Workshop to train communities on use and maintenance of solar irrigation 8 workshops @ US$2,000 per workshop (TS)
			Total Output 3.1:	**942,068**	

3I	Output 3.2. Diversified livelihoods developed and supported for the most vulnerable households	72300	Materials and Goods	2,275,000	- Financial assistance to provide inputs for alternative livelihoods 6500 beneficiaries @ US$450 per beneficiary
3J		71400	Contractual Services-Individual	180,000	- 2 permanently employed national consultants or livelihood specialists to conduct needs assessment, develop alternative livelihoods as well as support and capacitate implementing NGO 120 months (5 years) @ US$1500 per month (TS)
		Total Output 3.2:		**2,455,000**	
4A	Output 4.1. Local government institutions are capable of climate risk informed planning and implementation.	75700	Training	37,500	- Workshops to increase capacity of local government and extension officers 25 workshops @ US$1,500 per workshop
		Total Output 4.1:		**37,500**	
4B	Output 4.2. Knowledge and awareness generated to promote climate resilient approaches and strategies.	72100	Contractual Services-Companies	180,000	Materials and construction of innovation centres 4 centres @ US$45,000 per centre
4C		74200	Audio Visual&Print Prod Costs	99,000	Cost of disseminating information (e.g radio broadcasts, public billboards, pamphlets)
4D		75700	Training, Workshop and conference	27,000	6 presentations at regional workshops/seminars @ US$4,500 per presentation
4E		71600	Travel	32,000	16 exhange vists between different communities 16 exhange visits @ US$2,000 per visit
4F		71400	Contractual Services-Individual	129,600	Knowledge management and communication consultant: 2 consultants for 54 month @ US$1200 per month (TS)
4G		75700	Training, Workshop and conference	32,000	Workshops to train teachers and community leaders on climate change information, impacts and adaptive strategies 16 workshops @ US$2,000 per workshop (TS)
4H		71400	Contractual Services-Individual	57,600	1 Community facilitator to each manage innovation centres 192 months (4 years) @ US$300 per month (TS)

4I		71400	Contractual Services-Individual	20,000	National consultant to develop an advocacy startegy based on the lessons from project: 80 days @ US$250 per day (TS)
			Total Output 4.2:	**577,200**	
PM1	Project management	71400	Contractual Services-Individual	200,000	Recruitment of project technical staffs (project management and administrative staffs) - Project Manager (1 Position)
PM2		71400	Contractual Services-Individual	88,500	Recruitment of project technical staffs (project management and administrative staffs) - Project Finance cum Admin Associate (1 Position)
PM3		71400	Contractual Services-Individual	90,000	Recruitment of project technical staffs (project management and administrative staffs) - M&E Associate (1 Position)
PM4		71400	Contractual Services-Individual	52,500	Recruitment of project technical staffs (project management and administrative staffs) - Admin Assistant (1 position)
PM5		71400	Contractual Services-Individual	160,000	Recruitment of project technical staffs (project management and administrative staffs) - Community Development Assistant (3 positions)
PM6		71600	Travel	50,000	Field visits for monitoring and travel cost for project management unit.
PM7		72500	Stationary & Supplies	20,000	- Office Equipment and supplies
PM8		72800	Info. and technology equipt. / IT Equipment	14,000	- ICT Equipment and Supplies
PM9		74500	Miscellaneous	25,000	- Operation and Maintenance
PM10		72400	Communic & Audio Visual Equip	25,000	Communication costs
PM11		74100	Professional services	25,000	Audit costs
PM12		72100	Contractual Services-Companies	125,000	Project M&E (Inception meeting, steering committee meetings, technical meeting, Audits, Final evaluations)
			Total PMC:	**875,000**	

H. Include a disbursement schedule with time-bound milestones.

Table 10: Disbursement schedule including milestones.

	Upon Agreement signature (US$)	After Year 1 (US$)	After Year 2 (US$)	After Year 3 (US$)	After Year 4 (US$)	Total
Scheduled date (tentative)	July 2019	July 2020	July 2021	July 2022	July 2023	
Project funds	2,164,468	2,526,822	2,498,567	992,295	1,030,170	9,212,322
Implementing Entity fee	423,607	128,868	127,427	50,607	52,538	783,047
Total	**2,588,075**	**2,655,690**	**2,625,994**	**1,042,902**	**1,082,708**	**9,995,369**

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

Record of endorsement on behalf of the government[137]

Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:

Mr. Abdullah Al Mohsin Chowdhury Secretary Ministry of Environment, Forest and Climate Change (MoEFCC) Building 6, Level 13, Room 1309 Bangladesh Secretariat, Dhaka 1000 Tel: +88-9540481 Cell: 8801729234991 Email: secretary@moef.gov.bd	Date: *December 27th, 2018*

B. Implementing Entity certification

Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans and subject to the approval by the Adaptation Fund Board,commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.

6. Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

Pradeep Kurukulasuriya,
Executive Coordinator
Global Environmental Finance
Bureau for Policy and Programme Support
United Nations Development Programme

Implementing Entity Coordinator

Date: *January 8th* , 2019	Tel. and email:+66 87 017 8667; pradeep.kurukulasuriya@undp.org
Project Contact Person: Reis Lopez Rello	
Tel. And Email:+6623049100 ext.5286; reis.lopez.rello@undp.org	

ANNEXURE FOR AF PROPOSAL: ADAPTATION INITIATIVE FOR CLIMATE VULNERABLE OFFSHORE SMALL ISLANDS AND RIVERINE CHARLAND IN BANGLADESH

Annex A: Resilient Housing for Bangladesh coastal and north-western flood-prone areas[1]

Climate-resilient design features make homes resilient to climate impacts, such that they maintain an acceptable level of functioning and structure. Community consultation is one of the key requirements for developing climate-resilient housing. Natural phenomena like cyclones or floods become disasters because of lack of knowledge on how to construct disaster- resilient houses with feasible technologies. Recurrent losses of housing and livelihood due to natural hazards such as cyclones, riverine and flash flooding, a rising sea level rise and river erosion have major impacts on rural dwellings, leading to repeated displacement and migration. These vulnerabilities are exacerbated by the absence of guidelines, standards and procedures that could support sustainable and resilient housing construction in rural areas.

Minimum requirements to achieve resilient housing:

1. Hazard identification and vulnerability assessment – Identification of potentially damaging physical events, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.
2. Adaptations (otherwise referred to as "hazard mitigation") – Structural and non-structural measures undertaken to limit the adverse impact of hazards.
3. Preparedness planning – Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.

Salient features for resilient housing

Adequate housing means several aspects, i.e. legal security of tenure; availability of services, materials, facilities and infrastructure; affordability; habitability; accessibility; cultural adequacy and location.
However, for the project outcome, the salient features for resilient housing can be defined as**:**

1. Structural safety: cyclone resilient structural design, based on a 100-year tidal surge and 215 km per hour wind safety measures, saline proof structure etc.
2. Adaptation interventions: renewable energy, rainwater harvesting, etc. Use of local / alternative construction materials with standard specification etc.
3. Sustainable livelihood: In case of relocation of vulnerable to a safer cluster or habitat it should include e.g. aquaculture ponds, fishery supports, common production centre etc.
4. Community-driven / community participatory approach: to be self-governed by local committees with project support.

Implementation Strategy

The project implementation will principally follow a "owner-driven reconstruction" approach. The project will be implemented in partnership with the beneficiaries, the Local Government, Department of Disaster Management, UNDP and its partner NGO. Vulnerable households will be identified through the local officials and representatives. UNDP's role will be to mobilize donors to upscale the initiative; define with the government the broad parameters of the scheme, and help the designated authority design an effective and transparent monitoring mechanism. The arrangement will be supervised by local government with assistance from trained staff from UNDP. It will further involve monitoring and proactive management of social security in support of local administration. A crucial element of the project is land for the most vulnerable landless beneficiaries[2]. For this purpose, the government will provide land, e.g. *khas*[3] land.

Basic support provided to retrofit vulnerable or at-risk houses[4]

1. Reinforcement and expansion of vulnerable houses: Around 1700 USD/household which will include shelter materials, additional WASH facilities and labour cost.
2. Technical assistance and guidelines for resilient housing.

[1] Technical specifications were provided by disaster shelter specialists at the UNDP Bangladesh country office.
[2] The beneficiary selection process is included in a following annex (Annex B)
[3] Vacant government-owned land
[4] Examples of retrofitted houses or tentative designs for plinth raising are attached (Annex A-1)

3. Advising on the procurement and technical adaptive use of alternative construction materials.

Dual-purpose resilient cluster-house/community shelter for children, elderly and disabled[5]

Dual-purpose resilient cluster houses will be constructed that function as emergency shelters. The Resilient Habitat engages technology, physical and social infrastructure, local knowledge and social capital to complement the available resources to promote resilience through better living. In the event of major disasters, the at-risk communities protect themselves from mass displacement, destruction of assets, and the expensive rehabilitation or reconstruction afterwards. With the price of one cyclone shelter, the Resilient Community Habitat helps improve living conditions of a large number of the most vulnerable communities. However, availability of government *khas* land, land rights of the individual households in a particular community and their willingness for relocating to a habitation is a major challenge. A prototype design for accommodating approx. 500 people during cyclones could be used as a normal house for multiple families.

Principles/Standards towards resilient housing and adaptation techniques

- Standard 1 Security of tenure is guaranteed for a set period of time of at least 10 years
- Standard 2 Access to safe water and sanitation solutions are to be provided
- Standard 3 Use of materials and techniques should allow easy maintenance, repair
- Standard 4 All housing and sites are repaired and adapted to the local hazard profile to resist recurrent disasters over 10 years.
- Standard 5 Housing offers a comfortable and healthy internal climate
- Standard 6 Housing is adapted to special and specific needs of its inhabitants especially for women, children and the disabled etc.
- Standard 7 Housing is functional, culturally appropriate and adaptable.
- Standard 8 In case of relocation, individual house or cluster housing should be situated near to employment and education opportunities, medical and other social services.

Table 1: Technical Guideline towards resilient housing and adaptation technique[6]

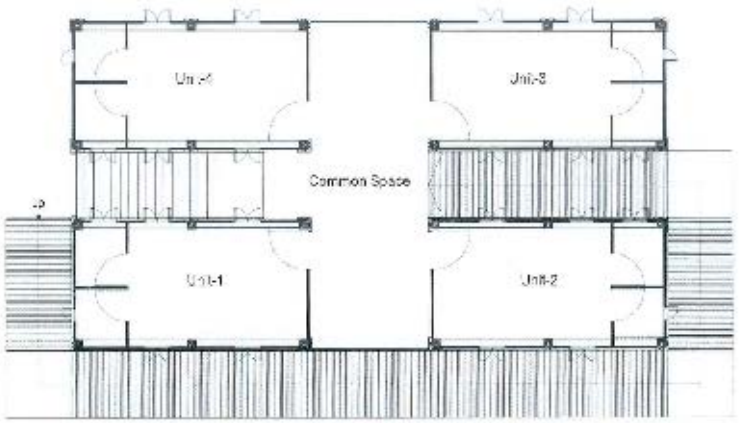
Local Practices	Resilient housing and adaptation technique
1. RCC post and metal/wooden frames are dominant in structure. 2. CGI/plain metal sheets are used as wall and roofing material for both house and latrines. 3. Timber used as door and window frames. 4. Both pucca and semi-pucca plinths are found in structure with not enough homestead and house plinth. 5. Bamboo mats/ tarpaulins are used under roofs in order to mitigate the heating.	Apart from local practices and shelter standards guidelines, following technicalities should be given due diligence while supporting the vulnerable households for a resilient housing repair. Homesteads are raised at least 5' above the level of the surrounding fields/ ponds. The house and toilet plinth is to be at least 2' above the Highest Flood Level known in the area. The plinth is to be stepped, 2, 3 or more steps, stabilized soil with a minimum of 5% cement content (depending on affordability and soil type), or with Ferro cement finishing, or protected with compressed mud blocks or eco-friendly bricks walls. The pillars can be wrapped with PVC pipe to avoid the harmful impact of saline weather. Due to the salinity, the soil bonding in the mud wall is a problem. Promote the use of bamboo sticks as reinforcement along with jute fibre, cement and sand mix. Use of alternative pre-cast Ferro cement slab as a wall and neat cement finishing protecting from humidity. Use of rubber sheet; in lieu of bamboo fencing can be useful against salinity and as a float during future cyclone induced flood that could help the people as a lifeboat

[5] A tentative design is attached (Annex A-2). Approx. Floor size: 1800-2100 ft^2. Estimated cost per unit is US$ 40,000.
[6] Standard Guideline for Rural Housing in Disaster Prone Areas of Bangladesh

Annex A-2: Cluster house design drawings

UNIVERSALLY ACCESSIBLE STILT HOUSE WITH MULTIPLE UNIT OPTIONS

Considering the inhabitant's requirement the house module can be multiplied around the given position of the staircase and formed into a cluster of multiple units. Accordingly the ramp can be placed ensuring universal accessibility.



Stilt house plan with four units for universal accessibility

House plans showing different options for universal accessibility

Annex B. Beneficiary selection

During project design, participatory exercises were conducted by UNDP to identify locations and beneficiaries for the implementation of project interventions. These interventions include: i) climate-resilient housing; ii) livelihood support; iii) drinking water solutions; iv) lighting solutions; and v) capacity-building. This process of identification accounted for current and future investments in climate resilience from the government and other development players, such as NGOs, so that duplication is avoided. The housing solutions will only be provided to households – and especially women-headed households – who are extremely vulnerable to climate change impacts because of their location and poor infrastructure. The livelihood solutions will be made available to those who are engaged in poorly adapted livelihoods, and that require support to shift towards climate-resilient livelihoods. The plinth-raise of cluster houses or mini-disaster houses will be provided where land is available for construction and where cyclone shelters are far away or unreachable. Successful resilience practices will be distributed as widely as possible through including all people in the targeted islands.

During the first phase of implementation, the final selection of beneficiaries will be based on the intersectional vulnerability of households, including prioritisation of: i) female-headed households; ii) households where an adolescent girl is solely responsible for household income; ii) households with indigenous people; and iii) households with people with disabilities. In addition, the selection will proportionally reflect the percentage of ethnic and religious minority households, to ensure that those with additional barriers to accessing resources are not further marginalised.

The final selection will prioritise the following beneficiaries:

- Gender: female-headed households (including those widowed, divorced or separated/abandoned).
- Age: for livelihoods, women between 18-49; for other support, households with children and the elderly.
- Income: households with income of less than US$1.25 per person per day.
- Household Status:
    - Women and girl beneficiaries from households where there are no able male members to earn livelihoods.
    - Women from households where there are a greater number of dependent members on the women (household members chronically ill; physically, mentally and/or visually impaired or disabled).
    - Indigenous (“Adivasi”) households.
- Land: for agricultural livelihoods, households that possess less than 30 decimals (1,214 m^2) of previously usable agricultural land and possess less than 50 decimals (2,023 m^2) of land in total. For housing support, priority will be given to people living on land exposed to extreme climatic events, people with only homestead land and landless people who arrange public land through official/customary process.
- Other requirements to assess eligibility:
    - Hindu minority households will be represented in proportion to their overall population in the wards.
    - The beneficiary cannot have been a recipient of GoB’s or any NGO’s schemes of similar nature and/or quantity of support within the last two years.

Annex C. Stakeholder consultations and inception workshop

Part A – Inception workshop

Inception Workshop: Developing a bankable project proposal on Adaptation Initiative for Climate Vulnerable Offshore Small Island and Char Land in Bangladesh
Date: 19 December 2016
Time: 06:00 PM to 8:00 PM
Venue: BRAC Inn, BRAC Centre, Mohakhali, Dhaka-1212

PARTICIPANTS

Sl No.	Name	Designation	Organization
1	Nurul Quadir	Additional Secretary	MoEF

2	Mirza Shawkat Ali	Director, Climate Change and International Convention	DoE
3	Md. Ziaul Haque	Director	DoE
4	Arif M Faisal	Programme Specialist	UNDP
5	Dr. Ainun Nishat	Professor Emeritus and Advisor	C3ER
6	Andrew Jenkins	Co-ordinator, RED	Consultant, C3ER
7	Md Aminul Islam	Economist	Consultant, C3ER
8	Md Zainul Abedin	Participatory Irr. Management Specialist	Consultant, C3ER
9	Md Hasan Zubair	Water Resources and Institutional Expert	Consultant, C3ER
10	Dr Nepal Chandra Dey	Senior Research Fellow	Consultant, C3ER
11	Dr Sajidur Rahman	Assistant Professor	C3ER
12	Roufa Khanum	Coordinator (Operations)	C3ER
13	Ibrat Sharif	Research Associate	C3ER
14	Nureen Faiza Anisha	Research Associate	C3ER
15	Hasnaeen Zakir	Research Assistant	C3ER
16	Mahjabeen Rahman	Research Assistant	C3ER
17	Saw. Mu. Shamoel Haque	Research Assistant	C3ER
18	Md Hafizul Hossain	DCO	C3ER

AGENDA

Agenda 1: Discussion on pre-concept note and result framework

Agenda 2: Discussion on validation of proposed components

Agenda 3: Dissemination of the Field Findings and completed activities

Agenda 4: Miscellaneous

Dr. Ainun Nishat welcomed all the members and initiated the discussion by a presentation on the concept of the project which included the selection of the chars, study area, field investigation, problems and proposed solutions (specific propositions) and template of the full proposal. After the presentation, there was an open discussion moderated by Dr. Nishat on various aspects of the project. The following reviews came up –

Mr. Nurul Quadir, Additional Secretary, MoEF:

He placed a query about implementing the body of the project. He also proposed that there should be an inter-ministerial meeting which may involve resource persons from different divisions. He thought that the concept of a floating house might not be well accepted in the context of Bangladesh and suggested that Killa could be a better idea.

Mr. Arif M Faisal, Programme Specialist, UNDP:

He maintained that it was decided upon the initial discussion that MoEF and DoE shall do the project implementation. He thought cleaner technologies like a non-fire brick, sunburnt brick, and green brick could be explored to build infrastructures like cyclone shelters or killas. He brought the example of floating houses in the Mekong delta, especially in Thailand and mentioned that floating houses could be introduced in Bangladesh, but the socio-economic acceptance of the intervention could be further explored. Also, he mentioned that the quantification of project components needs to be included in the resulting framework.

Mr. Mirza Shawkat Ali, Director, Climate Change and International Convention, DoE:

Mr. Ali thought that the implementation arrangement needs to be reorganized. He also thought that the proposal is too ambitious and the project is too diversified. Rather it could be much more focused and pinpointed towards the particularities of the proposition. He added that proposed housing options should be aligned with regional characteristics.

Mr. Md Zainul Abedin, Participatory Irr. Management Specialist, SMSP, BWDB-ADB:

According to Mr. Abedin, Union Parishad or LGED, any of the two could be a potential implementing body.
Mr. Mirza Shawkat Ali added to that asserting that in CDMP, TNO and UNO played a significant role in implementing and similar could be done here too.

Overall, the fund flow mechanism was discussed and according to the discussion, it requires more clarity in the proposal. Mr. Mirza Shawkat Ali added that as interventions, small embankments and road networks could be built. Mr. Arif Faisal said that innovative and feasible interventions with high impact need to be introduced and as an example, he mentioned about nano-grid and peer to peer technology. He also maintained that funding could be increased to US$15 Million and if partial financing can be managed from government's end, it would add to the advantage. But that

shall require discussion with the government. About this issue, Mr. Mirza Shawkat Ali thought that although co-finance with the government could be an option, it is not necessary to obtain adaptation fund.
The idea of Compact Housing / Cluster housing came in the discussion where Mr. Hasan Zubair mentioned his experience in CDSP. CDSP tried introducing compact housing in its early phases but was not accepted by the communities and hence was excluded in the latest phase of CDSP. Nonetheless, here, this concept could be included and turned into a model -based option. *Killa* based sanitation option, space for livestock and pond was discussed. Also, capacity building of local people, dissemination of climate information and knowledge was thought to be an important component. In all the cases, stakeholder validation is required.

Summary/Decisions of the meeting:

- DoE shall organize a stakeholder validation meeting with the relevant ministries and resource persons from different divisions.
- Institution wise implementation issues need to be explored based on their experiences during CDSP, CDMP and similar projects.
- A steering committee meeting would take place headed by the secretary of MoEF
- The project shall be scaled down to do fewer innovative and high impact focused activities
- The options for earthen, timber, non-fire brick, sunburnt brick structures could be explored
- Afforestation could be kept as an optional activity
- The proposed project needs to be linked with National (e.g. 7th Five Year Plan) and Global (e.g. Sustainable Development Goal) policies
- The fund can be increased to US$ 15 Million
- It could be explored if MoEF can co-finance the project
- Options for cluster village and the compact village could be explored
- The feasibility of a floating house in the context of Bangladesh was questioned. Rather it was suggested that the activity window needs to scale down and focus on adding sanitation options.
- The idea if *Killa* was appreciated
- Result framework needs to quantify the specifications and baseline and indicators need to be elaborated.

Part B – Community consultations

Bhola
Date of visit: 23/11/2017
The team visited ward no 1, 2, 3, 4 and 9 of the Mujibnagar union. The following stakeholders were interviewed:

- Ward member of each ward (IDI)
- Agricultural officer (KII)
- BWDB Engineer (KII)
- Teacher (FGD)
- Religious leader, Imam (KII)
- Community people (FGD)
- Students (KII)
- Female representative (KII)
- UNO
- Shomaj Kollyan Officer (Social Welfare Officer) (KII)

Table 1 Bhola Field Visit: List of Audio/Visual Data Records for Transcription.

Sl. No.	Type	Interviewer	Subject
1	IDI	Mim	Development Deficit (Shankardah)
2	IDI	Mim and Roaksana Nigar	Development Deficit and L&D (Niphamari)
3	FGD	Roufa Khanom	Resource Mapping, Shankardah
4	FGD	Roufa Khanom	Resource Mapping, Joyramojha
5	KII	Mim and Aziz	Bablu Miah, (member)Joyramo jha
6	FGD	Roufa Khanom	Resource Mapping, Shankardah
7	FGD	Roufa Khanom	Resource Mapping, Joyramojha
8	IDI	Mim and Aziz	Development Deficit (Joyramojha)
9	IDI	Ibrat Sharif	Member (Loss and Damage, Joyramojha)
10	IDI	Ibrat Sharif	Development Deficit and Resource Mapping (Joyramojha)
11	IDI	Aziz	Elderly Resident Joyramojha (Life History)
12	IDI	Aziz	Aziz (Farmer and Irrigation Supplier, Chollishal)
13	IDI	Ibrat Sharif and Pantho	Fazlul Haque (Agriculture)
14	IDI	Mim and Aziz	Sabina (Education, Health, Women)

15	GD	Mim	Women (Chollishal)
16	IDI	Ibrat Sharif	Mokhtarem (Agriculture, Health)
17	IDI	Mim	Development Deficit (Chollishal)
18	KII	Roufa Khanom	Health Issues with Women
19	IDI	Mim	Member; Gender Issues, Religion, Overall Prospects of Area (Shankardah)
20	IDI	Roaksana Nigar	Abdul Matin; Gender Issues, Religion, Overall Prospects of Area
21	IDI	Roaksana Nigar and Pantho	Laili (Life History Analysis, Chollishal)
22	FGD	Roaksana Nigar and Pantho	Water and Sanitation, Chollishal
23	IDI	Sa'ad and Pantho	Mozammel (Riverbank Dweller and Stone Extraction day labourer)
24	KII	Dr. Sajid	Agriculture Officer
25	KII	Nandan Mukherjee	PIO of Upazila
26	KII	Dr. Sajid	AC, Land
27	KII	Dr. Sajid	Public Health
28	FGD	Nandan Mukherjee	(Shankardah, Ward no.1, union: Laxmitary)
29	FGD	Dr. Sajid	Seasonal Calendar + Agricultural Production loss (Joyramojha)
30	IDI	Nandan Mukherjee	School Boy (Chollishal)
31	IDI	Dr. Sajid	Mujibnagar Union Chairman
32	FGD	Ibrat Sharif	Women, Agriculture and Health (Shankardah)
33	FGD	Ibrat Sharif and Pantho	Health and Agriculture (Joyramojha)

Rangpur
Date of visit: 6/12/2017
The following Stakeholders were interviewed:

- Abashan Project (FGD, KII, IDI)
- Chairman, Gangachara Upazila (KII)
- Ward member (KII)
- Community People (2 FGD at two wards)
- BWDB Engineer (KII)
- Agriculture officer (KII)
- UNO
- Assistant Commissioner, Land
- Elderly group (FGD)
- Disaster Preparedness Officer

Table 2 Rangpur Field Visit: List of Audio/Visual Data Records for Transcription.

Sl. No.	**Type**	**Interviewer**	**Subject**
1	IDI	Sa'ad and Pantho	Elderly Resident Joyramojha (Life History)
2	IDI	Sa'ad and Pantho	Sadiqul (Flood Affected Farmer)
3	IDI	Sa'ad and Pantho	Rahima (Lost Child to Flood)
4	IDI	Aziz	Aziz(Farmer and Irrigation Supplier, Chollishal)
5	FGD	Sa'ad	Water and Sanitation, Chollishal
6	IDI	Sa'ad and Pantho	Mozammel (Riverbank Dweller and Stone Extraction day laborer)
7	KII	Dr. Sajid	Agricuture Officer
8	KII	Dr. Sajid	PIO of Upazila
9	KII	Dr. Sajid	AC, Land
10	KII	Dr. Sajid	Public Health
11	FGD	Nandan Mukherjee	(Shankardah, Ward no.1, union: Laxmitary)
12	FGD	Nandan Mukherjee	Seasonal Calendar + Agricultural Production loss (Joyramojha)
13	IDI	Nandan Mukherjee	School Boy (Chollishal)
14	IDI	Nandan Mukherjee	Laxmitary Union Chairman
15	FGD	Ibrat Sharif	Women, Agriculture and Health (Shankardah)
16	FGD	Ibrat Sharif and Pantho	Health and Agriculture (Joyramojha)
17	IDI	Ibrat Sharif and Pantho	Fazlul Haque (Agriculture)
18	IDI	Ibrat Sharif	Sabina (Education, Health, Women)
19	GD	Ibrat Sharif	Women (Chollishal)
20	IDI	Ibrat Sharif	Mokhtarem (Agriculture, Health)
21	IDI	Mim	Development Deficit (Chollishal)
22	IDI	Mim	Development Deficit (Joyramojha)

23	IDI	Mim	Member (Loss and Damage, Joyramojha)
24	IDI	Mim	Development Deficit and Resource Mapping (Joyramojha)
25	IDI	Mim	Development Deficit (Shankardah)
26	IDI	Mim and Roaksana Nigar	Development Deficit and L&D (Niphamari)
27	FGD	Roufa Khanom	Resource Mapping, Shankardah
28	FGD	Roufa Khanom	Resource Mapping, Joyramojha
29	KII	Roufa Khanom	Bablu Miah, (member) Joyramo jha
30	KII	Roufa Khanom	Health Issues with Women
31	IDI	Roaksana Nigar	Member; Gender Issues, Religion, Overall Prospects of Area (Shankardah)
32	IDI	Roaksana Nigar	Abdul Matin; Gender Issues, Religion, Overall Prospects of Area
33	IDI	Roaksana Nigar and Pantho	Laili (Life History Analysis, Chollishal)

Summary of Validation Workshop on 'Adaptation Initiative for Climate Vulnerable Coastal and Riverine Small Islands in Bangladesh'

Date: 24 December 2018

Venue: Conference Room, Ministry of Environment, Forest and Climate Change, Bangladesh Secretariat, Dhaka

Chaired by: Mr. Abdullah Al Mohsin Chowdhury, Secretary, MoEFCC

Moderated by: Dr. SM Munjurul Hannan Khan, Additional Secretary, MoEFCC

Introduction

A validation workshop was held at the conference room of the Ministry of Environment, Forest and Climate Change (MoEFCC) on 24 December 2018 regarding the finalization and validation of project proposal titled "Adaptation Initiative for Climate Vulnerable Coastal and Riverine Small Islands in Bangladesh'." Mr. Abdullah Al Mohsin Chowdhury, Secretary, MoEFCC presided over while Dr. S M Munjurul Hannan Khan, Additional Secretary, MoEFCC moderated the workshop. Among others Dr. Nurul Quadir, Additional Secretary (Climate Change), MoEFCC and Dr. Sultan Ahmed, Director General, Department of Environment was also present. A total of 30 representatives from the relevant ministries, line agencies, experts, NGOs, private sectors and relevant officials of the MoEFCC, DoE, UNDP Bangladesh, Centre for Climate Change and Environmental Research(C3ER) attended the workshop. List of Participants, programme schedule and presentation of proposal are attached in Annexes 1, 2 and 3 respectively.

Presentation of Project Proposal and Key Discussion

Dr. SM Munjurul Hannan Khan, Additional Secretary, MoEFCC welcomed participants and briefly discussed about the purpose and outcome of the validation workshop. He then requested Mr. Khurshid Alam, Assistant Resident Representative, UNDP Bangladesh to discuss about the project formulation process. Mr. Alam briefly discussed about chronology for formulation of the project. He also discussed about the consultation process and other meetings that were conducted during preparation of the project. He emphasized on the rationale of implementation of the project in offshore small riverine and coastal islands where development intervention is very limited, climate risks and vulnerability are high and communities coping capacity is too limited.

At this stage of the workshop the Chair requested Dr. Ainun Nishat, Executive Director of C3ER, BRAC University to present the project proposal. Dr. Nishat discussed about the background, rationale, major components, outcome, breakdown of budget and implementation arrangement of the project. He mentioned that this project is very timely since small islands are located in very remote areas where development support rarely reached. Moreover, islands community are most climate vulnerable among all communities in Bangladesh. He mentioned urgent and immediate action is required to improve coping capacity of islands communities since frequency of cyclone and storm surge is increasing in these islands. He added that project site was selected with rigorous selection criteria using GIS maps and comprehensive consultation with stakeholders and discussion with local Government representatives. No one influenced the selection of the two project sites-he added. He also discussed about results framework and resource requirement for accomplishment of proposed project activities. As capacity of the community is low, a capacity building and knowledge management framework is included, which is also mandatory requirement for Adaptation Fund Board (AFB). Presentation by Dr. Nishat is attached in Annex 3.

Mr. Arif M. Faisal, Programme Specialist from UNDP supplemented on implementation arrangements and requirement of other due diligence process for Adaptation Fund. He also discussed about the basic principles and requirements of Adaptation Fund. Mr. Faisal also mentioned that relevant line agencies, local Govt institutes, NGOs and private sector will be engaged to implement major interventions of the project. These agencies are Bangladesh Water Development Board for repair and maintenance of embankments, Department of Agriculture Extension (DAE) for promoting climate resilient agriculture and livelihoods, Cyclone Preparedness Programme (CPP) for providing preparedness tools and packages for early warning and climate information/services, Local Government Engineering Department and

NGO/private sector for construction of climate resilient housing, Infrastructure Development Company Limited (IDCOL) or private company for setup of nano-grid and solar irrigation pumps, local Govt institutes for capacity building and research agencies/university for knowledge management. The MoEFCC will coordinate overall implementation.

Dr. Nurul Quadir, Additional Secretary (climate change), MoEFCC and Mr. Mirza Shawkat Ali, Director, DoE and member of AFB also discussed about the principles for funding mechanism and shared experience of international negotiation process. Mr. Mirza mentioned that Bangladesh never applied for accessing AF resources before and there are dedicated resources for each country and he urged to submit the proposal urgently to the AF by 7 January 2019 so that it can be considered for during the 33rd board meeting, which is scheduled to be held from 12-15 March 2019. He further mentioned many minor issues can be resolved even after submission of the project proposal to AF, which could be addressed along with the queries of adaptation fund. He requested the chair to consider submitting the proposal by 7th January, since proposal need to be submitted 9 weeks before the Adaptation Fund Board meeting. Dr. Quadir suggested excluding co-finance since it is not required as per funding requirement of accessing AF. He expressed that if we include co-finance it may become precedence for other poor and developing nations.

Feedback and suggestion from participants

1. The proposed project should highlight some uniqueness and innovative actions on adaptation. This may be some innovation in design of houses, ecosystem-based adaptation or even innovative approach for capacity building.
2. The proposed project may also consider the design of the climate resilient housing of Climate Technology Centre and Network (CTCN) Technical Assistance Project, which is designed by Green Technology Centre, Korea, with the technical support of Korean Institute of Civil Engineering and Building Technology (KICT).
3. Capacity of Local Government Institution (LGI) on climate change and enhance resilience capacity at the location level to be strengthened towards implementation and monitoring of the Project activities.
4. Budget to be increased for local level monitoring and evaluation of project implementation through enhancing capacity of LGI.
5. Consultation with following relevant ministries and line agencies are required to get their endorsement for involvement in the project. These include 1) Department of Agriculture Extension under Ministry of Agriculture, 2) Bangladesh Water Development Board under Ministry of Water Resources, 3) Cyclone Preparedness Programme under Ministry of Disaster Management & Relief, 4) Department of Fisheries under Ministry of Fisheries and Livestock, 5) Sustainable Renewable Energy Development Authority under Ministry of Power, Energy and Mineral Resources, 6) Bangladesh Forest Department under MoEFCC, etc. However, implementation arrangement should be kept flexible to keep the available options within wide scope of engagement. Moreover, engaging LGI, NGOs, private firm, university can also be considered to keep the implementation and procurement flexible. However, activity-specific relevant implementing partner agency should be clearly specified in the TAPP and Project Document.
6. The results framework of the project should clearly specify baseline and indicators and numbers of beneficiaries/household to be involved in each activity. Project Document needs to clearly specify all the activities along with the organizations responsibilities – who is responsible for what, who to do what, etc.
7. Capacity building of local carpenters, masons, electricians on climate resilient construction skills will be one of the priority activities.
8. Composition of the Project Steering Committee need further revision and should be written with detail explanation. Project board and senior supplier should be removed and include other relevant agencies like IMED, local Govt. representative (e.g. UNO, DC, etc.)
9. There should be official agreement with the proposed implementation agencies which will be confirmed after endorsement of the project by AFB and this implementation arrangement will be clearly mentioned in the Project Document and TAPP.
10. NGOs can be engaged in livelihood development and private firm/company can be engaged in installation of solar nano-grid & solar irrigation pumps while technical and other advisory support relating to specific livelihood options and energy options can be sought from relevant government departments (e.g. DAE, DoE, FD, SREDA, etc.)
11. Ownership of Project benefits should lie with general people. So, capacity building of local beneficiaries on management of the Project on a sustainable basis (exit strategy) is important.
12. Farmers, Fishers and other resource users should get important attention as those are the major livelihoods of island community.
13. After endorsement of project by AFB, TAPP should highlight clearly the baseline situation and expected results both in quantitative and qualitative terms.
14. To avoid the duplication, any kind of overlap with other Projects to be avoided (CDLP, CDSP IV, PROVATI, SUFAL, etc. However, it was agreed that the Project will adopt any possible lessons from other ongoing Projects.

15. Soon after endorsement of the project by AFB, MoEF and UNDP will organize a meeting with the head of other implementing partners to get their official endorsement on their engagement and implementation arrangement in the project.
16. There should be provision of local Monitoring Officer and site Engineer position in the PMU.
17. The MoEFCC will be the chair while all other implementing agencies will be members of the Steering Committee.
18. It is agreed that UNDP will prepare detailed terms of reference of all PMU staff and in consultation with the executing agency recruit them. However, ToR needs to be endorsed by MoEFCC
19. The guideline shared in the recent CBD CoP on Ecosystem based adaptation and Ecosystem based disaster risk reduction need to be reviewed to examine the appropriateness of the approach of this Project.
20. With respect to cash transfer provision for the beneficiaries, it was agreed that farmers and fisherman need some assistance from the project in terms of kind and cash to implement the knowledge they gather from different trainings. So, the beneficiaries of the Project will receive only US $ 325/ to spend for agricultural equipment and/or seeds, fishing nets, boats, etc.
21. The workshop suggested including flash flood and riverbank erosion along with salinity intrusion, cyclone and SLR.
22. Some participants suggested including all activities in 8 islands. However, MoEFCC opined that proposed two islands is adequate to include all project activities to show better impacts. They opined that instead of implementing proposed intervention in all 8 islands, the existing activity in selected two islands and expanding CPP in 6 additional islands will show better results. However, they proposed that it can be considered to increase number of islands and co-financing may be ensured after endorsement of the project by AFB.
23. A committee headed by the Director General, Department of Environment shall be constitute to select NGOs/Firms/private Companies to execute livelihood support to local communities. The committee shall advice UNDP for engagement of such NGOs/firm/company for implementing particular activities following proper procurement process.

Decision

1. MoEFCC will circulate meeting minutes to the relevant stakeholders by 27 December 2018. This urgency is to keep pace with the deadlines of the AFB.
2. Composition of the Project Steering Committee will be revised. Project board and senior supplier will be removed. Project steering committee will be headed by Secretary and Project implementation committee would be headed by Director General, Department of Environment.
3. The proposed project will be implemented by the Ministry of Environment, Forest and climate change, while Department of Environment will execute the project.
4. The project implementation will follow the National Execution (NEX) Modalities.
5. A committee shall be constituted for the selection of NGOs/local firms/private companies to execute particular activities at the local level following proper procurement process.
6. The MoEFCC endorsed this project proposal in principle and agreed for submission of Project Proposal to the AFB by 7 January 2019 with incorporation of suggested revision provided in the validation workshop. However, detail implementation modality with implementing partner's endorsement will be provided in the TAPP and Project Document after endorsement of the proposal by AFB.
7. UNDP will submit final project proposal to MoEFCC by 3 January 2019.
8. MoEFCC as the Designated Authority of Adaptation Fund in Bangladesh shall issue a Letter of Endorsement (LoE) to facilitate the formal submission of the proposed project to AF by 7 January 2019.

Lists of participants (not according to seniority)

1. Mr. Abdullah Al Mohsin Chowdhury, Secretary, Ministry of Environment, Forests and Climate Change, Bangladesh Secretariat, Dhaka.
2. Dr. SM. Munjurul H Khan, Additional Secretary (environment), Ministry of Environment, Forests and Climate Change, Bangladesh Secretariat, Dhaka.
3. Dr. Nurul Quadir, Additional Secretary (Climate change), Ministry of Environment, Forests and Climate Change, Bangladesh Secretariat, Dhaka.
4. Dr. Sultan Ahmed, Director General, Department of Environment, Agargaon, Dhaka
5. Representative, Department of Disaster Management, Mohakhali, Dhaka
6. Mr. Mirza Shawkat Ali, Director (Climate Change), Department of Environment, Agargaon, Dhaka
7. Mr. Md. Ziaul Haque, Director, Director (Air Quality)), Department of Environment, Agargaon, Dhaka
8. Mr. Mohammed Solaiman Haider, Director (Planning), Department of Environment, Agargaon, Dhaka

9. Mr. Shamsur Rahman Khan, Deputy Secretary, Ministry of Environment, Forests and Climate Change, Bangladesh Secretariat, Dhaka.
10. Dr. ANM Abdullah, Deputy Secretary, Ministry of Environment, Forests and Climate Change, Bangladesh Secretariat, Dhaka.
11. Ms. Farjana Jahan, Senior Assistant Chief, Ministry of Environment, Forests and Climate Change, Bangladesh Secretariat, Dhaka.
12. Dr. Md. Saifur Rahman, Senior Assistant Chief, Ministry of Environment, Forests and Climate Change, Bangladesh Secretariat, Dhaka
13. Mr. SM Tariq, Deputy Secretary, Ministry of Fisheries and Livestock, Bangladesh Secretariat, Dhaka
14. Mr. SM Imrul Hasan, Senior Assistant Chief, Ministry of Agriculture, Bangladesh Secretariat, Dhaka.
15. Mr. Farid Uddin Ahmed, Executive Director, Arannayk Foundation, House# 21, Western Road, DOHS, Banani. Dhaka - 1206
16. Dr. Ainun Nishat, Emeritus Professor, BRAC University, Mohakhali, Dhaka.
17. Ms. Taniska Mum Tahina Billah, Management Trainee for GCF, Infrastructure Development Company Limited (IDCOL), UTC Building, 16th Floor, 8 Panthapath, Kawran Bazar, Dhaka.
18. Md. Shafiqur Reza Biswas, Joint Secretary, Bangladesh Climate Change Trust, Mohakhali, Dhaka
19. Dr. Mohammad Zahirul Hoque, ACCF, Bangladesh Forest Department, Agargaon, Dhaka
20. Mr. Md Zafor Ullah Khan, Member, SPARRSO, Agargaon, Dhaka
21. Mr. Md SK Farid, Deputy Director, Department of Agriculture Extension, Khamar Bari, Dhaka
22. Ms. Sabrina Jahan, Research Assistant, IUCN, House B-138 (Level 5 & 6), Road 22, Mohakhali DOHS, Dhaka 1206
23. Ms. Badrun Nahar, Director, WARPO, Green Road, Dhaka
24. Mr. Md. Ali Akhter Hossain, SE(Planning), LGED, Dhaka
25. Mr. Mohammad Rezaul Karim, Project Director, CDSP-IV, LGED, Agargaon, Dhaka
26. Mr. Aminul Ishat, Programme Manager, BRAC, Mohakhali, Dhaka
27. Mr. Khurshid Alam, Assistant Resident Representative, UNDP, IDB Bhaban, Agargaon, Dhaka
28. Mr. Arif Mohammad Faisal, Programme Specialist (Environment Sustainability & Energy), UNDP, IDB Bhaban, Agargaon, Dhaka
29. Dr. Rokeya Khatun, National Consultant, UNDP, Dhaka.
30. Mr. Forhad Alam, Administrative Assistant, UNDP, IDB Bhaban, Agargaon, Dhaka
31. Ms. Rumana Ferdous, Intern, UNDP, IDB Bhaban, Agargaon, Dhaka

Program Schedule

Time	Activity	Responsible Facilitator/Resource Person
01:00–1:30	Registration and lunch	MoEFCC and UNDP
01:30–01.40	Welcome address	Mr. Khurshid Alam, Assistant Country Director, UNDP
01.40–02.10	Presentation on the project	Dr. Ainun Nishat, Professor Emeritus, BRAC University
02.10–03.30	Open discussion: Stakeholder's opinion on project proposal	Moderated by Dr. Munjurul Hannan Khan, Additional Secretary, MoEFCC
03.30-03.40	Special remarks	Dr. Nurul Quadir, Additional Secretary (climate change), MoEFCC
03.40-03.50	Special remarks	Dr. Sultan Ahmed, Director, DoE
	Special remarks	Mr. Mirza Shawkat, Director, DoE
03:50–04:00	Closing Remarks by the Chair	Mr. Abdullah Al Mohsin Chowdhury, Secretary, MoEFCC
04:00–04:10	Vote of Thanks	Mr. Shamshur Rahman Khan Deputy Secretary, MoEFCC

Annex D. Social and Environmental Screening

The completed template, which constitutes the Social and Environmental Screening Report, must be included as an annex to the Project Document. Please refer to the Social and Environmental Screening Procedure and Toolkit for guidance on how to answer the 6 questions.

Project Information

Project Information	
1. Project Title	Adaptation Initiative for Climate Vulnerable Offshore Small Islands and Riverine Charland in Bangladesh
2. Project Number	N/A
3. Location (Global/Region/Country)	Bangladesh

Part A. Integrating Overarching Principles to Strengthen Social and Environmental Sustainability

QUESTION 1: How Does the Project Integrate the Overarching Principles in order to Strengthen Social and Environmental Sustainability?

Briefly describe in the space below how the Project mainstreams the human-rights-based approach

The project has a specific human rights approach to improve the adaptive capacity of the most vulnerable community members in two chars in rural Bangladesh and will focus on the most vulnerable socio-economic groups, i.e., women and the landless belonging to extremely poor households. It will improve the climate resilience and adaptive capacity of ~32,000 vulnerable char dwellers by improving their housing and provisioning them with clean water and electricity. The project will also support the improvement of agricultural livelihoods and the development of new climate resilient livelihood options. The majority of alternative livelihood support will be focused towards women, which will empower women, who, among other members of the rural Bangladesh society, are most susceptible to human rights violation in different spheres of their lives.

Through this approach, the project adopts the principle of positive discrimination and includes specifically the most discriminated, marginalized and the poorest people in the communities. Therefore, both in principle and in practical terms, human rights violation by the project are not possible. On the contrary, by including all of the most disadvantaged people in the community-based activities, they will be provided with an opportunity to assert their socio-political and economic rights.

Although, there are existing human rights issues in the project areas (e.g., discrimination against women), the project itself will not result in any violation of human rights. Instead, it is committed to addressing human rights violations as much as possible. The process of fostering gender equality and empowerment of women is expected to reduce the occurrence of the most common human rights violations in the area (i.e. violence against women). A grievance redress mechanism has also been developed for the project and is included in the Environmental and Social Management Plan prepared as part of the project (see Annex 5).

Briefly describe in the space below how the Project is likely to improve gender equality and women's empowerment

This project incorporates gender considerations into all interventions, including for all training, support and awareness raising activities. Although the primary focus of the project is on households that have the greatest vulnerability, the position of women in Bangladesh – especially in relation to climate change impacts – makes them the most likely beneficiaries of the project interventions. The project interventions that focus on improving resilient infrastructure will benefit women in particular, as the twenty cluster houses will have women-led households as the prioritised beneficiaries. The use of these houses as shelters during cyclones and floods will also empower women, by positioning the owners of the cluster houses (i.e. women) as the authority governing these shelters for the duration of the cyclone or flood. This will also ensure that other women and girls are provided with safe shelters. The project will also focus on developing the livelihoods of the local communities, by improving agricultural knowledge and techniques and developing new alternative livelihood options. The development of alternative livelihoods (which will prioritise female beneficiaries) will empower women by providing them with the training and materials they require to become self-sufficient if they choose to. By improving the economic productivity and self-sufficiency of women through this activity, the project will support a shift towards greater empowerment of women. To support gender equality, the training and awareness-raising activities held at the knowledge and innovation centres will include a minimum of 50% female representation and will incorporate gender sensitivity training. This will include the training for the farmer field schools, community training for embankment management and community training for the maintenance of newly constructed infrastructure (i.e. nano-grids and rainwater harvesting systems).

Briefly describe in the space below how the Project mainstreams environmental sustainability

The project focuses on improving the social condition of the target populations, however, environmental sustainability is an important aspect of this. Environmental sustainability will be promoted by the project in a number of ways. Firstly, the project will generate environmental co-benefits through the establishment of solar energy for at least 600 houses. This will provide clean energy to the local communities, reducing the dependence on fuelwood or fossil fuels and avoiding the associated GHG emissions. The implementation of solar energy will also serve as a model for other rural areas of Bangladesh, thereby mainstreaming decentralised renewable energy solutions. Secondly, the project will incorporate environmental awareness-raising campaigns for local schools and communities. This will improve local understanding of climate

change, but also of the importance of environmental sustainability and maintaining functional ecosystems. Thirdly, Ecosystem-based Adaptation measures, such as planting grass and mangrove trees, will be used to strengthen embankments and eroding riverbanks. This will provide biodiversity co-benefits that would not result from regular embankment construction, as well as providing some mitigation co-benefits through carbon sequestration by trees and mangroves in particular.

Part B. Identifying and Managing Social and Environmental Risks

QUESTION 2: What are the Potential Social and Environmental Risks? *Note: Describe briefly potential social and environmental risks identified in Attachment 1 – Risk Screening Checklist (based on any "Yes" responses). If no risks have been identified in Attachment 1 then note "No Risks Identified" and skip to Question 4 and Select "Low Risk". Questions 5 and 6 not required for Low-Risk Projects.*	**QUESTION 3: What is the level of significance of the potential social and environmental risks?** *Note: Respond to Questions 4 and 5 below before proceeding to Question 6*			**QUESTION 6: What social and environmental assessment and management measures have been conducted and/or are required to address potential risks (for Risks with Moderate and High Significance)?**
Risk Description	*Impact and Probability (1-5)*	*Significance (Low, Moderate, High)*	*Comments*	*Description of assessment and management measures as reflected in the Project design. If ESIA or SESA is required note that the assessment should consider all potential impacts and risks.*
Risk 1: Plinths for retrofitted houses	I = 1 P = 1	**Low**	The plinths raised for retrofitting houses may shift or subside during high water events. This may cause the plinths to sink during floods or to become unstable once waters have receded.	The plinths will be designed, raised and compacted according to design specifications and best practices (see Annex A) to ensure that collapses will not occur during flood events. Community members who are trained to assist with retrofitting will also receive training to conduct periodic assessments on the structural stability of the plinths.
Risk 2: Construction sites could pose a risk to community members	I = 1 P = 1	**Low**	Certain project interventions will involve small earthworks, i.e. to raise plinths, to do excavations for repairing the embankments and constructing the cluster houses. Excess sediment may pose a risk post construction. The earthworks and construction sites for the cluster houses may also be hazardous during the night or other low visibility periods.	All construction activities will be conducted under the oversight of experienced professionals who will also train local staff on best construction practices. To ensure that sediment is not mobilised through current movement that will result in an impact, all excess sediment will be moved an acceptable distance from the construction site (see Annex 5). Further, any earthworks should be undertaken during the dry season and compacted sufficiently to reduce sediment movement. All construction sites will be properly demarcated to ensure that hazardous areas, such as holes, pits and exposed sharp objects do not pose a threat to nearby communities (i.e. areas will be fenced off or demarcated with reflective hazard tape)
Risk 3: Cluster houses may become structurally unsafe during extreme cyclone events	I = 3 P = 1	**Moderate**	The cluster houses that function as disaster shelters could become structurally unsafe during extreme cyclone events due to the number of individuals taking shelter and the strength of the cyclone.	The cluster house cyclone shelters will be designed according to rigorous standards to ensure they can withstand the extreme impacts of high-powered cyclones (refer to Annex A). To reduce the risk of extensive structural damage, local community members will be trained to identify signs of structural weakening, and construction specialists will conduct periodic assessments of these structures, especially after cyclones.
Risk 4: Women could face abuse or harassment when taking shelter in the cluster houses during cyclones	I = 2 P = 1	**Low**	There is a high incidence rate of women becoming the victims of harassment in cyclone shelters due to the general confusion, close proximity and lack of gendered washrooms in cyclone shelters.	The cluster houses that function as cyclone shelters will be designed to have separate wash facilities for women and for men. These cluster houses will also belong predominantly to women-led households, ensuring that women will, in general, hold the greatest authority over these shelters during cyclone events. The structure of the cluster houses will also ensure that if necessary there are multiple rooms where women and children could be separate from men during cyclone events.
Risk 5: The repair of embankments could be substandard leading to breaches during floods or cyclones.	I = 1 P = 1	**Low**	The project will involve the repair of two embankments in the target areas. If they are not repaired according to design specifications (See Annex A) they could be breached during high water events, leading to damage to assets and livelihoods.	Prior to installation, a full site evaluation will be undertaken to assess each site. Appropriate measures will be taken to ensure that the repairs are conducted in line with best practice and meet the design specifications. Furthermore, the community training for embankment management will incorporate training to support community monitoring of embankment condition to support proactive embankment maintenance instead of reactive embankment repair.

Risk 6: Potential conflict regarding access to cold storage	I = 1 P = 1	**Low**	As the cold storage units being established by the project will not be large enough to store the food produce of all community members it is possible that conflict over cold storage access could arise.	To support equal access to cold storage, the units will be located at the innovation centres at both of the target sites. Access to use the fridges will be determined through a beneficiary system based on assessed vulnerability for household-level food insecurity and need for short-term storage for crops intended for resale. The register will be managed by the project representatives at the innovation centres. Proportional access will be provided to store i) household food and ii) crops/fish intended for sale.
Risk 7: Beneficiary selection challenges	I = 1 P = 1	**Low**	There is the potential for conflict to arise if community members feel that they should be prioritized for certain interventions. The beneficiary criteria will be based on vulnerability assessments, but subjective self-perceptions of vulnerability may be contradicted by the assessments.	The project is based on similar existing programmes currently being undertaken in Bangladesh. The project has developed a clear beneficiary selection process (Annex B) that will be communicated to target communities during the project inception. Furthermore, in the event that any community members feel they are being discriminated against, they can file a complaint through the project's grievance redress mechanism (refer to Annex 5).
Risk 9: Interventions focusing on gender equality may cause conflict regarding traditional gender norms.	I = 1 P = 1	**Low**	Interventions that focus on disaggregated gender targets and prioritise equal participation by both men and women may run counter to established gender norms. This may result in conflict between groups who have different perspectives on gendered roles and responsibilities.	Gender sensitivity will be incorporated into all trainings and community level interventions, including farmer field schools, innovation centre training and awareness raising campaigns. This will reduce the occurrence of any conflict arising from the difference in perspective regarding the attendance of women or men at specific trainings and the support of women for the development of livelihoods.
Risk 10: Discrimination against minority/religious/landless	I = 1 P = 1	**Low**	Discrimination against minority groups is unlikely but possible as only very small numbers of minority groups are resident in the target areas, including the landless, women-led households and minority religions.	The selection criteria will ensure that selection is not based on any religious or other discriminatory reason but will be based solely on the vulnerability assessment and strict beneficiary selection criteria (see Annex B).

	QUESTION 4: What is the overall Project risk categorization?		
	Select one (see SESP for guidance)		**Comments**
	Low Risk	☐	
	Moderate Risk	**X**	**If the appropriate mitigation measures are put in place during the project, the project will have an extremely low environmental and social risk over the life of the project.**
	High Risk	☐	
	QUESTION 5: Based on the identified risks and risk categorization, what requirements of the SES are relevant?		
	Check all that apply		**Comments**
	Principle 1: Human Rights	☐	The project will provide support for the most vulnerable socio-economic groups, i.e., women, the elderly and the landless, especially those belonging to extremely poor households. The project adopts the principle of positive discrimination and includes specifically the most discriminated, marginalized and the poorest people in the community. Therefore, both in principle and in practical terms, the possibility of human rights violation by the project is not possible.

	Principle 2: Gender Equality and Women's Empowerment	**X**	In order to remove the long standing discrimination of women by the male-dominated Bangladesh society, aspects of the project are directly targeted towards women from vulnerable households. The results framework will also include disaggregated gendered results to ensure that women benefit equally from all interventions and trainings.
	1. Biodiversity Conservation and Natural Resource Management	**X**	The project does not have any components that will result in adverse impacts on the environment. Fish farms are, however, integrated into the community management of embankments (Output 2.2.), and fish farming will be developed in the innovation centres (Output 4.2.). These fish farms will be developed sustainably and in line with best practices for aquaculture.
	2. Climate Change Mitigation and Adaptation	**X**	The project interventions are designed in an integrated manner that will increase the adaptive capacity of vulnerable char communities in Bangladesh. These benefits will be geared towards assisting the most vulnerable members of the target communities. As no major infrastructure or resource utilization is included in the project interventions, there will be no large-scale emissions associated with the project. On the contrary, the establishment of solar power for 600 households will provide a small mitigation benefit in the form of reduced reliance on wood and fossil fuels.
	3. Community Health, Safety and Working Conditions	**X**	The project may create hazardous areas during the construction of cluster houses and the rehabilitation and repair of embankments. To mitigate this, best practice and national construction standards will be adhered to. All hazardous areas will be clearly demarcated with reflective tape and any excavations will be fenced off to protect communities in the vicinity of the construction sites. There is a further minor risk that the cluster houses, during their function as disaster shelters will be damaged during cyclones. To prevent this from occurring local community members will be trained to identify signs of structural weakening, and construction experts will conduct periodic assessments of the structures to ensure their stability.
	4. Cultural Heritage	☐	The project has no impact on cultural heritage.
	5. Displacement and Resettlement	**X**	Voluntary and temporary displacement of households is predicted to occur during the retrofitting of houses or the raising of plinths for increasing the climate resilience of houses. People who undergo voluntary and temporary resettlement, likely for only a few days, will either reside with neighbours or will be provided with local accommodation by the partner NGOs responsible for the retrofitting of the houses
	6. Indigenous Peoples	☐	The project has no impact on indigenous peoples.
	7. Pollution Prevention and Resource Efficiency	☐	The project will not result in increased pollution

Final Sign Off

Signature	***Date***	***Description***
QA Assessor		UNDP staff member responsible for the Project, typically a UNDP Programme Officer. Final signature confirms they have "checked" to ensure that the SESP is adequately conducted.
QA Approver		UNDP senior manager, typically the UNDP Deputy Country Director (DCD), Country Director (CD), Deputy Resident Representative (DRR), or Resident Representative (RR). The QA Approver cannot also be the QA Assessor. Final signature confirms they have "cleared" the SESP prior to submittal to the PAC.
PAC Chair		UNDP chair of the PAC. In some cases, PAC Chair may also be the QA Approver. Final signature confirms that the SESP was considered as part of the project appraisal and considered in recommendations of the PAC.

SESP Attachment 1: Social and Environmental Risk Screening Checklist

Checklist Potential Social and Environmental Risks		
Principles 1: Human Rights		**Answer (Yes/No)**
1.	Could the Project lead to adverse impacts on enjoyment of the human rights (civil, political, economic, social or cultural) of the affected population and particularly of marginalized groups?	No
2.	Is there a likelihood that the Project would have inequitable or discriminatory adverse impacts on affected populations, particularly people living in poverty or marginalized or excluded individuals or groups? [7]	No
3.	Could the Project potentially restrict availability, quality of and access to resources or basic services, in particular to marginalized individuals or groups?	No
4.	Is there a likelihood that the Project would exclude any potentially affected stakeholders, in particular marginalized groups, from fully participating in decisions that may affect them?	No
5.	Is there a risk that duty-bearers do not have the capacity to meet their obligations in the Project?	No
6.	Is there a risk that rights-holders do not have the capacity to claim their rights?	No
7.	Have local communities or individuals, given the opportunity, raised human rights concerns regarding the Project during the stakeholder engagement process?	No
8.	Is there a risk that the Project would exacerbate conflicts among and/or the risk of violence to project-affected communities and individuals?	No
Principle 2: Gender Equality and Women's Empowerment		
1.	Is there a likelihood that the proposed Project would have adverse impacts on gender equality and/or the situation of women and girls?	No
2.	Would the Project potentially reproduce discriminations against women based on gender, especially regarding participation in design and implementation or access to opportunities and benefits?	No
3.	Have women's groups/leaders raised gender equality concerns regarding the Project during the stakeholder engagement process and has this been included in the overall Project proposal and in the risk assessment?	No
4.	Would the Project potentially limit women's ability to use, develop and protect natural resources, taking into account different roles and positions of women and men in accessing environmental goods and services?	No
Principle 3: Environmental Sustainability: Screening questions regarding environmental risks are encompassed by the specific Standard-related questions below		
Standard 1: Biodiversity Conservation and Sustainable Natural Resource Management		
1.1	Would the Project potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services?	No
1.2	Are any Project activities proposed within or adjacent to critical habitats and/or environmentally sensitive areas, including legally protected areas (e.g. nature reserve, national park), areas proposed for protection, or recognized as such by authoritative sources and/or indigenous peoples or local communities?	No
1.3	Does the Project involve changes to the use of lands and resources that may have adverse impacts on habitats, ecosystems, and/or livelihoods? (Note: if restrictions and/or limitations of access to lands would apply, refer to Standard 5)	No
1.4	Would Project activities pose risks to endangered species?	No
1.5	Would the Project pose a risk of introducing invasive alien species?	No
1.6	Does the Project involve harvesting of natural forests, plantation development, or reforestation?	No
1.7	Does the Project involve the production and/or harvesting of fish populations or other aquatic species?	Yes
1.8	Does the Project involve significant extraction, diversion or containment of surface or ground water? *For example, construction of dams, reservoirs, river basin developments, groundwater extraction*	No
1.9	Does the Project involve utilization of genetic resources? (e.g. collection and/or harvesting, commercial development)	No
1.10	Would the Project generate potential adverse transboundary or global environmental concerns?	No
1.11	Would the Project result in secondary or consequential development activities which could lead to adverse social and environmental effects, or would it generate cumulative impacts with other known existing or planned activities in the area?	No

[7] Prohibited grounds of discrimination include race, ethnicity, gender, age, language, disability, sexual orientation, religion, political or other opinion, national or social or geographical origin, property, birth or other status including as an indigenous person or as a member of a minority. References to "women and men" or similar is understood to include women and men, boys and girls, and other groups discriminated against based on their gender identities, such as transgender people and transsexuals.

	For example, a new road through forested lands will generate direct environmental and social impacts (e.g. felling of trees, earthworks, potential relocation of inhabitants). The new road may also facilitate encroachment on lands by illegal settlers or generate unplanned commercial development along the route, potentially in sensitive areas. These are indirect, secondary, or induced impacts that need to be considered. Also, if similar developments in the same forested area are planned, then cumulative impacts of multiple activities (even if not part of the same Project) need to be considered.	
Standard 2: Climate Change Mitigation and Adaptation		
2.1	Will the proposed Project result in significant[8] greenhouse gas emissions or may exacerbate climate change?	No
2.2	Would the potential outcomes of the Project be sensitive or vulnerable to potential impacts of climate change?	No
2.3	Is the proposed Project likely to directly or indirectly increase social and environmental vulnerability to climate change now or in the future (also known as maladaptive practices)? *For example, changes to land use planning may encourage further development of floodplains, potentially increasing the population's vulnerability to climate change, specifically flooding*	No
Standard 3: Community Health, Safety and Working Conditions		
3.1	Would elements of Project construction, operation, or decommissioning pose potential safety risks to local communities?	Yes
3.2	Would the Project pose potential risks to community health and safety due to the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. explosives, fuel and other chemicals during construction and operation)?	No
3.3	Does the Project involve large-scale infrastructure development (e.g. dams, roads, buildings)?	No
3.4	Would failure of structural elements of the Project pose risks to communities? (e.g. collapse of buildings or infrastructure)	Yes
3.5	Would the proposed Project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, erosion, flooding or extreme climatic conditions?	No
3.6	Would the Project result in potential increased health risks (e.g. from water-borne or other vector-borne diseases or communicable infections such as HIV/AIDS)?	No
3.7	Does the Project pose potential risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during Project construction, operation, or decommissioning?	No
3.8	Does the Project involve support for employment or livelihoods that may fail to comply with national and international labor standards (i.e. principles and standards of ILO fundamental conventions)?	No
3.9	Does the Project engage security personnel that may pose a potential risk to health and safety of communities and/or individuals (e.g. due to a lack of adequate training or accountability)?	No
Standard 4: Cultural Heritage		
4.1	Will the proposed Project result in interventions that would potentially adversely impact sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible forms of culture (e.g. knowledge, innovations, practices)? (Note: Projects intended to protect, and conserve Cultural Heritage may also have inadvertent adverse impacts)	No
4.2	Does the Project propose utilizing tangible and/or intangible forms of cultural heritage for commercial or other purposes?	No
Standard 5: Displacement and Resettlement		
5.1	Would the Project potentially involve temporary or permanent and full or partial physical displacement?	Yes
5.2	Would the Project possibly result in economic displacement (e.g. loss of assets or access to resources due to land acquisition or access restrictions – even in the absence of physical relocation)?	No
5.3	Is there a risk that the Project would lead to forced evictions?[9]	No
5.4	Would the proposed Project possibly affect land tenure arrangements and/or community-based property rights/customary rights to land, territories and/or resources?	No
Standard 6: Indigenous Peoples		

[8] In regard to CO_2, 'significant emissions' corresponds generally to more than 25,000 tons per year (from both direct and indirect sources). [The Guidance Note on Climate Change Mitigation and Adaptation provides additional information on GHG emissions.]

[9] Forced evictions include acts and/or omissions involving the coerced or involuntary displacement of individuals, groups, or communities from homes and/or lands and common property resources that were occupied or depended upon, thus eliminating the ability of an individual, group, or community to reside or work in a particular dwelling, residence, or location without the provision of, and access to, appropriate forms of legal or other protections.

6.1	Are indigenous peoples present in the Project area (including Project area of influence)?	No
6.2	Is it likely that the Project or portions of the Project will be located on lands and territories claimed by indigenous peoples?	No
6.3	Would the proposed Project potentially affect the human rights, lands, natural resources, territories, and traditional livelihoods of indigenous peoples (regardless of whether indigenous peoples possess the legal titles to such areas, whether the Project is located within or outside of the lands and territories inhabited by the affected peoples, or whether the indigenous peoples are recognized as indigenous peoples by the country in question)? *If the answer to the screening question 6.3 is "yes" the potential risk impacts are considered potentially severe and/or critical and the Project would be categorized as either Moderate or High Risk.*	No
6.4	Has there been an absence of culturally appropriate consultations carried out with the objective of achieving FPIC on matters that may affect the rights and interests, lands, resources, territories and traditional livelihoods of the indigenous peoples concerned?	No
6.5	Does the proposed Project involve the utilization and/or commercial development of natural resources on lands and territories claimed by indigenous peoples?	No
6.6	Is there a potential for forced eviction or the whole or partial physical or economic displacement of indigenous peoples, including through access restrictions to lands, territories, and resources?	No
6.7	Would the Project adversely affect the development priorities of indigenous peoples as defined by them?	No
6.8	Would the Project potentially affect the physical and cultural survival of indigenous peoples?	No
6.9	Would the Project potentially affect the Cultural Heritage of indigenous peoples, including through the commercialization or use of their traditional knowledge and practices?	No
Standard 7: Pollution Prevention and Resource Efficiency		
7.1	Would the Project potentially result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and/or transboundary impacts?	No
7.2	Would the proposed Project potentially result in the generation of waste (both hazardous and non-hazardous)?	No
7.3	Will the proposed Project potentially involve the manufacture, trade, release, and/or use of hazardous chemicals and/or materials? Does the Project propose use of chemicals or materials subject to international bans or phase-outs? *For example, DDT, PCBs and other chemicals listed in international conventions such as the Stockholm Conventions on Persistent Organic Pollutants or the Montreal Protocol*	No
7.4	Will the proposed Project involve the application of pesticides that may have a negative effect on the environment or human health?	No
7.5	Does the Project include activities that require significant consumption of raw materials, energy, and/or water?	No

Annex E. Information on Cyclone Preparedness Programme (CPP) equipment packs

Technical Specifications of CPP equipment pack

The Goods and Related Services shall comply with following Technical Specifications:

Item No	Name of Item or Related Service	Technical Specification and Standards	
1	**2**	**3**	
Lot No A:			
1.	Megaphone	**Brand**	To be mentioned by the bidder/supplier.
		Model	To be mentioned by the bidder/supplier.
		Country of origin	To be mentioned by the bidder/supplier.
		Name of Manufacturer	To be mentioned by the bidder/supplier.
		Power source	Dry cell Battery Operated (D-size 1.5 v x 10= 15 volt)
		Rated Output	Rated-30watt, max-45watt.
		Battery Life	Minimum 16 hours.
		Audible Range	Minimum 750 meter.
		Signal sound	Whistle/Siren.
		Finish	ABS resin.
		Weight	Max. 3.75kg .
		Text & Logo Screen Print	As per direction of the authority
		Sample:	As per specification and sample must be submitted with tender.
Lot No A:			
2.	**Hand Siren**	**Brand**	To be mentioned by the bidder/supplier.
		Model	To be mentioned by the bidder/supplier.

		Country of origin	To be mentioned by the bidder/supplier.
		Name of Manufacturer	To be mentioned by the bidder/supplier.
		Operating System	Hand Operated.
		Sound Rating	110 -120 ±2dB (A) @1M.
		Output Frequency	550-600 ±20Hz. (Dependent on Rotation Speed)
		Tone	Single Tone.
		Siren Range	500 meter (min).
		Construction	Metal.
		Dimension	186X186x179mm (Standard & Portable).
		Weight	1.2 kg
		Screen print Logo & Text	As per direction of the authority
Sample:		Sample must be submitted with tender.	

The Goods and Related Services shall comply with following Technical Specifications:

Item No	**Name of Item**	**Technical Specification and Standards**		**Bidder offer**
1	**2**	**3**		**4**
Lot No B:				
2.	**CPP Vest**	**Brand**	To be mentioned by the bidder/supplier.	
		Model	To be mentioned by the bidder/supplier.	
		Country of origin	To be mentioned by the bidder/supplier.	
		Name of Manufacturer	To be mentioned by the bidder/supplier.	
		Basic fabrics:	Cotton (Gabardine)	
		a) Materials	100% Cotton	
		b) Color	Orange	
		c) GSM	130 ± 5	
		d) Pocket button	Metal	
		Measurements Size	**(L)** **(XL)**	
		a) length body	69 cm 71 cm	
		b) chest	57 cm 69 cm	
		c) Half solder	15 cm 16 cm	
		d) opening neck	18 cm 19 cm	
		e) neck droop	18 cm 19 cm	
		f) 2zipper length all size	34 cm 34 cm	
		g) arm hole curve	28 cm 29 cm	
		h) back yoke	34 cm 35 cm	
		i) chest pocket all size (Left &Right)	15.5X16	
		j) front bottom pocket left side for all size as per sample	18cm X 23cm	
		k) pocket zipper length all size as per sample	17 cm	
		l) back length	70 cm 72 cm	
		m) back pocket all size as per sample	28 cm X 37 cm and zipper length 18 cm	
		Text & Logo Screen Print	Text & Logo Embroidery with design should be reflective as per sample shown in the office.	
		Sample	Everything as per sample & sample must be attached with tender.	

Item No	**Name of Item or Related Service**	**Technical Specification and Standards**	
1	**2**	**3**	
Lot No D:			
1.	Signal Flag	**Brand**	To be mentioned by the bidder/supplier.
		Model	To be mentioned by the bidder/supplier.
		Country of origin	To be mentioned by the bidder/supplier.
		Name of Manufacturer	To be mentioned by the bidder/supplier.
		Materials:	Polyester Cloth with water proof
		Color:	Red & Black
		Size:	Strictly as per sample shown in the office. Square shape, 23"x23" size (red colored cloth outer side), inside of the red colored cloth 11.5"x11.5"

			black cloth. Sizes mentioned here after stitching. Should have enough provision (made of same cloth) to knot the flag with flag mast.
		Sample:	Everything as per sample & sample must be submitted with tender.
Lot No -D			
2.	Signal Flag Mast	**Brand**	To be mentioned by the bidder/supplier.
		Model	To be mentioned by the bidder/supplier.
		Country of origin	To be mentioned by the bidder/supplier.
		Name of Manufacturer	To be mentioned by the bidder/supplier.
		Materials:	Made of GI Pole
		Size:	Outer Diameter 2", thickness 3.00 mm to 3.25mm & 20 feet long.
		Hanging system	The provision on top to hang the rope of the flag and another provision at the bottom (5 feet from the bottom end and 6"X6" base plate thickness 3mm)
		Sample:	Sample must be submitted with tender.

Invoice for the "Supply, Installation and Commissioning of Cyclone Preparedness Equipment					
SL	**Description of supplied, Installation & Commissioning of Items**	**Quantity(Pcs/Nos)**	**Unit Price(BDT)**	**Total Amount(BDT)**	**Total Amount(US$)**
1	Supply, Installation & Commission of Megaphone Brand: TOA, Model: ER2230-W	1000	14,330.00	14,330,000.00	170,885.54
2	Supply, Installation & Commission of Hand Siren Brand: Tizohou Lion Signal Co. Ltd. Model: LK-100,	1000	6,300.00	6,300,000.00	75,127.63
3	Supply of CPP Vest as per your approved sample & specification Brand: As per sample	1000	567.00	567,000.00	6,761.49
4	Supply of Flag as per your approved sample & specification Brand: As per sample Orgin of Country: Bangladesh	1000	243.00	243,000.00	2,897.78
5	Supply, fitting & fixing of Signal Flag Mast Brand: UNION Orgin of Country: Bangladesh	1000	4,675.00	4,675,000.00	55,749.47
6	Motor Cycle 100 CC	40	150,000.00	6,000,000.00	71,550.38
7	Miscellaneous (lumpsum)				2027.72
	Grand Total				**385,000.00**

Annex F. Selection of Chars and Islands for Developing a Bankable Proposal for Adaptation Fund

Bangladesh is a deltaic plain and formed by the deposition of discharges of the Ganges (Padma), Brahmaputra (Jamuna), and Meghna Rivers and their tributaries and sub-tributaries. Major rivers including these big three are very dynamic in nature. Islands and bars (chars) are common in Bangladesh and formed by the hydro-morphological processes of rivers(EGIS, 2000)(Sarker & Alam, 2003). These Islands are also known as Coastal Chars and Bars are also known as Riverine Chars.

The riverine chars can be defined as the sandbars emerging as an island within the river channel, or as attached land to the riverbanks which formed due to the dynamism of erosion and accretion in the rivers of Bangladesh, which often create new opportunities to establish settlements and pursue agricultural activities on them. In many studies, vegetated Islands within the riverbanks is defined as char(EGIS, 2000). On the other hand, Islands are the sediment deposited landmasses which formed in the estuary or coastal areas by the delta progression process and extremely active and dynamic in nature. Both chars and islands can be attached with or detached from the mainland. Figure 1-1 represents the chars and islands of Bangladesh. Generally, these areas are vulnerable to erosion, flooding (both tidal and monsoon) and other sorts of climatic and non-climatic incidences (Chowdhury, 2006). Except for the permanent chars and islands, most of the chars are exposed to severe erosion and flooded at least once each year. Poor and landless people live in these areas. So, the life and livelihoods of the dwellers of char areas are too much uncertain(EGIS, 2000).

Classification of Chars and Islands of Bangladesh

In different studies, it was tried to identify the total number of coastal Islands and chars as well as their location. But due to the nature of formation the location of chars and Islands, its number, and other characteristics are not always fixed like the mainland. In 2001 ICZMP (Integrated Coastal Zone Management Program) conducted a detailed survey of 'Coastal & Estuarine Island and char lands' inventory and found total 187 number of coastal Islands and riverine chars. Depending on the dynamism and formation process chars can broadly be classified as Riverine chars and coastal chars/islands. ICZMP classified Islands and Chars into three broad classes like i. Marine & Estuarine Island, ii. Detached Riverine Chars and iii. Chars attached to the mainland (Figure 2-2). Marine and estuarine islands are similar to the coastal islands. Some of the marine and estuarine islands are Sonadia, Maheshkhali, Charmatarbari, Kutubdia, Sandwip, Urir Char, Hatiya, Nijumdwip, Manpura, Bhola, Charfasson, Dhalchar, Charkukrimukri, Char Mantaz, Char Lakshmi, Rangabali etc. Attached chars are those which are accessible from the mainland without crossing the main channel. However, detached chars are those which can be reached from the mainland only by crossing the main channel even in the dry season (EGIS, 2000).

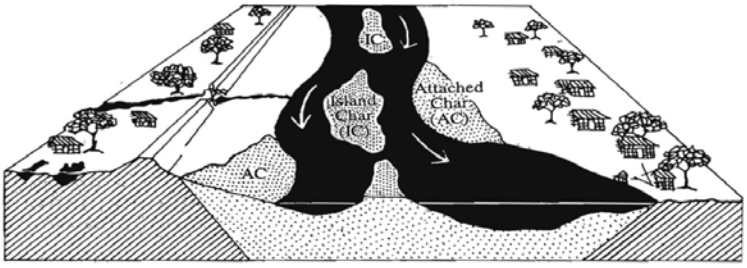


Figure 0-1 Islands and Attached Char(EGIS, 2000)

Morphological Phenomenon of Chars and Islands in Bangladesh

The formation process of chars and islands are very much complex and dynamic in nature. The characteristics and process of chars formation may vary in braided and meandering rivers as well as in the estuaries. Predominantly in the monsoon, rivers overflow and carry a substantial amount of silt towards downstream. The silt eventually deposits, a huge part of it settles in the shallow water along the river and coastal belt and ultimately leads to a new land formation in the form of riverine or coastal Chars (Wameq Raza, Anindita Bhattacharjee, Narayan Chandra Das, 2011). The Ganges-Brahmaputra-Meghna (GBM) river system keeps the deltaic floodplains active in the coastal region of Bangladesh making the coastal area the most geomorphologically dynamic in the country. On another hand, flood actions resulting in erosions keep the riverine chars, especially in Jamuna and Ganges, subjected to continuous morphological changes (Islam S. N., 2016). The high amount of sediments carried by the GBM river systems is hence subjected to dynamic processes, especially around the Meghna estuary, resulting in continuous accretion, erosion, formation and alteration of offshore islands (Figure 3-1). Out of the 60 islands and 177 char lands that are identified in Bangladesh most are located in the central coastal zone due to this the dynamic estuarine and coastal system (Islam M. R., 2004). In general upper stream are formed by coarse materials while the downstream comprises finer particles. Water level may vary depending on the annual water level variations. At the downstream, end of each island scouring the bed to produce deeper and narrow channels. The morphological stability of chars and islands depends on the duration of these newly formed lands (EGIS, 2000).

Selection of Chars and Island for the proposed project

The life and livelihood of Islands and chars dwellers vary due to the size (areal coverage) of chars and islands, accessibility to different types of life supporting and essential services, level and extent of exposureand vulnerability, morphological stability, the existence of polder, availability of agricultural land and other natural resources etc. To develop a bankable project proposal for the char and island dwellers under this UNDP funded project, chars and islands have been selected from the list provided by ICZMP. Some criteria for selecting Islands and chars are size, connectivity, the existence of polder. Another important criterion of chars and islands selection was attached or detachedness with the mainland. In this study, preference has been given to those which are separated from the mainland and suffering a lot due to lack of basic services i.e. access to education, income generating activities, health facilities, etc. Vulnerability and risk of these areas depending on the accessibility, i.e., how quickly and easily one can reach there to rescue or evacuate them.

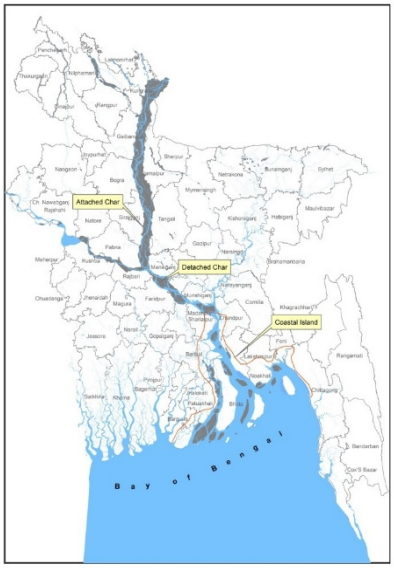


Figure 0-2 Chars and Islands of Bangladesh (Source: C3ER, BRAC University)

Figure 0-3 Classification of Chars

Steps Applied to Select Chars and Islands for this Project

The following steps have been applied to select the potential chars and islands for this project.

Figure 0-4 Steps Applied to Select the Chars and Islands

Selection of Chars and Islands

A GIS-based multi-criteria analysis and filtering procedure were conducted to select islands for this study. Some chars and islands excluded from the list as because of no physical existence and don't have detail information recorded in BBS (Bangladesh Bureau of Statistics) and other resources. Using GIS analysis Islands and chars are separated into two groups: I) Islands and chars attached to the mainland; and ii) islands and chars detached from the mainland. According to the demands of the project, attached islands and chars are excluded from the list. Existing islands were then assessed according to a risk database and analyzed in GIS environment. Processed data then classified using multi-criteria analysis depending on area, vulnerability and integrated risk.

Figure 0-5 Analysis of vegetation and settlement coverage

Approximate areas of Islands and chars have been extracted using Landsat TM/ETM satellite images, and the population has provided from 'Population and Housing Census 2011', Bangladesh Bureau of Statistics. A time series of satellite images of different resolutions (Landsat MSS 80m, Landsat TM/ETM 30m, and Quick Bird (Google Earth) 2.4m) from 1973 to 2013 was used for selection. In the recent high-resolution satellite images, physical statuses of some medium and small islands and chars are clearly visible and found that in some Islands and chars there are no traces of settlements. The size of chars and islands has been classified into four classes depending on their physical area following the percentile filtering technique and GIS analysis.

- Type I. Very small chars (0-25 percentiles of total chars and islands)
- Type II. Small chars (26-50 percentiles of total chars and islands)
- Type III. Medium chars (51-75 percentiles of total chars and islands)
- Type IV. Large chars (76-100 percentiles of total chars and islands)

Considering many other things it was decided that the medium size islands are suitable for this study. In addition, another criterion of Island and char selection is whether it is environmentally or biologically protected or not. Char Kukri Mukri is a wildlife sanctuary, and due to this, it is excluded from the list. Based on the size, accessibility, environmental and ecological significance and physical existence, a list of chars and islands have been prepared for a secondary screening process. Detailed information about climate vulnerability and risk, maturity level, broad land use classes (especially the vegetation coverage), etc., on the shortlisted chars and Islands, are collected from various sources and provided in table 4-1. The maturity of islands has studied through visual observation using satellite images. Different stages of chars and islands such as a formative stage, pre-mature stage, and mature stage have been observed in a time series of images from 1973 to 2013. The distance of Islands and chars from the respective Upazila or nearest accessible Upazila has been calculated by using GIS tools. Depending on the mode of transportation, weather condition, and temporal dynamics, the accessibility of chars and Islands also classified into three classes (Easy to access, medium accessibility and hard to reach). **Considering the criteria mentioned above, Mujib Nagar Union of the Char Fasson Upazila under the Bhola District as the representative of coastal char and Gajaghanta and Lakshmitari Union of the Gangachara Upazila under the Rangpur District can be selected as the representative of riverine charland for detailed field investigation.**

Existing Problems of the Study Area

Considering the geophysical attributes of the coastal char study area, the region was found to be prone to natural hazards such as cyclones, storm surges and tidal flood etc. with sea level rise induced by climate change increasing the magnitude and frequency of these phenomena. Tidal flooding in the region has been observed to be worsening with locals reporting an increase in the highest flood level over the past years. This corresponds to the IPCC's AR5 findings which indicate that the Average Sea Level has risen over the last century and establishes a correlation between Climate change and the increased highest tidal flood level in the study area. Apart from tidal flooding the increased frequency of extreme weather events like cyclones, hailstorms and storm surges also contribute to list of natural hazards that peril the human population of the study area in Mujibnagar. It is likely that monsoon flooding is increasing over the past few years in Rangpur. It can be noted here that the change in these climatic patterns corroborate with the findings of the IPCC in the recent annual report and as such can be attributed as being direct impacts of Climate Change upon the Char region.

Higher tidal/monsoon flood level has far reaching consequences from the inundation of roadways, causing damage to the existing earthen soiling road works, housing, schools and disrupting the normal flow of life for children and adults alike. Delving deeper into the nature of these natural hazards and their complex interrelationship with the developmental problems, the far-reaching impact they have upon the life of the people living there can be appreciated to an understandable degree of clarity.

The major livelihood of the char dwellers is agriculture which is affected by tidal or monsoon flooding, hailstorm, cold waves, heat waves, erratic rainfall etc. which leads to decline in crop yield, crop damage and ultimately causes a loss of agricultural production. The most extreme form of erosion is induced by tidal as well as monsoon flooding with erratic rainfall causing loss and damage to the agricultural land and crop production. In both the areas, damage to cultivable land and crop production leads to loss of economic and household assets, exacerbating farming livelihood risks. In 2016, Rice and Watermelon have been particularly damaged in Bhola. About 50% of the investments

in rice have been lost due to tidal flooding which caused “chita” formation in the rice grains and damaged the paddy harvest. Watermelons and other Rabi crops have been damaged due to water intrusion. Storm surges and cyclones lead to sudden crop loss while extreme weather events such as cold waves and prolonged fog events harm crops such as chilies. In Rangpur, short periods of extreme temperature and changes in precipitation cause harm to agriculture and also dwindle the meager water resources available. This ultimately leads to drought and this predicted increase in temperature will create an adverse situation for the inhabitants of

Climatic events such as extreme temperatures, flood and drought also threaten the livestock in both the study areas. The fluctuation in temperature and precipitation facilitate the propagation of diseases specially vector borne diseases to the cattle. In 2016, cattle were washed away and died during the tidal floods in the coastal chars.

Non-climatic drivers such as a weak market structure, information asymmetry, and limited access to credit increase the vulnerabilities of Char inhabitants. In Bhola, it is the unavailability of agricultural inputs especially fertilizers due to syndication of fertilizer dealers decreasing the input efficiency of farmers in crop production. In both the areas, lack of modern technologies along with insufficient extension and support from the agriculture sector and inadequate land equipment results in high production cost for the crops which has far reaching consequences, chief among those being the loss in income. No strong or effective backward and forward market linkages were observed in the char areas. An ineffective early warning system which happens to be byproduct of the lack of road ways and communication networks is likely responsible for the loss of livelihood and household assets. While agriculturists are facing the direct consequences of the climatic stressors, the nonagricultural wage workers have become vulnerable due to the fluctuating nature of their livelihood which correlates with the status of the agriculture of the respective areas.

When considering infrastructure it is necessary to understand that the term encompasses a wide variety of sectors and as such has far reaching consequences upon the development as well as assessment of the adaptation need of the study regions. Considering the field of transport and communication infrastructure, the common observation in both the regions was the absence or lack of pucca roadways and other transportation modes to and from the mainland. The causes identified for these sectoral problems are irregular maintenance, lack of funding, lack of connectivity to the mainland, unavailability of construction materials and land for constructions. Delving further into the root of the problems, for example when considering the irregular and high cost of maintenance and the unavailability of construction materials and land for construction, inundation and erosion of roadways due to tidal flooding, storm surges and cyclones are key drivers. Changes in the intensity and frequency of these key drivers have been correlated to climate change in the IPCC’s 5th Assessment Report, which implies that climate change has been a contributing factor to the inadequacy of transportation and communication infrastructure. Apart from these climatic drivers we can attribute this inadequacy to excessive costs for excavation and filling of land in repair works, lack of donor interest and an insufficient budget which comes as part and parcel of being a low priority region. This lack of transportation facilities has a detrimental effect upon the development of trade infrastructure by restricting the access to the outside markets and limiting the number of marketplaces accessible to the char population. The power infrastructure was also found depended on renewable energy sources, (predominantly solar power)

Moving on from transportation, observations regarding housing infrastructure revealed a case of frequent depredation of housing which in turn can be said to be an outcome of the housing units being constructed on low lands or the plinth not being elevated to an adequately safe level due to a lack of available resources or insufficient financial capability. Also, the cost of maintaining a safe plinth height imposes further costs associated with the need for regular maintenance (greater expenditure). Most of the residents in both the coastal and riparian Char Lands live in CI sheet housing or mud houses with CI sheet or thatched roofing. This low cost housing infrastructure for a majority of the population puts them at a greater risk of being harmed during disaster events. Looking at the climactic drivers for frequent depredation of housing, the major role is played by erosion cause by rising tidal flood level, storm surges and other water related disaster events.

The coastal study area of the Mujibnagar union (at Char Fasson, Bhola), which consisted of Char Motahar, Char Leulin and Char Manahar, has certain wards which fall outside the existing embankment/bund protection system which skirts the shores. This shows a distinct lack of coastal protection infrastructure in the region which is aggravated by the high cost of implementation of projects.

However, the main cause behind the lack of this kind of infrastructure seems to be an inadequate number of embankments and the existing level of damage to the current ones, and here yet again the impacts of climate change are manifest in the drivers being tidal flooding, cyclones and storm surges.

The state of Water and Sanitation infrastructure in Mujibnagar was found to be poor, as is evident through the inadequacy of access to groundwater resources (very few number of tube wells) and use of surface water resources contaminated through open defecation practices in the absence of pit latrines. Lack of government intervention, poor maintenance, inundation and damage of water resources and sanitary facilities during storm surges and floods makes whatever meager sanitation faculties available not sustainable. In the chars of Rangpur, the water and sanitation infrastructure was more developed than what was observed for the coastal chars. However, the overreliance of the population upon groundwater through tube wells causes depletion of the water table and increases the chances of water contamination during monsoon season.

The educational infrastructure was also found to be lacking in both the char areas. The main climatic drivers behind this were found to be tidal and monsoon flooding along with storm events, contribute to a lack of usable approach roads, which makes school buildings inaccessible during the disaster period and also wreak heavy damage upon the structure. Non-climatic drivers were the remoteness of the community, inadequate transportation and communication facilities and the financial conditions of the local government and community. A major problem is the lack of high schools in both char areas which is associated with a lack of connectivity to the mainland.

Considering the healthcare facilities available to the riparian and coastal char dwellers, the inaction of the local government, inadequate NGO intervention, the remoteness of the area (which adds to the fact that it is low priority region with a small budget) and a disinterest on behalf of the assigned health workers seem to be the main driving forces behind the inadequacy and inaccessibility of medical and treatment facilities. Analyzing the overall condition of the Chars at Bhola and Rangpur, societal degradation was found to be interconnected with the absence of infrastructure as well as lack of required livelihood options. All these issues lead to socio political problems, unemployment, poverty, child labor, early marriage, migration, educational instability, social unrest and finally psychosocial incongruity worsening the misery of the people. It has been found that, in both the coastal and riverine chars the problem of children dropping out of school is a common scenario, albeit one that the local governmental agencies have failed to properly address. Parents are unsure whether to send their children to the schools located faraway. During extreme disaster events, roads are inundated and most of the students are unable to attend school. In both the chars, this high incidence of school dropouts, female students are getting married at an early age, causing health hazards that contribute to an increased mother and child mortality rate culminating in psychological trauma. Furthermore, due to the impacts of climate change like- the rise in sea level, erratic rainfall, tidal flooding, and monsoon flooding and river erosion etc. char dwellers lose their agricultural land and assets on a frequent basis and live from hand to mouth most of the times. In the search for livelihood security, some stop their children (mostly boys) from going to school and engage them in various household as well as agriculture-based work to supplement their monthly income. As a result of this child labor has been a grave problem in these areas

The most critical impacts of the problems observed at the chars are loss of livelihood and loss of income which brings instability into the economics of the char settlement. Here, poverty appears to be the biggest societal issue complicating the social and psychosocial dynamics with its far-reaching consequences. Losing livelihood and assets due to climatic and non-climatic factors combined, most char dwellers take loans and become indebted, and this often happens to be a contributing factor for their migration to different areas in the quest for work or a source of income only to come back to the char in order to repay the loan as well as to recover from the damages afflicted by a disaster event. Being in a state of debt, circumstances often lead to these indebted individuals engaging in criminal activity. This likely leads to a state of social unrest and fosters socio cultural dissonance in the area studied.

River erosion in both char's shows, erosion and accretion of land commence a new societal conflict among the inhabitants. According to the East Bengal State Acquisition and Tenancy Act (EBSATA) of 1950, if any land is lost due to river erosion, the owner will get it back following few conditions like-

1. Land resurfacing must take place within 20 years,
2. By paying rent owner can get back the land settled by revenue officer,

3. Original owner will possess the land but not more than 375 bighas.

But unfortunately, no act or policy is being implemented at char owing to administrative mismanagement and self-advantage of the powerful political and non-political persons. Those who had land before but lost their land for river erosion are living a marginalized life and they expect to get their land back. This claiming of char land when it resurfaces in the river leads to an escalation of conflict between the neighboring land owners thereby contributing to societal anarchy and dispute which eventually culminates in litigation. Sometimes, the rightful parties get their land back though often, that is not the case. This litigation continues for years and many people are financially ruined.

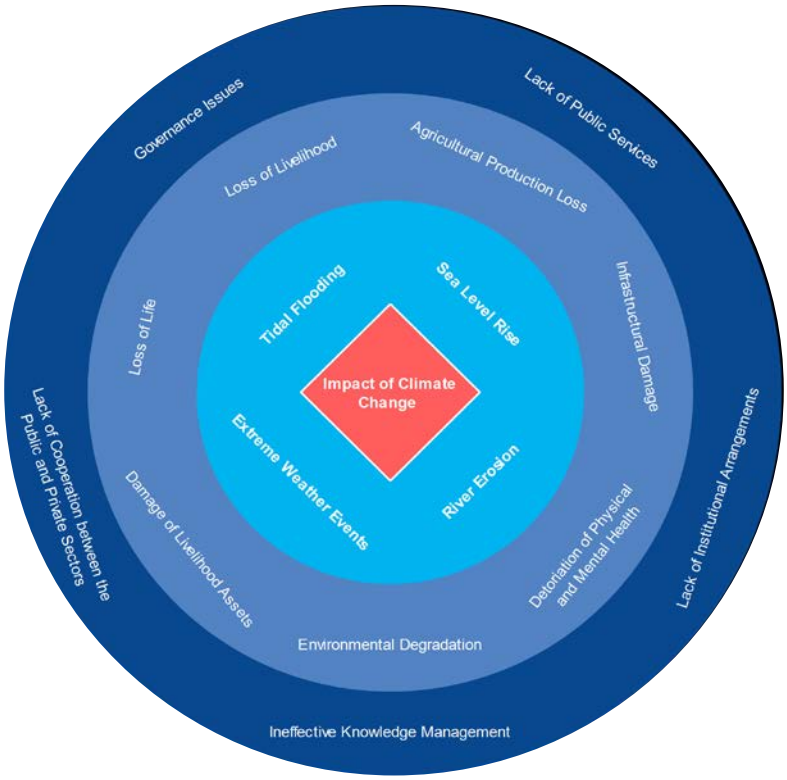


Figure 6 Problems of the Study Area

References

Chowdhury, J. U. (2006). *Issues in Coastal Zone Management in Bangladesh.* Dhaka: IWFM, BUET.

Deltaic floodplains development and wetland ecosystems management in the Ganges–Brahmaputra–Meghna Rivers Delta in Bangladesh2016*Sustainable Water Resources Management*

EGIS. (2000). *Riverine Chars in Bangladesh Environmental Dynamics and Management Issues.* Dhaka: UPL.

Sarker, M. H., & Alam, M. (2003). Rivers, chars and char dwellers of Bangladesh. *Intl. J. River Basin Management*, 61-80.

Wameq Raza, Anindita Bhattacharjee, Narayan Chandra Das. (2011). *Impact of Char Development and Settlement Project on improving the livelihood of Char dwellers.* Bangladesh: BRAC.

*Where Land Meets the Sea: A Profile of the Coastal Zone of Bangladesh*2004DhakaThe University Press

CHAPTER 1
Introduction

The United Nations Development Programme has undertaken a study for designing a project (with detailed feasibility study) to access global climate funds for addressing climate risks and vulnerability of the community leaving in the small and medium offshore islands and char lands of Bangladesh. For this purpose, a contract has been signed between UNDP and the Centre for Climate Change and Environmental Research (C3ER), BRAC University on 24 October 2016 to carry out the aforementioned feasibility study. According to the agreement, the study will assess socio-economic, demographic and poverty status along with climate risks and vulnerabilities of the small offshore islands and major vulnerable char lands of Bangladesh and provide a suite of recommendations for improving the climate resilience and adaptive capacity of the selected char islands.

Study Area

Lakshmitari Union, Gangachara Upazila

Gangachara Upazila, one of the important Upazila's of Rangpur District, is bounded by Kaliganj of Lalmonirhat and JaldhakaUpazilas on the north, Rangpur Sadar and KauniaUpazilas on the south, Aditmari and Lalmonirhat Sadar Upazilas on the east, Kishoreganj (Nilphamari) and Taraganj Upazilas on the west. The Teesta River flowing west to east, divided the Upazila into two parts. That is why the influence of Teesta River on this Upazila is huge and unavoidable. This Upazila is affected by river bank erosion and frequent flooding during monsoon. The most vulnerable area of this Upazila is Lakshimatari union. Figure 1-1 shows Lakshimatari union and surrounding area which is considered for the current study.

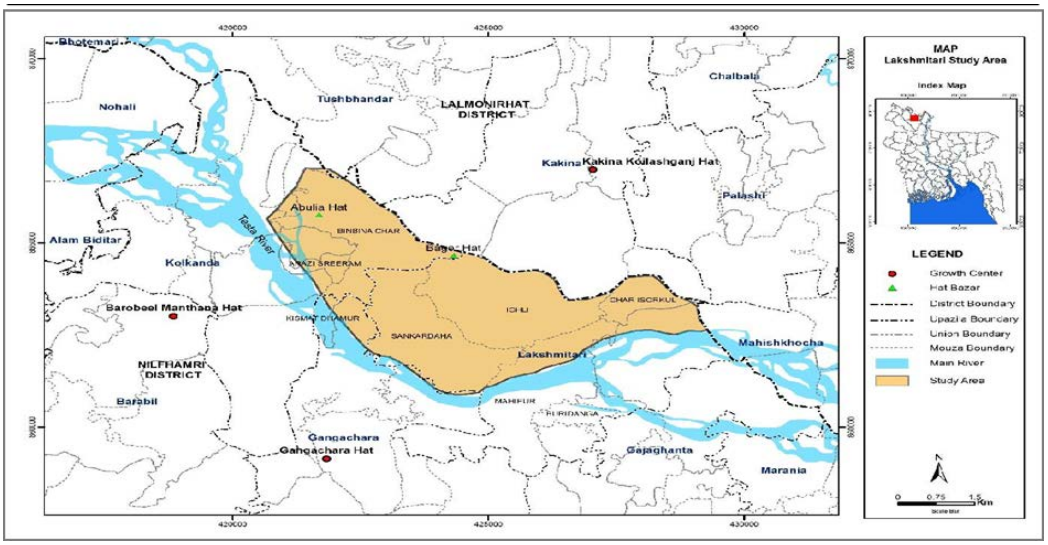


Figure 1-1: Study Area at Gangachara Upazila

Mujibnagar Union, Char Fasson Upazila

Almost all the coastal region of Bangladesh is enclosed by coastal embankment to prevent salinity intrusion and tidal flooding. These are commonly known as polders. Mujibnagar union of Char FassonUpazila under Bhola district belongs to a coastal polder. The embankment of this polder was constructed during the 1990s and within the past 25 years, the embankment was breached at numerous locations. Moreover, cyclones and tidal surges in the past have caused serious damage to many sections of the polder. At present, the embankment crest is lower than the original design specifications. The drainage canal inside the polder, which was designed to remove rainwater from the polder, has now been silted up. This Mujibnagar union and surrounding area are considered for the present study. Figure 1-2 shows the study area of Mujibnagar Union.

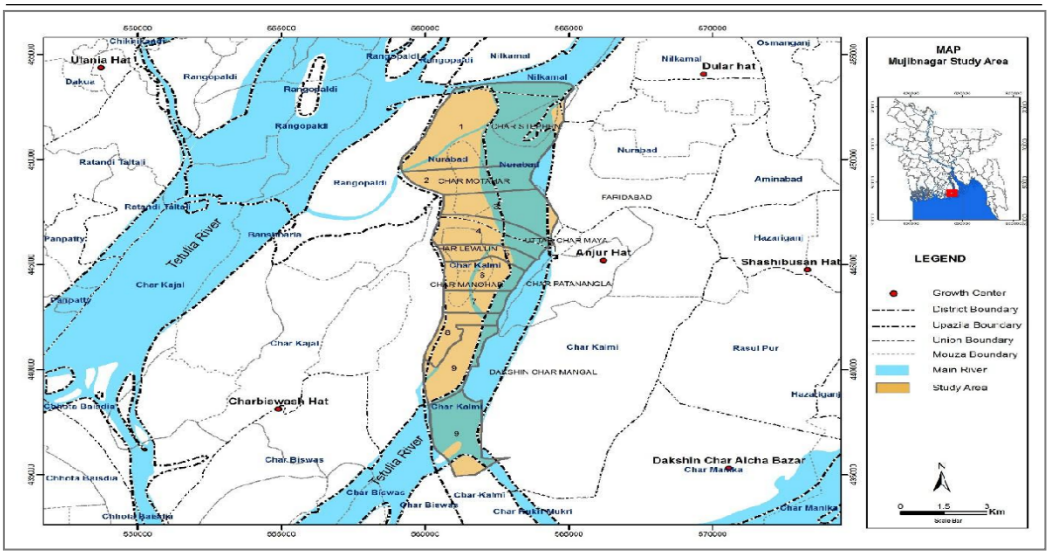


Figure 1-2: Study Area at Mujibnagar Union

- **Cyclone and climate resilient house:** Identify the houses which are structurally most vulnerable to the extreme climatic events. Assess the required repairing of the structure and retrofit where necessary.
- **Nano-grid, rainwater harvesting:** Identify the suitable households for installing the community based nano-grid facility and rainwater harvesting system. Provide detail design, specifications, cost estimates along with the operation and maintenance of the interventions.
- **Cold storage, solar powered pump:** Assess the demand of the study area and design cold storage and solar power pump to meet the demand. The design shall include details about the intervention and the associated equipment along with the cost estimations.
- **Embankment:** Identify the repairable portions of the embankment and provide adequate design for re-sectioning of the embankment. to protect the project area from flooding. The design shall include typical drawings, specification and cost estimates.
- **Floating ambulance:** Provide necessary information about the design and costing of the floating ambulance based on the requirement of the area. Details will also be provided on the operational costs for the floating ambulance.

CHAPTER 2
Background Information and Data Analysis

Existing Components Gangachara Upazila in Rangpur

The Lakshmitari Union under Gangachara Upazila of Rangpur district is one of the most river bank erosion vulnerable areas. Every year a huge amount of land is engulfed by the river. People are losing home and their agricultural land which consequences ultimate poverty. Riverbank erosion is a nightmare for the people living in this area. Moreover, flooding during the monsoon causes serious disaster in this area every year. There are neither flood protection measures nor erosion protection measures in this area. At downstream part of the union, a bridge is under construction which is likely to be completed by the next two years. The bridge consists of two guided revetment which will constrict the flow and expected to reduce the erosion of the riverbank at immediate downstream of the bridge. It was observed that there are two existing floodplain channels upstream of the Bridge, which has been silted up in the past 30 years and resulted in greater flows during peak flows, causing flooding.

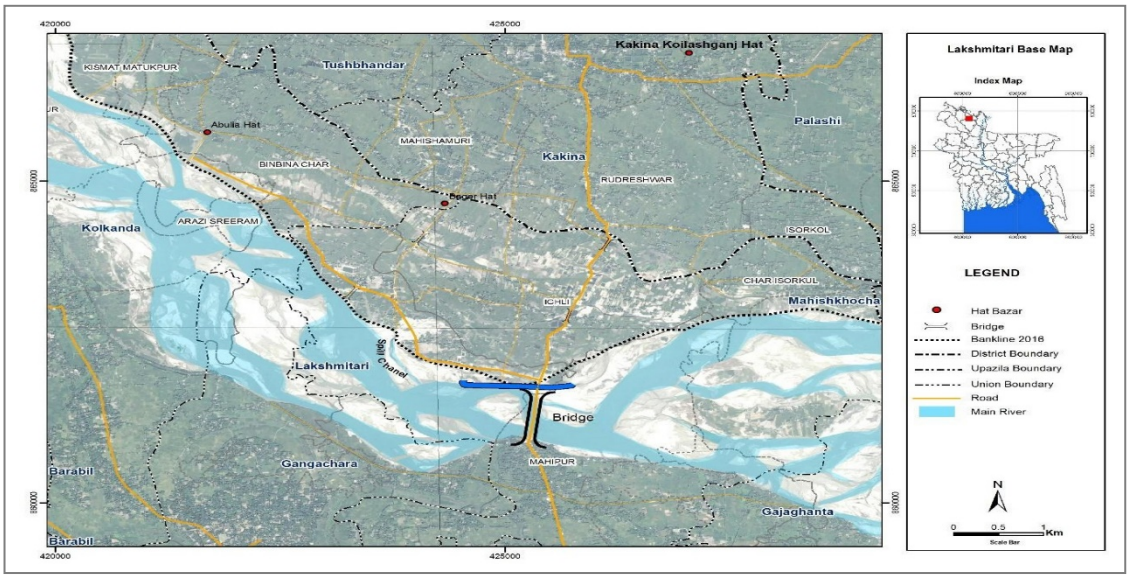


Figure 2-1: Gangachara Upazila Basemap

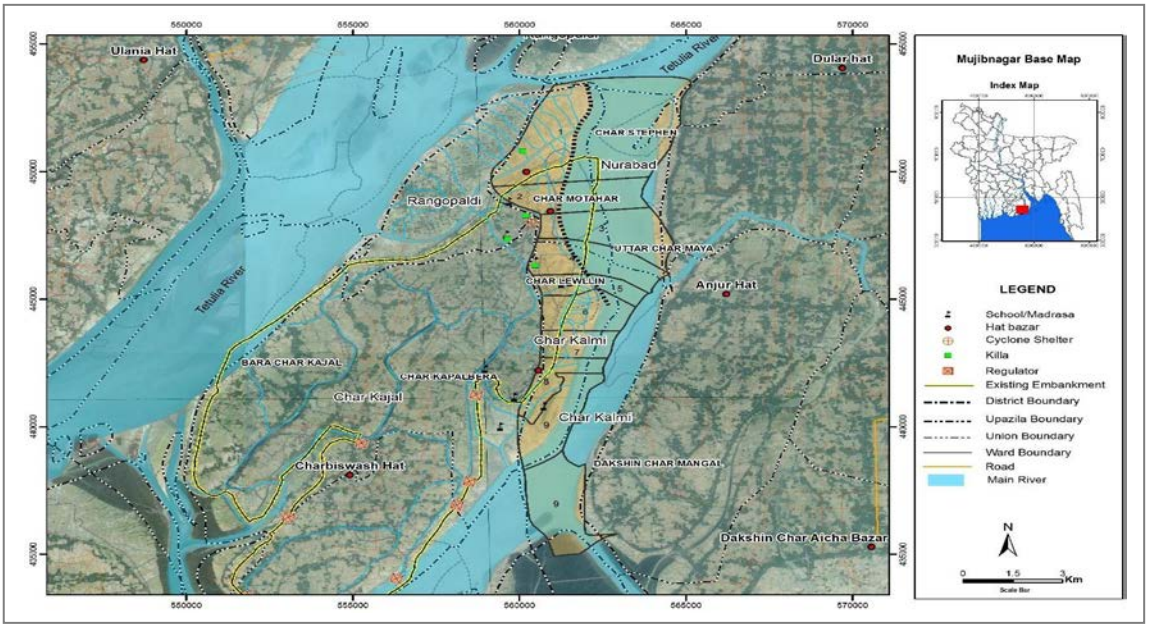


Figure 2-2: Mujibnagar Union Basemap

Existing Components in Mujibnagar Union of Bhola

Embankment

The existing embankment length in the polder is 66 km. It was constructed betweeen 1987 to 1992 under CEP (Coastal Embankment Project). The embankment was desingned to protect the polders against salinity and tide intrusion. The occurrence of recent cyclones accompanied by storm surge over the Coastal zone of Bangladesh and climate change scenario need to be considered in future designs. The Cyclone Sidr hit the South West Bangladesh Coast in the year 2007 with the storm surging 2 to 3m high. Another recent Cyclone Aila hit the South West coast of Bangladesh in the year 2009. Furthermore, river bank erosion has also engulfed the embankment in many places. Retired embankments were built in some places and other existing embankments have breaches. Considering the above factors, the embankment requires re-sectioning and retirement in multiple sections.

Drainage canal

The main function of the drainage channel is to safely drain out the design discharge or the drainage basin runoff volume generated by 5-day duration storm of 1 in 10-year frequency. The other function of the drainage canal is to drain out the surplus water from cropping lands, which is of ultimate importance for the satisfactory growth of crops. The total length of the drainage canal in this polder is 59 km. A significant portion of the existing drainage canal is silted up and blocked in many places. Excavating the drainage canal is recommended to improve the situation and to increase agricultural and fish production.

Drainage Structures

The original objective of constructing polder was to protect agricultural lands from salinity intrusion and to drain out excess precipitation from the polder area through drainage sluices. Later on, agricultural practices developed among the farmers to cultivate winter boro crops inside the polder area. For this winter agriculture, the farmers use to take fresh water into the polder during the monsoon/ post-monsoon and store in for late use. In view of the above, the sluices constructed only for drainage began to be used for both drainage and flushing. The types of sluices found in polder are commonly referred to as:

- **Regulator/sluice:** The function of this Structure is to drain out the excess water from the polder area to the river and also to allow the river water to enter into the polder area for various purposes. It is also either constructed with a reinforced concrete pipe or with reinforced concrete boxes of various sizes. In total nine regulators were found along the embankment. Most of them are in good condition excepting a few that show minor damage.
- **Flushing Inlet:** Its main function is to allow the river water to enter the polder area for various purposes. These inlets are also constructed from either reinforced concrete pipe or reinforced concrete boxes of various sizes. Limited drainage is also allowed through this type of structures. There are total 17 numbers of pipe inlets along the embankment and 12 of them are not functioning.

Available Water Level data

Water Level at Teesta River

BWDB is recording daily water level at different locations on Teesta River. Water level data of the nearest two gauge stations of Teesta River (Kaligonj SW 293 and Kaunia SW 294) were collected for Analysis. SW 293 is 8 km upstream and SW 294 is 28 km downstream of the study area at Gangachara Upazila. Collected Water level data is summarized in table 2.1.

Table 2-1 Collected Water Level Data Summary of Teesta

SL	Station ID	Station Name	Duration
1	SW 293	Kaligonj	1980-2014
2	SW 294	Kaunia	1980-2014

Water Level at Bhola

There is no water level measuring station at Char Fasson. The relevant water gauge station is SW 279 at Tozumuddin which is on the east side of Mujibnagar union and SW 20 at Amtoli which is west side. Historical water levels were collected from BWDB to perform water level analysis. A summary of water level stations is presented in Table 2-2.

Table 2-2: Collected Water Level Data Summary

SL	Station ID	Station Name	Duration
1	SW 279	Tozumuddin	1980-2014
2	SW 20	Amtali	1980-2014

Discharge of Teesta River

After originating from Pauhunri Glacier in Sikkim of India, the Teesta river flow was diverted by India at an upstream location and then by Bangladesh at a downstream location. For these reasons, the maximum flow of the river does not impact the downstream region where the project will be situated. However, during the monsoon, the peak flow causes serious erosion on both banks of the river at different sites. The maximum flow ranges from 2000 m3/s to 8000 m3/s and average maximum flow is 4500 m3/s. Figure 2-3 presents the yearly maximum discharge of the Teesta River at Teesta Bridge.

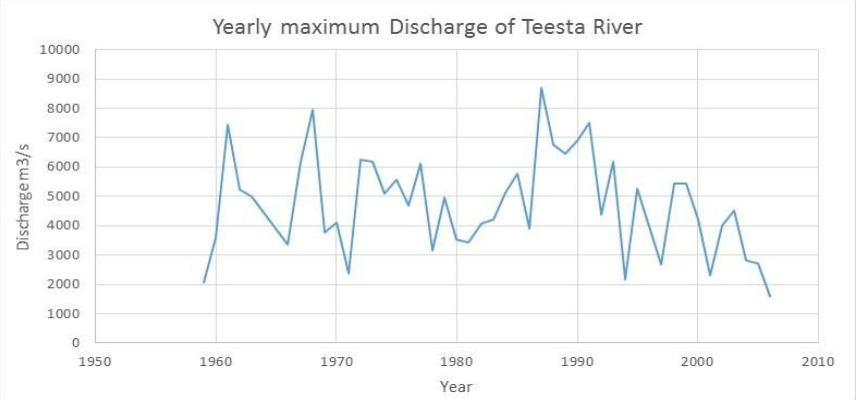


Figure 2-3: The Yearly Maximum flow of the Teesta River

Flow Velocity at Teesta

BWDB records velocity at Teesta Bridge location along with discharge. The average velocity of Teesta River at this location is 0.82 m/s where maximum velocity was observed 2.11 m/s and minimum velocity was observed as 0.16 m/s. For the design of river bank protection, a design was developed to allow a maximum velocity of 3.0m/s.

Flow Velocity at Bhola

There is no field measurement of flow velocity at Mujibnagar union of Bhola District. However, some records and studies were conducted in past from where we can take the velocity of this area. Moreover, during the design of the polders, an assessment of design velocity was performed. This area experiences semi diurnal tide and the velocity range lies in about 0 to 1.5 m/s. A design allowing for a maximum velocity of 1.76 m/s for the construction of this polder.

Frequency Analysis of Water Level at Teesta River

Frequency analysis was carried out for two water level stations namely SW 293 and SW 294. Two major distributions such as Log Pearson and Log-Normal were carried out to evaluate the value for different return period. Two different tests namely Chi-square and KS test were also carried out to select the best distribution. Results of frequency analysis of SW 293 are presented in Figure 2-4. The water level for different return period is furnished in Table 2-3.

Frequency Analysis of Water Level at Bhola

Frequency analysis was carried out for two water level stations namely SW 279 and SW 20. Two major distributions such as Log Pearson and Log-Normal were carried out to evaluate the value for different return period. Two different tests namely Chi-square and KS test were also carried out to select the best distribution. Results of frequency analysis of SW 293 are presented in Figure 2-5. The water level for different return period is also presented in Table 2 –4

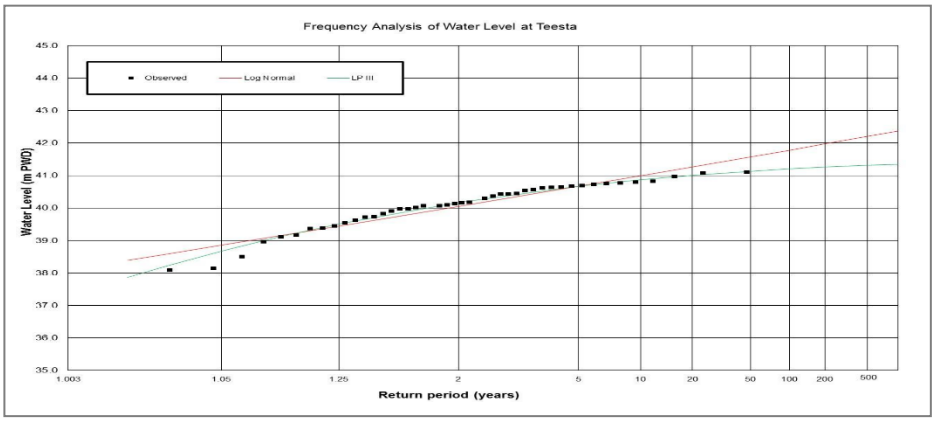


Figure 2-4: Frequency Analysis of Water Level of
Teesta River at SW 293

Table 2-3: Frequency Analysis of Water Level of Teesta

SL	Return Period (Year)	Log-Normal	Log Pearson III
1	2	40.05	40.18
2	5	40.67	40.67
3	10	41.00	40.87
4	20	41.27	41.01
5	50	41.58	41.13
6	100	41.78	41.21
7	200	41.97	41.26
8	500	42.20	41.32

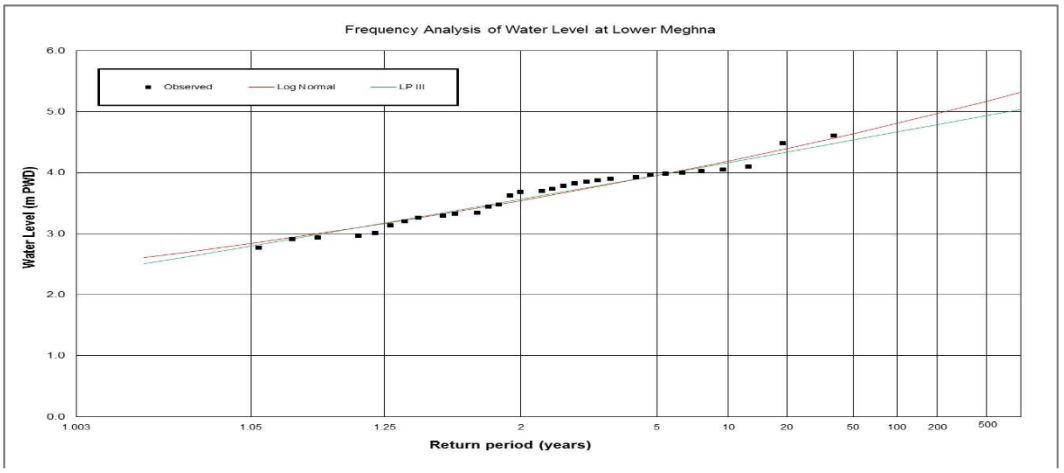


Figure 2-5: Frequency Analysis of Water Level at SW 279

Table 2-4: Frequency Analysis of Water Level of Lower Meghna at SW 279

SL	Return Period (Year)	Log-Normal	Log Pearson III
1	2	3.54	3.57
2	5	3.95	3.96
3	10	4.19	4.17
4	20	4.40	4.34
5	50	4.64	4.54
6	100	4.81	4.67
7	200	4.97	4.79
8	500	5.17	4.93

CHAPTER 3
Design of Cyclone and Climate Resilient Houses

General

The majority of the population of Bangladesh lives in rural area and their standard of living in terms of protection and safety is very low. Under difficult natural conditions, the country is extremely prone to natural disasters such as floods, cyclones and earthquakes which pose a great threat to life and property, especially in the rural areas where poverty is widespread. Apart from the physical damage that such disasters cause to the people's property, they also have a great negative impact on the country's economic situation.

In a context of non-engineered construction, construction expertise is often passed on from generation to generation and from one construction professional to another. Tried and tested over decades, in a particular context, non-engineered housing often holds a lot of inherent wisdom. Construction engineering knowledge on

the other hand offers a formal understanding of how particular materials, techniques and designs react under certain circumstances. Moreover, it can offer alternative and innovative ways of addressing current and new challenges for safer construction. The combinations of tried local practices and engineering knowledge makes allows to formulate standards for safer housing for the different hazards impacting on the rural housing stock of Bangladesh. Through respecting the general design principles and minimum technical standards for specific threats presented below, the current rural housing stock in Bangladesh can be rendered substantially more resistant to future disasters.

Climatic Factors for Design Considerations

The generic and case specific climatic features of flood affected regions that can affect the design task are:

- Flood
- Lateral water pressure
- Intense Radiation
- Humidity
- Nor westerly
- River Erosion
- Sand Heat
- Driving Rain

Issues Identified in Char Lands10

- Removable structure is needed for Char area owing to transient nature of the landscape.
- Issues like unavailability of course sand, quick removability of house structure calls for introducing prefabricated building elements.
- Durable structural members concerning issue of longer house lifespan.
- Structural members to be fastened to each other properly.
- Additional structural stability to be ensured by the means of introducing bracing elements at due strategic points.
- Mound raising should be undertaken to establish new settlements.

GENERAL DESIGN PRINCIPLES FOR DIFFERENT THREATS

Specific design principles are to be respected to counter the various threats a house may be exposed to. This section is based on a multitude of guidelines that have been produced in the context of previous disaster preparedness and response projects, both in Bangladesh as internationally, by a variety of housing actors. Since all rural areas in Bangladesh are exposed to a combination of hazards, in most cases, more than just one set of design principles will need to be adhered to. In those cases, the strictest principle across the different hazards is to be applied.

Ensure tie down from bottom to top

The house is to be firmly tied to the ground, to avoid it flying off, starting by connecting the roof well to the columns, the columns well to the foundation and anchoring the foundation well into the ground. The columns should be made using reinforced concrete to resist high lateral pressure (i.e., wind pressure, water pressure).

Figure 3-1: Strengthening of rural houses using ties (Source: IFRC BD Shelter Volunteer Training after cyclone Sidr)

Ensure cross-bracing in all planes of the house

All planes of the house are to be equipped with cross-bracing to resist the lateral winds impacting on the house, to avoid the house falling over.

Ensure that wind pressure cannot build up inside the house

There are two opposite strategies to avoid wind pressure building up inside the house:

10 Standard guideline for rural housing in disaster prone areas of Bangladesh, February 2018

- Ensure that wind can flow freely through the house, by ensuring openings on all opposite walls of the house, and by ensuring wind pressure can escape through the roof
- Ensure that no wind can enter the house, by closing it off completely, including impermeable walling and latched windows and doors
- In most rural housing, certainly when walls are of natural materials, the first strategy is the only possible one.

Ensure a qualitative plinth
The house plinth is to be 2 feet above the highest flood level, 2 or 3 stepped and finished with cement capping or other, to resist exposure to water.

Protect the lower parts of the house
By sufficient roof overhang, proper drainage, treatment of materials, alternative material choices: protect the lower parts of the structure and wall cladding from humidity and exposure to water

Apply foundation and bracing
Foundation of sufficient depth is required to resist soil being washed out from underneath the house. Bracing of the superstructure to resist lateral forces from the water and increase the overall stability of the structure.

Cost
The actual cost for strengthening a vulnerable house to make it cyclone/flood resilient can be estimated after conducting feasibility study. However, on an average USD $600 will be allocated for strengthening each house. Based on the feasibility study, required method will be identified and implemented to retrofit the vulnerable house. In the selected study areas total 900 houses will be identified which are more vulnerable to climatic disasters. If it is considered that each household consists of 6 members on average, then total beneficiaries from this intervention will be around 5400.

CHAPTER 4
Design of Community-Level Nano Grid Facility

General
The nano-grid idea is based on the fundamental concept of the Solar Home System, where the basic necessities of households are met, but at the same time some small-scale applications like irrigation can also be incorporated. This concept takes advantage of the fact that houses in Bangladesh are usually clustered together in rural areas in a group of 10-20 houses (within a diameter of less than 150m).. In the proposed nano- grid system, something like a 1.5–2 kWp PV system is installed in a small cluster of households within a radius of 60–70 m and power is distributed to 10-15 households from this system. The PV panels and the battery used in the proposed nano-grid will be connected in series in such a way that the grid voltage is 220 V DC (nominal) and the households are supplied with this voltage. Rooftop locations of one or two houses will be chosen for PV installation and the storage battery will be placed in a convenient location close to it. Considering the typical load in a household, the expected summer time (May to September) load is around 3 times the expected winter (November to March) household loads. This, as explained above, is due to the fact that there is expected to be high usage of fans in summer due to hot weather condition. The average typical household load in rural Bangladesh given below in Table 4-1 and Table 4-2. The demand for refrigerator is not considered at this stage as it goes beyond the affordability of the average households.

Table 4-1: During summer, estimated energy consumption is given below:

Description	Light		Fan		Television
Household (HH)		20		20	5
No./HH	3		2		1
Watt/unit	5			20	30
Hrs of usage, h		4.5	8		2
Diversity		0.8		0.8	0.8
Energy/day, W-h		54		256	48
Total/day, W-h	1.1			358	

Table 4-2: During winter, estimated energy consumption is given below:

Description	Light	Fan	Television

Household (HH)		20		20		5		
No./HH	3		2		1			
Watt/unit	5			20		30		
Hrs of usage, h		4.5	0			2.5		
Diversity		0.8		0.8		0.8		
Energy/day, W-h		72		256		60		
Total/day, W-h		2.1		132		3.1		

Solar PV based grid systems, less than 10 kW, named as a nano-grid, is provided as a recommended solution.

- Cost of the system and electricity and description of a model system is given below:
- Size of the PV—1.9 kWp (kilowatt peak)
- Size of the battery bank—480 AH (ampere hour) at 12 V
- One irrigation pump (AC) – 1.1kW (1.5HP)
- No. of households—10
- Summer load per household—360 W-h per day Winter load per household—135 W-h per day
- Estimated total cost of the system including installation and accessories is US$4927.

CHAPTER 5
Design of Locally Appropriate Rainwater Harvesting System

General

Rainwater Harvesting is a water collection method, which has been utilized by communities for a long time. This process is very simple, technically feasible, cost-effective and provides a safe drinking water supply system in geo-hydrologically disadvantaged areas. It can be considered a possible option to drinking water crisis in the saline zone in the coastal regions, areas prone to declining water table and having rocky/ stony layer in soil formation. The physical, chemical and bacteriological characteristics of harvested rainwater usually represent a suitable and acceptable standard of potable water.

Rainwater Harvesting System (RWHS) is an option, which has been adopted in many areas of the world where conventional water supply systems are not available or adequately meets requirement of the people. To provide safe drinking water to rural communities; some organizations implemented several pilot programs and developed range of technological options of RWHSs considering affordability of the general mass. These models of RWHS are from indigenous do-it-yourself models to high cost profile Ferro-cement models.

In the monsoon season, safe drinking water has been a primary concern. The existing shallow tube wells can serve water during the dry season, but in monsoon, the shallow layer of groundwater gets contaminated from the flooded water. Also, the existing tubewell becomes non-functional at the flooding condition. As a result, Water-related disease is common in the season. For this reason, an alternative source has become necessary in the area.

Rainwater Harvesting has a diverse range of uses. In dry areas of the world, designed systems have sufficient surface area available for water collection and adequate storage capacity to meet the full needs of the user. However, a wide variety of different users patterns or regimes exists, and there are many variables involved in the determination of various components of Rainwater Harvesting systems. The design of the main elements of an RWHS is described below:

- Storage Tank
- Catchments
- Gutter
- Flushing System
- Water Collection Point

The large capacity community-based Rain Water Harvesting System will be designed as an underground facility. [11] This type of system is suitable where a group of families live together and face a scarcity of safe drinking water. The community based underground RWHS will have a capacity of 25000 litres considering an average household

[11] WaterAid Bangladesh, Step by Step IMPLEMENTATION GUIDELINES for RWHSs, http://www.wateraid.org/~/media/Publications/rainwater-harvesting-systems-implementation-rural.pdf,2006

size of 6 members in the offshore coastal islands in Mujibnagar and Lakshmitari Union. Total 300 units of RWHS will be made; 150 units for Mujibnagar Union and 150 Units for Lakshmitari Union. The total number of beneficiaries covered through this intervention will be 11,000-12,000 people.

Table 5. 3 Cost of RWHS (Community Based)

Storage capacity (Liters)	Size of the reservoirs	Minimum Catchment area (Sq. m)	Type of Catchment	Nos. of family members (No.)	Number of reservoir per system	Average total Construction Cost (USD)
25000	Height: 2.44 m Diameter: 3.66 m 150 mm wall thick	55 - 57	CI sheet, Concrete, Tiles,	55 - 60	1	625.00

Functional Criteria for RWHS

a. Could able to store adequate quantity of water having acceptable quality for certain period of time.
b. All necessary parts are in place.
c. Good, clean and effective catchment, gutter, down pipes, first flush system, platform, tank with lid are available.
d. Effective waste water disposal system is available.
e. Sanitary condition of RWHS and surrounding is satisfactory.

Construction of Underground RWHS (Community Based)

The concept of the construction of large capacity community based Rain Water Harvesting System had developed and practised from the ancient. The world largest community based RWH System constructed in Istambul. This type of RWHS is suitable where a grouped of family live in a compacted area and faced the scarcity of safe drinking water. This types of RWHS may be constructed that circumstances. The Community based underground RWHS may be different capacities such as 10000 litres, 15000 litres, 20000 litres, 25000 litres, 30000 litres, 35000 litres, 40000 litres and 50000 litres. It also one of the cheapest model of RWHS. The construction requirements of different capacity of community RWHS is described below:

Step –1: Preparing and construction of base

• Select a suitable place for the construction of subsurface Brick tank at one side of the house. The place should be relatively high and hard soil. Draw a circle with the outer dia of the tank on the soil and excavate soil in a depth so that about 1 – 6” of the tank remain above the ground.
• The bottom of the excavation should be like a inverted dome as per the mentioned dimension in the drawing.
• After digging level the bottom of the pit and compact the soil. Give a layer of brick flat soiling. Cutting and binding MS rod as per specification. Mix cement concrete (Cement: Sand: Khoa = 1:2:4) and pour mixed cement concrete on brick flat soling at 4 inch thick. Compact the cast of R.C.C before setting with hammering by wooden patent.

Step – 2: Construction of main body of tank

• Draw a circle with respect to the centre of Base considering the diameter of the tank least 12 hours after casting RCC at base.
• Construct a circular tank with 5" thick brick wall. The thickness of mortar should not be more than ½ inch thick and the joints of the brick wall should be filled mortar properly. The wall should be constructed up to the mentioned height of the tank.
• Provide 5”x6” lintel at the middle height of the tank.
• Keep steps inside the brick wall.

Step – 3: Plastering

• Warping wire meshes around the inner side of the tank wall and fixes the wire mesh with the brick wall.
• Plaster inner side of the tank (wall and bottom) with cement sand mortar (1:3) and the thickness of the plaster will be about 1 inch. cement finishing in the inner side of the wall.
• Rough plaster will be provided on the outer side of the tank.

Step – 4: Construction of cover slab

• Provide necessary and adequate shuttering for the construction of slab. Lay polythene sheets and seal the opening of the shutter. Cut and bind 9mm dia MS Rod @ 5" c/c in both direction. Keep a hole of 1'- 10" dia at the corner of the cover frame for placing manhole cover.
• Mix cement concrete (1:2:4). Before casting identify the location for placing pump, water level indicator, air vent pipe etc. Then pour cement concrete (1:2:4) with 5 inch thick keeping the frame of MS Rod at least 1” clear cover of cement concrete layer.
• To make a collar of outer ridge of the slab so that rainwater could drain out through one location of the slab.

Step – 5: Setting of manhole cover

• Place the manhole cover at the proposed local (hole) on the slab. Mix cement concrete (1:2:4), set the cover and cast a layer of cement concrete mixture 2" thick.
• Finish the cement concrete with mortar (1:4).

Step – 6: Setting of inlet and overflow pipe

• Place inlet and overflow pipe, the inlet pipe should be one inch below the bottom of the slab. The over pipe should be at least one inch below the inlet pipe.
• The joint between wall and pipe should be properly sealed and finish with cement mortar.

Step – 7: Setting of flushing system
• According to figure flushing system to be set with PVC pipe 75mm-dia elbow and "T".
• Flushing system would be joined with the nipple to inlet gutter and with inlet pipe.
• As per drawing a flushing box will be constructed with brick masonry work.

Step – 8: Tube Well setting
• A simple hand Tube well would be set on the slab as per the drawing. The legs of the pump should be properly fixed with slab with cement concrete.
• The pipe of the Tube well inside the tank would be tied with mortar so that it cannot move easily.

Step – 9: Construction of stair
• As per drawing construct stair for easily go on the roof the tank.
• Stair will be constructed with brick masonry work.

CHAPTER 6
Design of Cluster Houses

Background
Cluster houses can be good solution for the flood affected areas. Recently the government of Bangladesh has undertaken Community Climate Change Project (CCCP) under the Bangladesh Climate Change Resilience Fund (BCCRF) under which communities were supported to raise household plinths and provide opportunities for better and secured livelihood. The project focuses on the three most vulnerable climate zones in Bangladesh, composed of: saline affected coastal zones, flood-affected areas and charlands, and drought-affected or rain-scarce areas in north-western Bangladesh. Many of the homes in the clusters were raised by five feet on average based on highest flood level of that area to protect the families from being inundated with water. The plinths were designed to offer benefits inclusive of growing vegetables, rearing poultry and providing shelter for domestic animals in addition to providing safe shelter for resident. In its second year, the project already made a difference in flood affected regions. Beneficiaries did not have to migrate to distant high ground for shelter this year like before. Their crops are also being protected by elevation. Raising the plinths of their homes in clusters has helped more than 15,000 families escape floods, and they continued to earn their livelihoods by planting vegetables and rearing goats on raised ground.

Components of Cluster Houses
From the lessons learned from the CCCP project, this project will construct 20 cluster houses in the selected char lands; 10 cluster houses in Mujibnagar Union and 10 cluster house in Lakshmitari Union. Each of the cluster will consist of four houses. The plinth of the houses will be raised by five feet on average based on the highest flood level of that area to give protection from flood. The raised plinth will be used for facilities like hygienic sanitary latrine, safe drinking water source, small household livelihoods of poultry, livestock, and homestead garden. There will be provision for solar panels and improved cooking stoves in the households. Proper slope protection measures will be ensured to protect the raised platform. To protect slope from soil erosion naturally, various fruit trees and grass will be used. Also, A drainage channel will be provided below the slope to drain out the excess water.

Cost
The total cost for constructing each of the cluster houses will be USD $40,000 including the materials and labor cost. An engineer will be assigned to provide support/assessments for location and construction of cluster houses.

CHAPTER 7
Repair and Strengthening of Embankment

General

The coastal embankments were initially constructed during the 1960s. The purpose of the construction of embankments was to protect the cultivable land in the coastal areas against tide and saline water intrusion. These embankments were designed with no regard to cyclone surges. The crest height of the embankments was determined as the maximum normal high tide plus a freeboard of 5 feet. The design of the embankments was

carried out using the design criteria followed by BWDB at that time. The recent cyclones accompanied by storm surge over the Coastal zone of Bangladesh and climate change scenario needs special attention to be considered in the design of embankments to serve the present need.In Mujibnagar Union which belongs to polder no 55/3, the main work comprises of the resectioning/reconstruction of the existing damaged or deteriorated embankments and in places construction of new/retired embankments, where the embankments are already breached or threatened to be breached in near future due to river/ wave action. On the other hand, at Gangachara Upazila of Rangpur district, there is no flood protection embankment in the proposed project location which causes serious flood every year.

For the detailed design of embankments, the basic data were gathered first from primary and secondary sources including satellite images. The physical features of both of the sites have been mapped and entered in the GIS. The rehabilitation/ improvement plan for embankment begins with an assessment of the current state of the site giving particular attention to

- The physical condition of the embankment, whether the embankment is under attack by river erosion, wave action and threat or fact of overtopping by a previous storm surge.
- Performance of drainage system, whether deficiencies are due to inadequate design, poor condition of structures etc.
- Agriculture and fisheries activities
- Population centres and settlements, livelihoods, socio-economic conditions and public infrastructure including the existence of cyclone shelters.

The proposed improvements to the embankments have been designed in such a way so that the physical and operational conditions in the polder are made satisfactory under the present conditions as well as under the future conditions taking into account climate change projections and changes brought about by other projects currently underway or being developed by the Government of Bangladesh.

Guideline for Designing a Stable Embankment
Embankment section is designed to fulfil the following criteria:

- The countryside slope of the embankment should remain stable during steady seepage at design specifications
- The side slope of the embankment on the riverside must be stable during rapid drawdown conditions, where the seprevail.
- The phreatic line should be well within the downstream face so that no sloughing of the slope takes place.
- A fill material of sufficiently low permeability should be selected from the available material.
- Sufficient freeboard must be provided in the design specifications to avoid overtopping during maximum flooding.
- The u/s and d/s slope should be flat enough. For this, a suitable factor of safety should be provided.
- The riverside slope should be stable against wave run up in case no treatment is anticipated.

Selection of Location

Gangachara Upazila
Flooding is one of the major two disasters for the people of Gangachara Upazila. There is an existing road at the upstream area which acts as embankment during flood but the road is engulfed by the river downstream, and because of this the area is flooded during monsoon every year. To protect from flooding 3.5 km embankment is required in this area. Figure 3-1 shows the proposed embankment alignment.

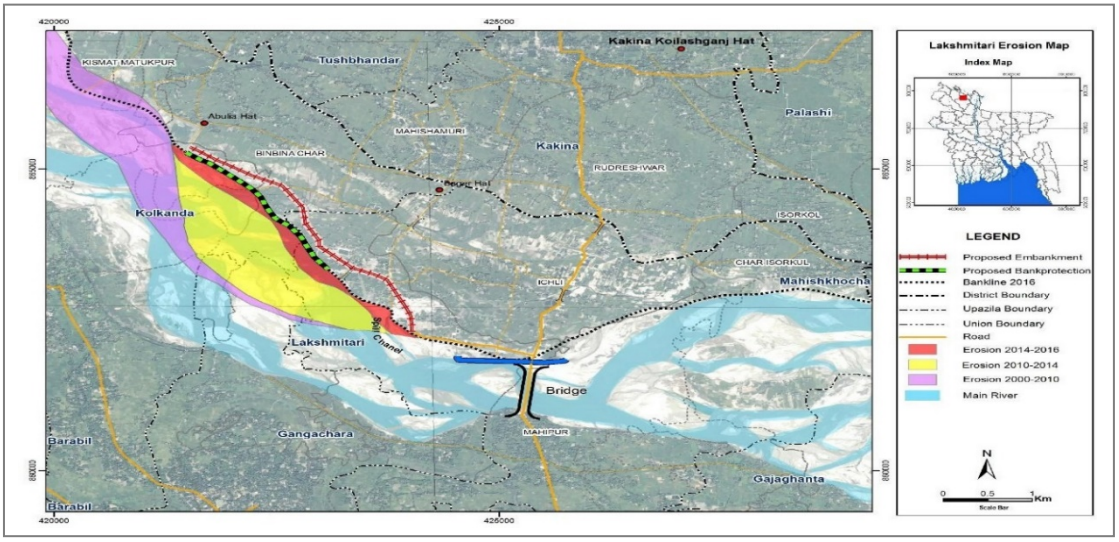


Figure 3-1: Proposed embankment alignment at Gangachara Upazila

Mujibnagar Union

Out of 66 km long embankment of polder 55/3, 15 km embankment belongs to Mujibnagar union. This 15 km embankment is damaged at many places and about 1 km length is currently breached. To protect this union from flooding 1 km new embankment is proposed to close the embankment. Another 8 km of existing embankment is proposed for resectioning or strengthening so that it can defend against flooding. Figure 3-2 shows the proposed alignment of new and resectioned or strengthened embankments.

Design Parameter

The following design parameters were considered during designing the Embankments.

Embankment Crest

The embankment at Mujibnagar union is designed to keep selected storm surges (with incident waves) and overtopping the polder. They must also withstand toe scour and slope erosion due to incident waves during stormy weather. At Mujibnagar union a return period of 25 years is considered for embankment design. On the other hand embankment at Gangachara Upazila is aimed to defend a 50 year return period flood with standard toe protection on the riverside. The design storm surge levels are obtained from 38 cyclone simulations based on 19 actual events and 19 additional events of the same magnitude and identical tracks but with their landfall occurring at exactly the opposite tidal phase to the corresponding actual storm. The 25 year return period storm surge levels are computed for cyclonic storms that would occur at the present situation.

Safety Margin

These values refer to climate change conditions and are based on previous specifications for embankment slope and roughness. The Climate Change Conditions refer to conditions in 2050 (IPCC predictions which will be revised from time to time. 2050 refers to 40 years after the base simulations in this study. Given that we are designing for 30 years, there is a ten-year factor of safety built in – which might be worthwhile because there has been a tendency for the sea level rise estimated to revised upwards more often than downwards. Although the crest levels are nominally based on a return period of 25 years, this return period is applicable only in (eg) 2035, whereas return period of the design will be higher in the earlier years, making for an additional margin of safety.

Design Crest Level

The considered design crest level at Gangachara Upazila: 42.10 m PWD
The considered design crest level at Mujibnagar Union: 4.90 m PWD

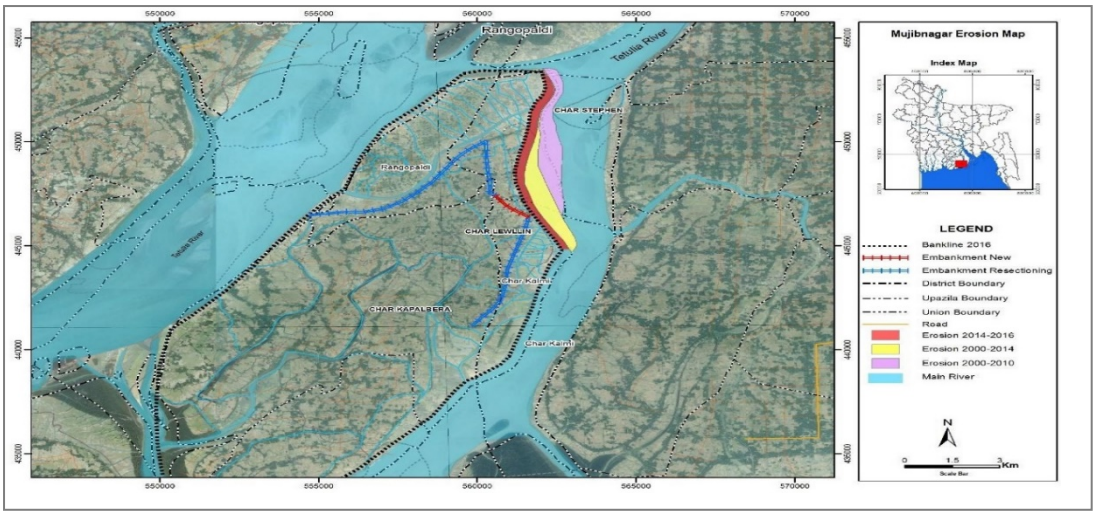


Figure 3-2: Proposed embankment alignment at Mujibnagar Union

Embankment materials
The materials required for the construction of embankments will be gathered from the nearest sources. It can be mentioned here that embankment materials cannot be collected from borrow pit (BWDB design Guideline 2010). It is highly recommended to construct the embankment with dredged material where available.

In Gangachara Upazila the embankment materials can be collected from the river bed where temporarily submerged chars are formed. The river bed material is mainly sand (medium to fine) and it can be used as the core material of embankment. To protect seepage a 20 cm thick clay layer is proposed to cover the top surface of the embankment (top and the sloped surface on both sides). This will reduce the amount of clay materials significantly and the nominal amount of clay can be collected from nearest sources. While in Mujibnagar Union: The embankment materials can be collected from riverside submergible char. The top layer of these chars is composed of silt and clay, which can be collected and used for the embankment.

Embankment Surface
A further protecting element is grass turfing or the planting of trees. In standard designs, this serves on the surfaces of the embankment for the protection against erosion resulting from rainfall.

Toe Protection
The cladding on the riverside embankment toe is susceptible to destruction from ploughing. To secure it against unintended damages during farming a 1.5m wide strip of land can be reserved and used to plant a suitable tree.

Ecosystem based Adaptation
Afforestation of embankment slopes was found to induce localised erosion problems in many cases in Bangladesh. This contradiction retarded the afforestation of embankment slopes as an effective means of erosion protection, provided turfing is ensured with grasses and systematic management is established. In practice, however, the embankments are not simply engineering structures, but the focus of complex land-use systems. This, combined with institutional shortcomings and funding shortages, has made a system of routine maintenance – in the engineering sense – impossible to establish. As a result maintenance has been restricted to major repairs or rehabilitation, generally carried out only when embankment is close to failure or has completely failed and caused serious losses. For a least developed country like Bangladesh, the most effective forms of erosion control should be vegetative protection combined with limited hard protection. Ecosystem based adaptation against erosion are the cheap and simple practical solution that must be:

- technically suitable: for different levels of exposure to erosion; for different soil types; for
- saline and non-saline condition,
- financially suitable: with respect to the cost of both initial construction and maintenance,
- environmentally suitable,
- people-oriented and sustainable: for routine maintenance.

Very recent experiences of the coastal greenbelt project and subsequent development made under the Coastal Embankment Rehabilitation Project (CERP) provide a sound footing for adopting the land-use approach for biological means of protection against erosion while providing various commodities for local communities. For

controlling runoff erosion of embankments and for increased fodder production, a model has been developed, including vetiver (Vetiveria zizanioides) and associates like Napier grass (Pennisetum purpureum), Para grass (Brachiaria mutica), German grass (Echinoclora grousgali), in addition to other suitable plants like Ipil-Ipil (Leucaena leucocephala), Jhau (Casuarina equisetifolia), Akashmoni (Acacia auriculiformis) and the like. A model has also been developed combining mechanical and vegetative toe protection methods as a sufficiently low-cost alternative for sites where the embankment is not directly exposed to wave attacks and the toe erosion is moderate. CERP has made a breakthrough in organizing the embankment settlers for plantation on embankment slopes and toes in the country and at the seaside. Instead of being evicted from the embankment, the settlers are provided with shelters and other assistance, including leasing out a reach of embankment where they can make homestead gardens for vegetable production and even plant trees for timber, firewood and consumptive uses. This will ensure proper preventive maintenance of the embankments by the settlers on a regular basis, CERP suggests. This project will adopt the strategies and knowledge from the CERP project and apply that to strengthen the embankments in the selected char lands. For the maintenance of the embankments, community management will be introduced. Community Based Organizations (CBOs) will be formed and trained to maintain the embankments properly. The envisaged vegetation pattern will have a short-term economic benefit for the settlers; grasses and bushes will provide quick benefits from the production of fodder and thatching material; the trees will start to be productive after four to ten years. Gradually local interest in embankment protection may also be engaged.

Cost

Embankment Construction/ Repair

For repairing or constructing of the embankments, approximately USD $75,000 will be required for per km of length. The total cost for this will be USD $1,162,500. This will include earthwork with mechanical compaction to attain >90% maximum dry density at optimum moisture content with reference to laboratory density test AASHTO modified hammer with borrowed earth as per technical specification.

Ecosystem based Adaptation

For EbA in the embankments, USD $12,500 will be required for per km length. The total cost for this intervention will be USD $192,200. Workshops will be arranged for the community people to provide training on embankment management. Also, a National consultant or specialist will assess and develop livelihoods to be connected to embankment management and conduct trainings. Total USD $35,000 will be required to conduct the workshops and assign the consultants.

General Notes for Embankment:

1. All elevations are in meter (m) (PWD) unless otherwise mentioned in the drawing.
2. Any ditch/drain within 50.00m from the C/S TOE shall be filled up to the ground level with available locals and/earth.
3. Earth in embankment shall be placed in a horizontal layer of 150mm thick, clod breaking to a minimum size of 100mm and compaction is to be made to attain 90% dry density at optimum moisture content.
4. Base of the embankment shall be stripped of not less than 150mm to remove vegetation, slushy earth and other soft materials to develop strong bondage between the base materials and borrowed earth for embankment, before re-sectioning of the embankment, benching the side slopes, removing roots and stumps of trees of girth upto 200mm from the ground. All sorts of organic and other foreign materials must be removed properly.
5. Slopes and crest of the embankment shall be finally dressed and closely turfed (preferable vetiver gross) to retain earth from being washed away by rain and wind.
6. If required, a smooth transition to be provided between higher & lower crest level and steeper & flatter slope of the embankment.
7. The earth borrowed for construction of embankment must be free from grass & vegetation etc. Peat soil shall not be used in embankment construction.
8. 150mm cambering at the centre of the of embankment should be provided.
9. The earth shall not be removed from the crest of the embankment where the existing crest level is higher than the design crest level.
10. c=5.00ka/m^2& 0=18^0 shall be attain for completed embankment.
11. Shrinkage as per schedule shall be considered so that final crest level remains at design level after shrinkage.
12. Dredged material from river bed shall be used as embankment material and 90% compaction must be attained at optimum moisture content and a clay blanket of 0.20 m must be used to cover the new section of the embankment.

The selected study areas are two of the most vulnerable places of the county in terms of climatic incidents. The Mujibnagar Union is a coastal region that suffers from flood, storm surges, salinity intrusion, etc. On the other hand the Lakshmitari Union is located in an area which subjected to both flood and drought. Both of the areas have high potentiality addition in the crop and horticulture sector. But the unfavorable weather, climatic disasters, inadequate water management, lack of availability of quality surface water for irrigation, lack of market linkage, lack of processing technology and storage system are the main challenges for the increased productivity in these areas. Despite many challenges, both the region has considerable potential for crop, horticulture, fishery, livestock and value chain enhancement. The region is largely dominated by medium high land which is suitable for different agricultural practices around the year.

Due to lack of proper post-harvest management and storage facility, the postharvest loss of produced vegetables is very high and farmers are bound to sale their products immediately which sometimes restrict farmers to get better price. modern storage of vegetables and fruits and is virtually absent in Bangladesh. Cold storage facility is only available for potato. However, from the last couple of years many research organization, development projects, government line departments are trying to replicate low cost farmers' friendly natural cold storage which operates without energy or in some cases renewable energy like solar. After reviewing different organization's initiatives for natural cold storage for vegetables were identified like one storage established at Atmul village under Shibgonj upazila of Bogra distric with capacity of 240 metric tons in 2015, another one is Baniachong sub-district of Habigonj district which capacity is 200 kg of vegetables by using vaporization technology. Farmers can store their vegetables in these natural cold-storage for 10 to 15 days. Prof Dr Monzur Hossain from Rajshahi University has also established an environment-friendly cold storage with 300 metric-tons capacity in Rajshahi city at a cost of around Taka 14 lakh where agricultural produce can store through the process of vaporization.

From the lessons learned from these projects, a non-electrical cold storage facility is proposed under this project. The cold storage will use vaporization process to preserve fruits and vegetables. The Improve Natural Storage unit is a brick walled, thatched roof building constructed over an open water reservoir using the concept of evaporative cooling to greatly reduce the temperature within the facility. Farmers and traders can easily store surplus or unsold vegetables at any time by paying minimum amount for two weeks to avoid seasonal clearing as well as to create bulk amount for selling in distanced markets. The large farmers or traders or any entrepreneur of the area can take initiative to establish this type of storage to store own produce or to sale the storage facilities.

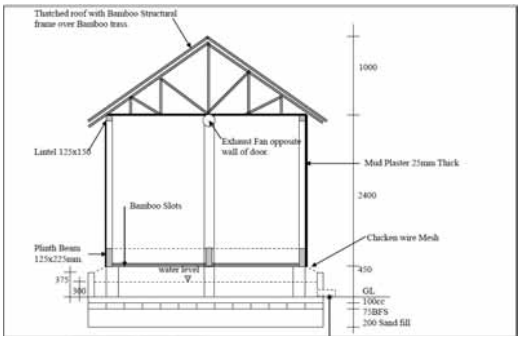


Figure 8-7: Sectional Layout the natural cold storage

The 65 feet long and 40 feet wide rectangular storage is made of bricks, cement, bamboo, and thatch that can house 500 tons of produce. The vital part of the storage is the two parallel walls. The inner wall is made of brick and cement and the outer wall is constructed with concrete blocks and bricks. The gap between the two walls is three inches that is filled with sand. To allow sunlight inside the storage, there are two windows made of glass in the upper part of the storage. Four solar panels of 110 watt have also been set up to generate electricity to light the storage. The total cost is provided in the Table 8-1.

Table 8-1 Cost of Cold Storage

Sl. No.	Item	Total Cost (BDT)
A	Land Lease for One year	60,000
B	Design & Layout	70,000
C	Materials Cost	
1	Bricks	550,000
2	Brick Chips	160,000

3	Sands (For Filling the Basement)	230,000
4	Sand for Bricks work and casting	120,000
5	Mud Plastering	50,000
6	M S Rod	500,000
7	Cement	400,000
8	Thatched roof	70,000
9	Wood for door	70,000
10	Bamboo (75 mm diameter)	600,000
11	Electric motors and cables	80,000
12	Pipeline for electrification, motor boring	60,000
13	Miscellaneous	120,000
D	Machinery & Equipment	60,000
E	Mason & Labor	600,000
F	Solar panel (4 nos.)	200,000
	Total Material Cost	**4,000,000**

CHAPTER 9
Design of Solar Powered Pump

The use of solar energy in irrigation is popular now owing to cost-effective financing and innovative business model. IDCOL has started to promote renewable energy since 2010 and promoted solar irrigation pumps. Already, over 600 solar irrigation pumps have been installed by IDCOL and more is to come to cut dependency on electricity and diesel used to operate more than 1.6 million tube wells and pumps for irrigation. In a bid to promote alternative energy, perhaps, Bangladesh has sped up installing solar-powered irrigation pumps in 2012. The success stories on solar irrigation pumps have brought light from the piloted upazilas of Dhaka, Chittagong, Rajshahi, Rangpur, and Khulna regions. In 2017, BASE Technologies Ltd, in collaboration with the Department of Agricultural Extension (DAE), launched Solar Irrigation Project in the village at the cost of Tk20 lakh. It was a Corporate Social Responsibility initiative and part of BASE's sustainable agricultural development programme. The 7.5 horsepower solar pump can irrigate 30 bighas. About 100 farmers are reaping direct benefits of the project.[12] This project will implement 6 solar irrigation pumps of 18.5 KW capacity, three in Mujibnagar Union and three in Lakshmitari Union. To install each solar irrigation pump USD $ 85,500.00 will be required.

Technical standard for Photovoltaic Module (PV Module) for mini-grid and irrigation projects[13]

- The following are applicable standards for PV modules:
- International Electro-technical Committee (IEC) 61215:2005: Crystalline Silicon Terrestrial PV Modules Design Qualification and Type Approval
- IEC 61646: Thin Film Silicon Terrestrial PV Modules Design Qualification and Type Approval
- IEC 61701 Ed 2.0: Salt mist corrosion testing of PV Modules.
- IEC 61730 for safety equipment.
- The photovoltaic module should have a peak power output of at least 250Wp.
- All modules must be product tested and certified from IEC accredited laboratories. IEC 61215 (Or IEC 61646, whichever applicable) and IEC 61730 are mandatory for PV modules. IEC 61701 will be applicable for PV module installation in coastal areas.
- Each module must be factory equipped IP65 junction box with terminal strip that allows safe and long-lasting wiring connection to the module. Where applicable, protective diodes should be used to avoid the effect of partial shading. Factory test report of the PV module must be provided during supply of product.
- Each module must have permanent labeling indicating at a minimum: Manufacturer, Model Number, Serial Number, Peak Watt Rating, Voltage and Current at peak power, Open Circuit Voltage, Short Circuit Current and Cell Efficiency of each module.
- Power tolerance must be positive for each of the PV modules.
- Cell Efficiency (η%) should be minimum 15% at STC.
- Fill Factor (FF) should be more than 70%.

CHAPTER 10
Design of Floating Ambulance

[12]https://www.dhakatribune.com/tribune-supplements/tribune-climate/2017/08/12/solar-powered-irrigation-revolutionising-bangladeshi-agriculture

[13] IDCOL, Technical Standard for Solar Irrigation Pump (SIP) Projects

Floating ambulance will be present there to provide emergency health support to the vulnerable people of Mujibnagar. The floating ambulance will be equipped with particular emphasis being made upon the design to reduce travel time between destinations. This will enable patients to receive treatment in time and also facilitate the dissemination of other emergency services. The boats will be approximately 23 feet long and 11 feet wide, to accommodate two to three patients at a time along with attendants. Standard medical equipment will be provided in the ambulance with provisions for the boat to be used as weekend clinics. The cost approximated for a floating ambulance is USD $26,522. For the boat USD $11,872.00 and for the necessary equipment and medicines, USD $ 14,650 will be required. For staffing the ambulance, UDS $1550 will be required for each month and the staff will be hired for 48 months preliminarily. Details costing is provided in Table 10.1 and Table 10.2.

Table 10.1 Costing of Equipment for Floating Ambulance

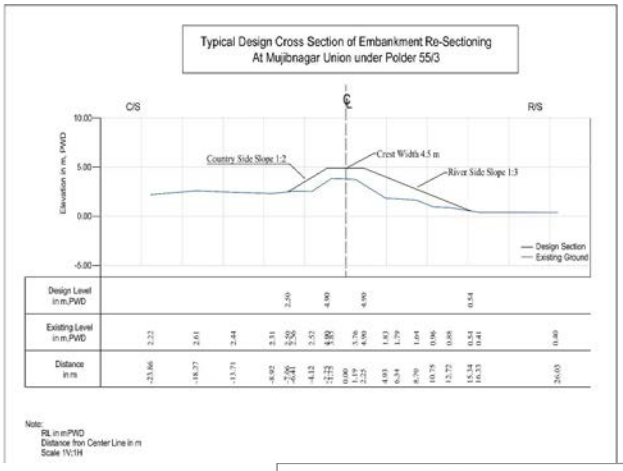
Serial No.	Name of Equipment	Cost (BDT)	Cost (USD)
1	General medicine storage	200,000.00	2,500.00
2	Surgical medicines and necessary medicines for women	100,000.00	1,250.00
3	X-ray viewer	50,000.00	625.00
4	Balance	15,000.00	187.50
5	Microscope	50,000.00	625.00
6	Blood bank refrigerator	200,000.00	2,500.00
7	Surgeon stools	20,000.00	250.00
8	Bed (3)	30,000.00	375.00
9	ICU baby cot	100,000.00	1,250.00
10	Blood group testing kit	50,000.00	625.00
11	Fire extinguisher	20,000.00	250.00
12	Oxygen supplement (2 set)	40,000.00	500.00
13	Cabinet (2)	10,000.00	125.00
14	Stethoscope (5)	25,000.00	312.50
15	Surgery equipment	20,000.00	250.00
16	Saline stands	5,000.00	62.50
17	Machine (Pressure, height, weight)	20,000.00	250.00
18	Computer (2)	100,000.00	1,250.00
19	Chair and table	50,000.00	625.00
20	First aid box (2)	2,000.00	25.00
21	Suction machine (manual)	60,000.00	750.00
22	Orthopedic surgery equipment	5,000.00	62.50
23	Stretcher (2)	20,000.00	250.00
Total		**1,192,000.00**	**14,900.00**

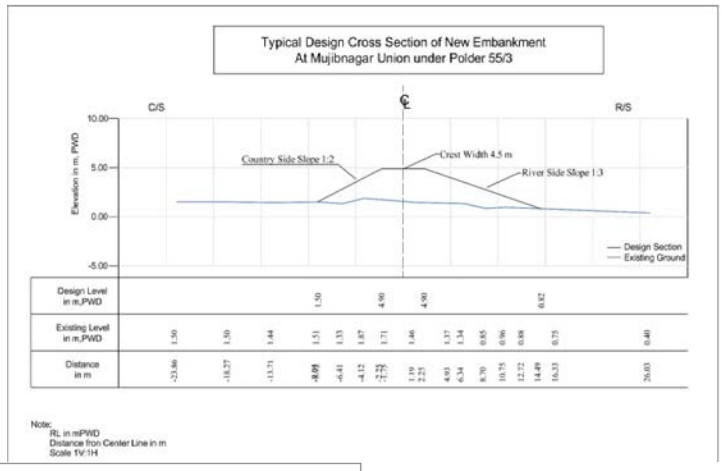
Table 10. 2 Cost for staff of Floating Ambulance

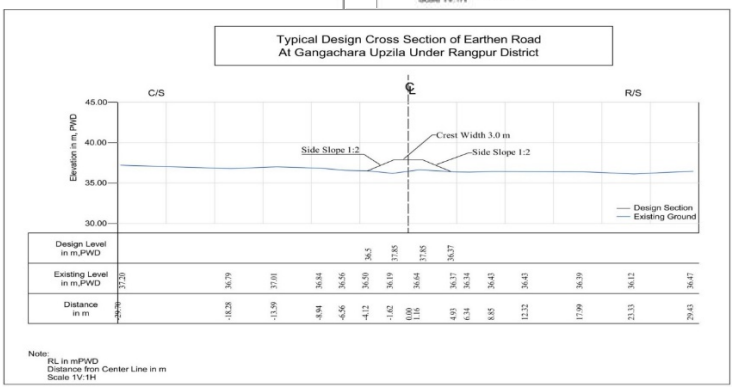
Serial No.	Staff	Cost (BDT)	Cost (USD)
1	Doctor (Medicine)	28000	350
2	Doctor (Surgeon)	30000	375
3	Doctor (Practice)	20000	250
4	Nurse (3)	27000	337.5
5	Staff	14000	175
6	Co staff	5000	62.5
Total		**124000**	**1550**

APPENDIX 1.

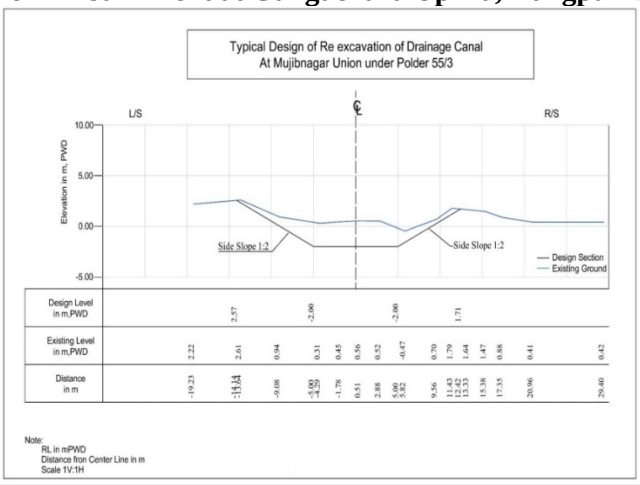
Design section of Embankment at Mujibnagar Union, Bhola District

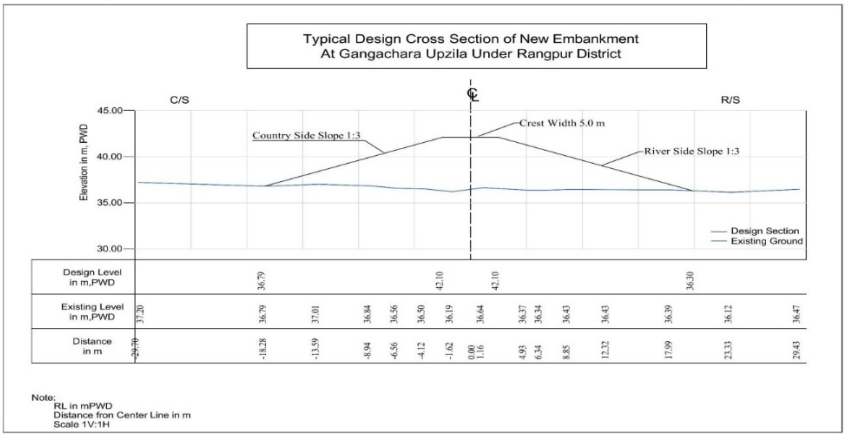






Design of Embankment at Gangachara Upzila, Rangpur District





Annex H. Climate change risk and vulnerability assessment and feasible adaptation options

Bangladesh is considered one of the most vulnerable countries of the world in terms of climate change impacts due to its geographical location, flat and low-lying topography, high population density, and high level of poverty. The country is ranked sixth among the world's top ten countries most affected by extreme events in the last 20 years according to the Global Climate Risk Index by think-tank Germanwatch in 2017.[14]Bangladesh is affected by climate-induced disasters, namely flash floods, river floods, tidal floods, sea level rise, droughts, erosion, landslides, and lightning. Moreover, due to changing climatic pattern different health issues are also in the rise. Due to the geographic location the char lands are particularly vulnerable to floods, droughts and river erosion.[15] In addition, Char households are sensitive to seasonal unemployment and are considered the most food insecure in Bangladesh.[16] The main objective of the proposed project will be to comprehensively address the adaptation deficit, thereby seeking to reduce the impacts of climate change upon the Char regions –the impacts of increasing temperature, erratic rainfall, intensifying extreme weather events like flash floods, cyclones, storm surges and tidal flooding.

Climatic Projections According to the AR5

Fifth Assessment Report (AR5) of the United Nations Intergovernmental Panel on Climate Change (IPCC) is the fifth in a series of reports intended to assess scientific, technical and socio-economic information concerning climate change, its potential effects, and options for adaptation and mitigation. The report is the most exhaustive and presents detailed summary of the climate change situation ever undertaken, involving thousands of authors from dozens of countries, and states. A special report on Global Warming of 1.5° C was released in 2018 in which Bangladesh was identified as one of the vulnerable countries in terms of climate change impacts.

According to the projection of the Intergovernmental Panel on Climate Change (IPCC), Bangladesh would have high exposure to SLR in the 21st century using 1.5°C and 2°C scenarios. At the basin scale, Mohammed et al. (2017)[17] found that floods are projected to be more frequent and flood magnitudes greater at 2°C than at 1.5°C in the Brahmaputra River in Bangladesh. In coastal regions, increases in heavy precipitation associated with tropical cyclones combined with increased sea levels may lead to increased flooding. In a groundwater-dependent irrigated region in northwest Bangladesh, the average groundwater level during the major irrigation period (January–April) is projected to decrease in accordance with temperature rise (Salem et al., 2017)[18]. For 1.5°C or 2°C stabilization conditions in 2200 or 2300 plus surges, a minimum of 44% of the Bangladeshi Ganges-Brahmaputra, Indian Bengal, Indian Mahanadi and Ghanese Volta delta land area (without defenses) would be exposed unless sedimentation occurs (Brown et al., 2018b)[19].

Table 4 Future Climate Trends for South Asia[20]

Precipitation	Temperature	Sea Level Rise
Increased rainfall under high emissions scenario by 2050	Increase by >2° C by 2050 under high emission scenario	26–55cm globally under low-emissions scenario by 2080–2100
Increased rainfall at high latitudes under low emissions scenario by 2050,	Increase by >3° C by 2100 under high emissions scenario	45–82cm globally under high-emissions scenario by 2080–2100

[14] Global Climate Risk Index 2017, Germanwatch
[15]ISPAN (Irrigation Support Project for Asia and Near East), (2003). Char Land Study Overview: Summary Report (Draft). Flood Plain Coordination Organization, Ministry of Irrigation, Water Development and Flood Control, Dhaka
[16]WFP, (2002). The coping strategies index, a tool for rapidly measuring food security and the impact of food aid programmes in emergencies. Accessed 22nd September 2011, Retrieved from ftp://ftp.fao.org/docrep/fao/meeting/009/ae513e.pdfWorld Bank, (2008). World Development Report 2008. (Washington, DC).
[17] Mohammed, K. et al., 2017: Extreme flows and water availability of the Brahmaputra River under 1.5 and 2°C global warming scenarios. Climatic Change, 145(1–2), 159–175, doi:10.1007/s10584-017-2073-2.
[18] Salem, G.S.A., S. Kazama, S. Shahid, and N.C. Dey, 2017: Impact of temperature changes on groundwater levels and irrigation costs in a groundwater dependent agricultural region in Northwest Bangladesh. Hydrological Research Letters, 11(1), 85–91, doi:10.3178/hrl.11.85.
[19] Brown, S. et al., 2018b: What are the implications of sea-level rise for a 1.5, 2 and 3°C rise in global mean temperatures in the Ganges-Brahmaputra- Meghna and other vulnerable deltas? Regional Environmental Change, 1–14, doi:10.1007/s10113-018-1311-0.
[20] IPCC, 2014. Fifth assessment report, South Asia summary. Available at: https://cdkn.org/wp-content/uploads/2014/04/CDKN-IPCC-Whats-in-it-for-South-Asia-AR5.pdf

but no significant changes at low latitudes		
Increased extreme rainfall events associated with monsoons	Increase by >2° C by 2100 under low emissions scenario	
Increased extreme rainfall associated with cyclones making landfall	Increased frequency of hot days	

Source: (IPCC, 2014)

Key future Impact and Vulnerability

Fl**ood is very likely to be more frequent in the coming years.** (Mirza, Warrickb, Ericksenb, & Kenny, 2001)showed that a 20-yr return period flood event in the Ganges, Brahmaputra and Meghna River will be changed to 13-yr, 15-yr and 5.5-yr return period floods due to a possible increase in temperature by 2ºC; which means the catastrophic flood[21] events. For the extreme level rise in temperature by 6ºC, return period of the same frequency catastrophic flood event will reduce by 3.4 times, 2.3 times and 8.5 times for the Ganges, Brahmaputra and Meghna rivers respectively. Another study by Tanner et al (2007) reaffirms that there will be uncertain rainfall changes, ranging from large decreases to large increases, as a result of which flooding in Bangladesh will also be extremely uncertain. Extreme peak river-discharges are likely to occur more frequently. For example, the recurrence interval for the devastating 1998 flood will reduce from roughly 50 years to 30 years in the 2020s and 15 years in 2050.

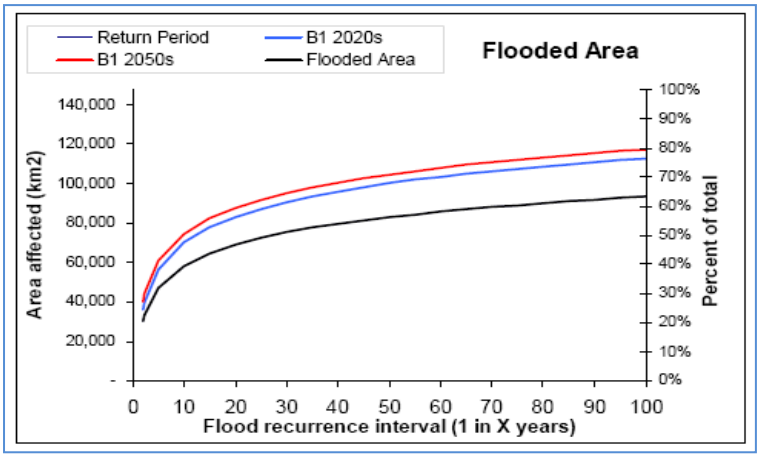


Figure 8 Increase in area and percentage of total area affected by flood from present situation (black line) to the 2020s (blue line) and 2050s (red line).

Drainage congestion in the southern region of Bangladesh is very likely to be exacerbated by climate change. Most of the rivers in south- western coastal regions of Bangladesh are going to become more congested due to sedimentation in the river bed related to bank embankments[22]. Due to embankments on both the sides of the tidal rivers and obstructing the mouth of the tidal creeks, sedimentation takes place on the channel beds rather than dispersing on tidal flat and floodplain areas. As a result, the channel width and depth are decreasing day by day. Climate change is causing higher water level in the drainage systems, sea level rise and sedimentation in the flood plains which further accelerates drainage congestion. Permanent loss of land in the coastal region is likely to happen. Drainage congestion is already a growing problem in the southern region of Bangladesh and is likely to be exacerbated by sea level rise. Loss of land due to permanent inundation is another major threat posed by the rising sea level. WARPO (2005) study showed that an additional area of 4,69,000 ha (13% of land area of coastal region) will be remain inundated by the year 2080 due to 62cm sea level rise for highemission scenario (A2 scenario). The most vulnerable areas along the Bangladesh coastline are the areas without polders which encompasses most offshore islands. Increase in rainfall (10% increase in rainfall within Bangladesh) in addition to the 62cm sea level rise in 2080 will increase the permanent inundated area by 16% (5,515,000 ha) in the monsoon. The following figure shows the inundation of the coastal region of Bangladesh for 15cm (B1 scenario), 27cm (A2 scenario) and 62cm (A2 scenario) sea level rise during the monsoon. On the contrary, in the dry season due to 62cm sea level rise about

[21] Range of flooded area 50,000-57,000 sq. km and range of % inundation 34%-38.5%, as classified by Mirza (2001)

[22] Rashid, M. B., Mahmud, A., Ahsan, M. K., Khasru, M. H., Islam, M. A., 2013a. Drainage Congestion and Its Impact on Environment in the South-Western Coastal Part of Bangladesh. Bangladesh Journal of Geology, v. 31-32, pp. 43-55.

364,200 ha (10%) more area will be inundated (inundation more than 30cm) for the A2 scenario in the year 2080. However, the 15cm sea level rise has an insignificant impact on inundation in the dry season.

The intensity of cyclones in the Bay of Bengal is likely to increase. According to the IPCC, tropical cyclone frequency in Bangladesh is likely to decrease or remain the same, but the number of intense cyclones will likely increase . Dynamic and regional climate models project increased intensity of tropical storms by 2100 for the North Indian Ocean and increased frequency of the highest storm surges across the Bay of Bengal. Combined with sea level rise, the country is expected to face increasing tidal surge and inundation of coastal areas. By 2050, an additional 15% of the coastal area of Bangladesh is projected to be inundated by storm surges during cyclones. Storm surge from a 10-year return period cyclone (such as Sidr) could inundate an area 80% greater than what would be flooded presently, with a total of 9.7 million people (compared to 3.5 million in the no climate change scenario) expected to be exposed to severe inundation (>3m) . Between 1961 and 2013, a total of 61 cyclones hit Bangladesh, with the south-western zone affected by 28% of these cyclones . A study by the World Bank (WB 2000) indicated that usually cyclones are generated in the deep sea when sea surface temperature reaches the threshold value of about 27 degree Celsius. With increasing temperature, barometric pressure drops, and the additional energy is dissipated in the form of high-speed winds. A recently published study by IUCN stated the evidence of 3-4-degree Celsius increase in the sea surface temperature above the stated threshold and the IPCC have documented the probability of 5-10% increase in the wind speed by the year 2050.

The drought situation in the southwest and northwest region is very likely to aggravate. IPCC has also confirmed the probable increase of water stress condition in the south-Asian region. In Bangladesh, an earlier estimate suggests that the area severely affected by drought in Rabi season could increase from 4000 km2 to 12000 km^2 under severe climate change scenario (Huq et al., 1996). A geographical distribution of drought-prone areas under climate change scenarios shows that the western parts of the country will be at greater risk of droughts, during both the Kharif and pre- Kharif seasons. It was found that, under a moderate climate change scenario, Aus production would decline by 27 percent while wheat production would be reduced to 61 percent (Karim et al., 1998). The geographical distribution of drought-prone areas under climate change scenarios shows that the western parts of the country will be at greater risk of droughts, during the pre-Kharif and Kharif seasons (July – October). This could result in a decline in rice production by ~27% and wheat production by ~39% under a moderate climate change scenario. Under a severe climate change scenario, the area severely affected by drought in the Rabi season (October – March) is predicted to increase from 4000 km2 to 12,000 km2, further affecting agricultural productivity.

Salinity front in the south-west region is very likely to move upward. Due to change in salinity extent, there will be significant changes in the freshwater zone and brackish water zone. Considering the threshold value of salinity for agriculture, drinking water and biodiversity, changes in freshwater and brackish water area for dry and monsoon have been calculated from the model result. It is revealed that during the dry season, 2050 and 2080, for 27cm (A2) and 62cm (A2) sea level rise, brackish water area will be increased by 6% and 9% respectively. In the monsoon, an increase of brackish area will be 2% and 6% for 27cm and 62cm sea level rise.

In order to properly understand the climatic risk and vulnerability of the regions under consideration, it is essential to have a scientific and quantifiable basis for the assessment being carried out. Hazard analysis is the first step of risk assessment. Potential hazards of the country have been identified, and those are flood, drought, storm surge and soil salinity. The IPCC defines hazard as “The potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources” (IPCC, 2012). Here, the term “potential” sets the key directive for hazard assessment, i.e., the probabilistic approach. The term ‘integrated’ used in the risk assessment approach is used to specify the joint probability of multiple or consecutive occurrences of natural hazards.

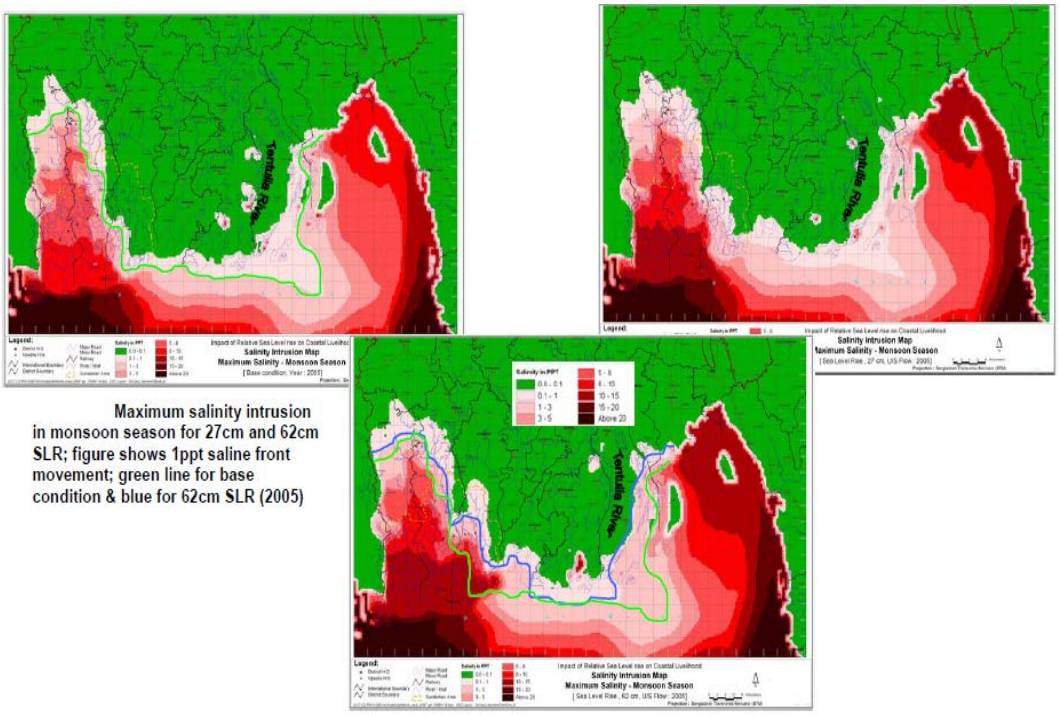


Figure 9 Salinity intrusion in monsoon season

Climate Change and Variability

Recently published fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC) depicted an average increase in the warming of 0.85 [0.65 to 1.06] °C globally, over the period 1880 to 2012 (IPCC, 2014). However, the estimates vary at the local level, and precise estimation is not possible mainly due to the unavailability of the weather measurement stations in the area of interest. Under this circumstance, summary statistics are calculated from the nearest available meteorological stations to depict the changes and variability of the climatic parameters.

Temperature

Higher temperature or warming leads to a chain reaction of a wide range of impacts across different sectors. That is because increasing air temperature also affects the oceans, weather patterns, hydrological cycles, plants, and animals. Therefore, the warmer it gets, the more severe the impacts on people and the environment will be. Changes in the average yearly statistics of mean, maximum and minimum temperature are considered as a proxy for detecting changes in the climatic pattern.

Mujib Nagar Union, Upazila: CharFasson

Figure 3 shows the trend and the variability of the yearly average temperature anomaly from the climatic baseline (pre-1990). The mean temperature has increased by 0.284 °C in the post-1990 period and showing an increasing trend towards the recent period. The estimate is statistically significant at the 95-percentile level. The annual trend in the maximum daily maximum and minimum daily minimum temperature of each month also shows increasing and 0.53 trend respectively (see figure 3). It can be depicted that the maximum temperature is increasing by 0.029 °C per year, and the minimum temperature is increasing to 0.038 °C per year. It signifies the possibility of more heat waves during summer days and relatively warmer nights during the winter.

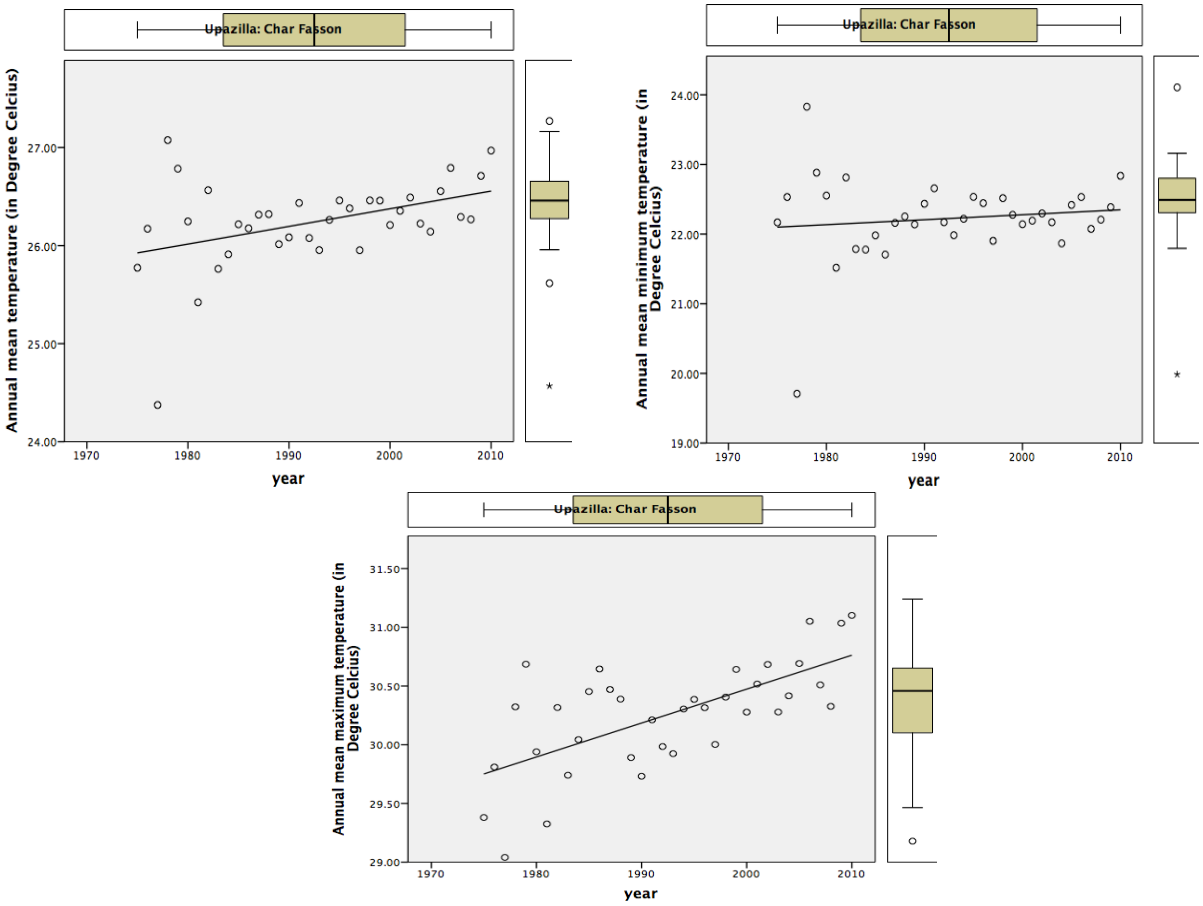


Figure 10. Historical trend in the mean average, minimum and maximum temperature for Char Fasson

Lakshmitari Union, Upazila: Gangachara

The meteorological station -10208 of Rangpur is the representative station for Gangachara Upazila. Figure 2.1, shows the usual average temperature in January varies from 16°C to 18°C. The average temperature of Gangachara Upazila increases gradually and reaches the highest in May. The average temperature in hot seasons varies from 26°C to 30°C in this Upazila. North-western region of Bangladesh is mostly vulnerable to drought. Within the last two decades (1994–2013), annual average maximum temperature has increased by 0.16 _C and the average minimum temperature is forecasted to be increased by 1.3 _C at the end of this century considering the four decadal (1964–2013) trend.[23]

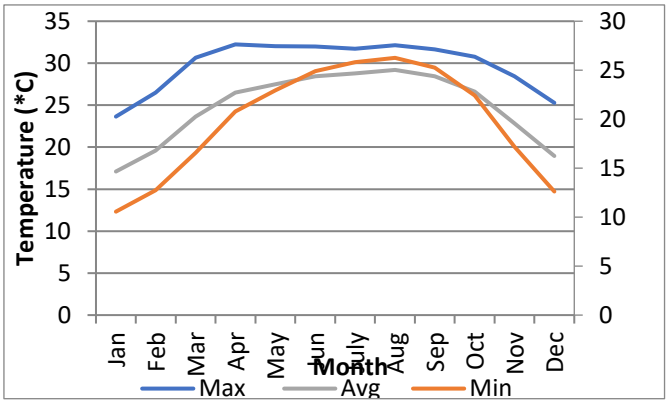


Figure 11Monthly average temperature of Station-10208 from the year 1948 to 2008

[23] Rahaman KM, Ahmed FRS, Islam MN (2016) Modeling on climate induced drought of north-western region, Bangladesh. Model Earth Syst Environ 2(1):45. Available at: https://doi.org/10.1007/s40808-016-0089-7

Rainfall

Changes of seasonal rainfall, shifting of the spatial and temporal distribution are triggered by the increase in the temperature. The monsoon seasonal rainfall might increase, and the dry seasonal rainfall might decrease projected by the IPCC's fifth assessment report. At the same time, the rural agrarian economy is severely affected by the increasing intensity of short duration heavy rainfall events.

Mujib Nagar Union, Upazila: Char Fasson

Figure 5 shows the historical anomaly in the total annual rainfall with respect to the baseline period (1960- 1990). It is evident that the mean annual rainfall has increased from 2466.3 mm/yr to 2903.8 mm/yr. The mean annual rate of increase is assessed as 15.1mm.

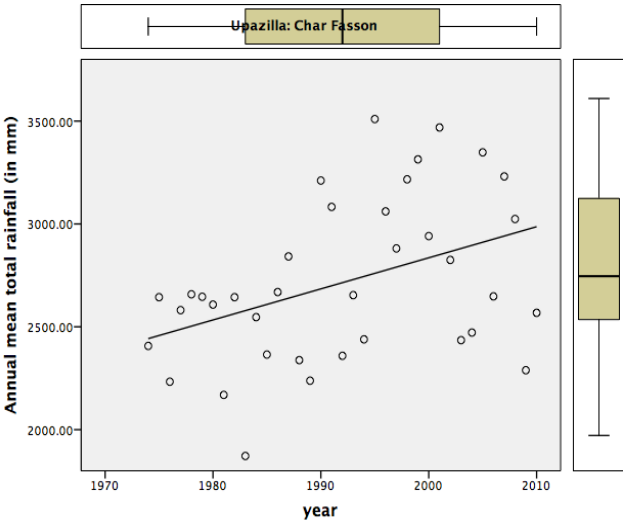


Figure 12 Historical annual rainfall anomaly

Laxmitary Union, Upazila: Gangachara

Mean annual rainfall estimated for Gangachara is 2157.31 mm. Figure 6 shows that there is hardly any rainfall from November to February (dry season). These four months contain less than 4% of the annual rainfall. The amount of rainfall increases rapidly from June to September (monsoon season) and reaches up to 1265 mm. Heavy rains throughout the monsoon leave thousands of people in northern Bangladesh homeless or in dire straits as the mighty Brahmaputra, Dharla and Teesta rivers burst their banks, spilling out over the countryside. In 2014 heavy monsoon rainfall in Bangladesh and river catchment areas pushed levels of several of the country's major rivers and one of the worst affected districts was Rangpur[24]. Over the last two decades i.e. 1994–2003 and 2004–2013, the annual average rainfall has calculated 151.50 and 138.09 mm, respectively. Rainfall has decreased quite significantly in the last decade.[25] Northwestern region is an important agricultural hub of Bangladesh. Decrease in rainfall and its seasonal variability have made the region more dependent on ground water for irrigation. Spatial and trend analysis shows groundwater depletion trend is getting steeper in this region.

[24] Davies, R. (2014). Floods in 20 Bangladesh Districts after Rivers Overflow - FloodList. FloodList. Retrieved 15 December 2016, from http://floodlist.com/asia/floods-bangladesh-rivers-overflow

[25] Rahaman KM, Ahmed FRS, Islam MN (2016) Modeling on climate induced drought of north-western region, Bangladesh. Model Earth Syst Environ 2(1):45. Available at: https://doi.org/10.1007/s40808-016-0089-7

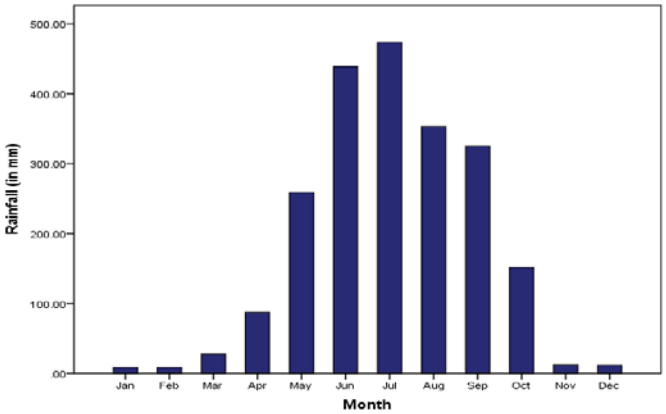


Figure 13Monthly rainfall of Station-10208 from year 1948 to 2002

Risk Assessment: Hazard exposure

Mujib Nagar Union, Upazila: Char Fasson

Overall flood exposure score for Char Fasson upazila for the baseline scenario is calculated as 194.8 km^2 that might increase to 260.5 sq km under the climate change scenario. Mujib Nagarhas a comparatively high exposure (score 27.4) which might rise to 40.8 sq. km. under the climate change scenario. More than 25% of people are exposed to flood under the baseline scenario for Mujib Nagar. Under climate change scenarios the population exposure will increase to values exceeding 33% people.

Overall storm surge exposure score for Mujib Nagar Union, considering the baseline scenario, is calculated as68.7sq km that might increase to 76.9sq km under the climate change scenario. More than 78% of people are exposed to storm surge under the climate changescenario. Depth adjusted storm surge exposure of the settlement area in the Char Fasson upazila is calculatedas 547.4 sq.km. which might increase to 684.5 sq. km. under the climate change scenario. Mujib Nagar has a fairly high level of exposure to storm surge with a base area of around 68.7 km^2 which can be expected to rise to 76.9 km^2.

Overall soil salinity exposure score for Char Fasson upazila for the baseline scenario is calculated as1366.3 sq km that might increase to 2732.6 sq km under the climate change scenario. Mujib Nagar yet again happens to be highly exposed (score 41.7) which might double to 83.3 sq. km. under theclimate change scenario. More than 436790.4 people are exposed to soil salinity under the climatechange scenario in Char Fasson, with 10,410 situated in Mujib Nagar Union. Multi-Hazard Risk, Salinity and Storm Surge Scenarios for the Baseline as wells as 2050 Prediction based on Climate Change Impacts have been attached as follows.

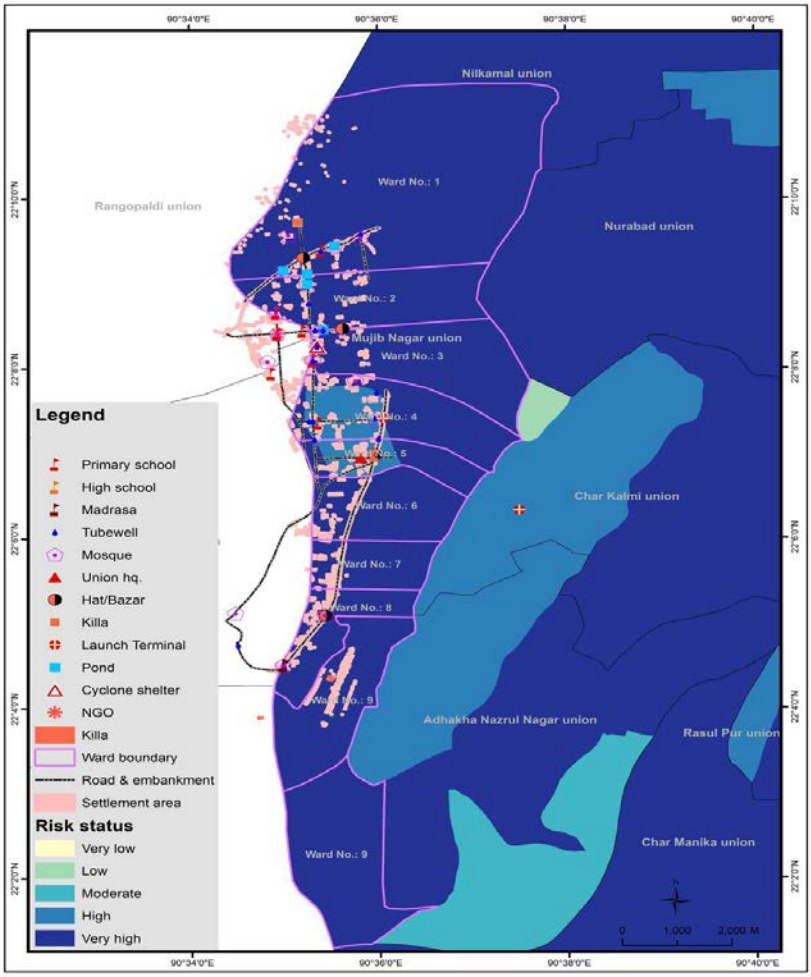


Figure 14 Multi-Hazard Risk scenario: Baseline (Mujib Nagar Union)

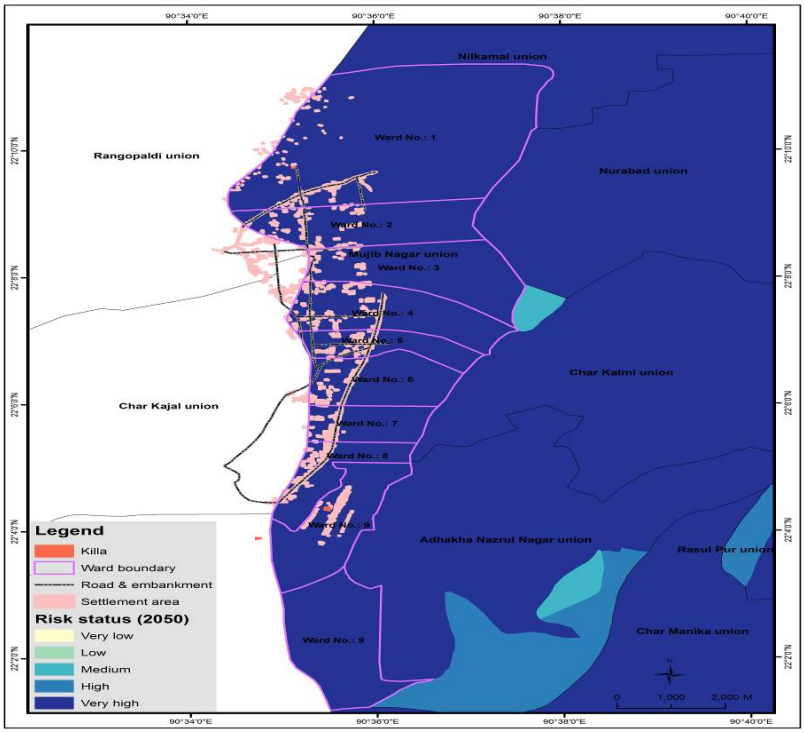


Figure 15 Multi-Hazard Risk Scenario: 2050 Prediction based on Climate Change Indicators (Mujib Nagar Union)

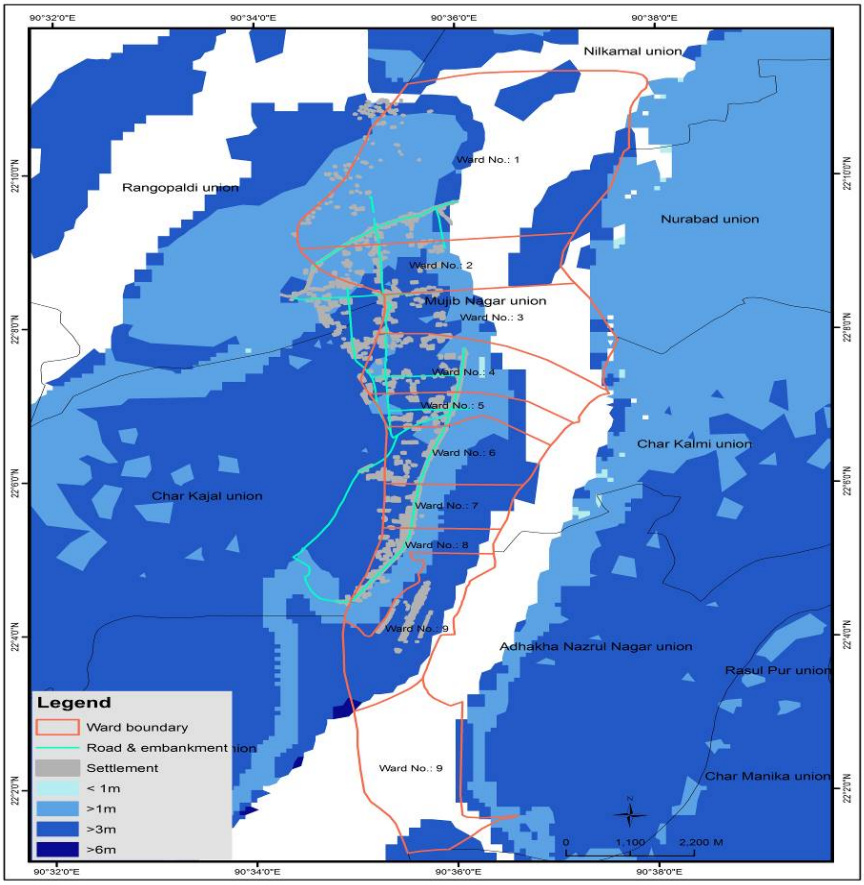


Figure 16 Storm Surge Risk Scenario: Baseline (Mujib Nagar)

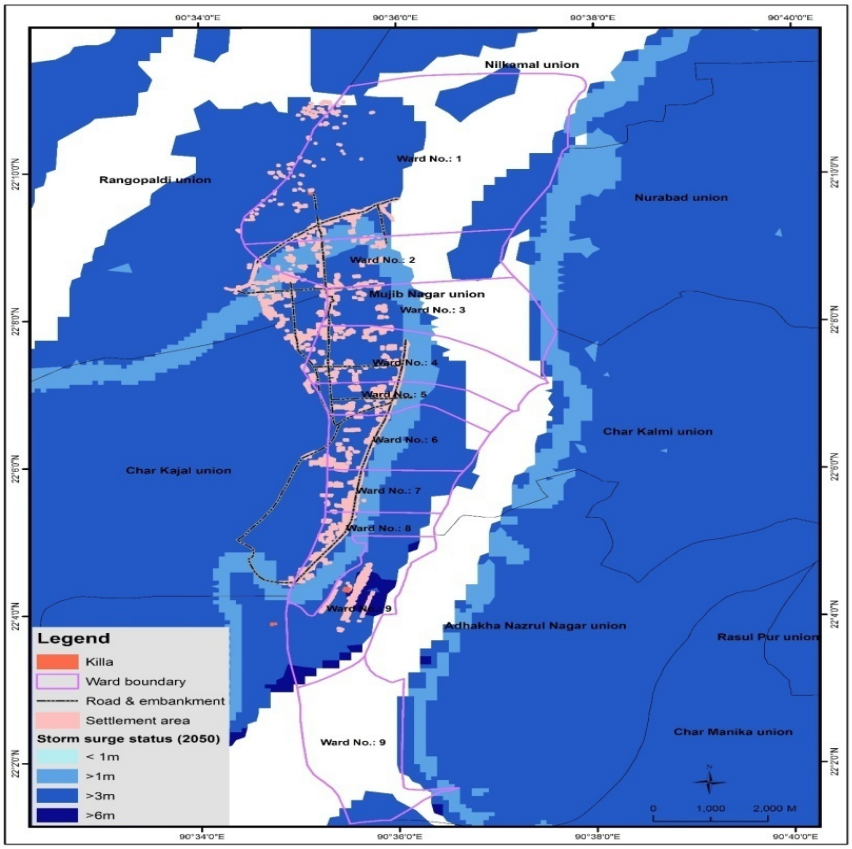


Figure 17Storm Surge Risk Scenario: 2050 (Mujib Nagar)

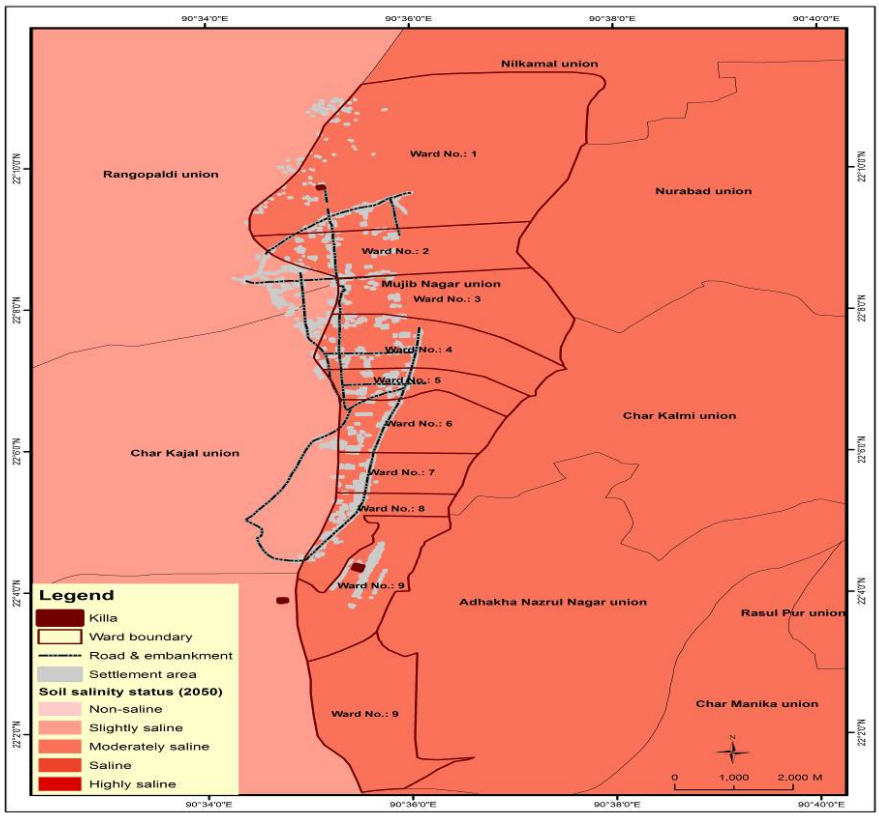


Figure 18 Salinity Risk Scenario: Baseline (Mujib Nagar)

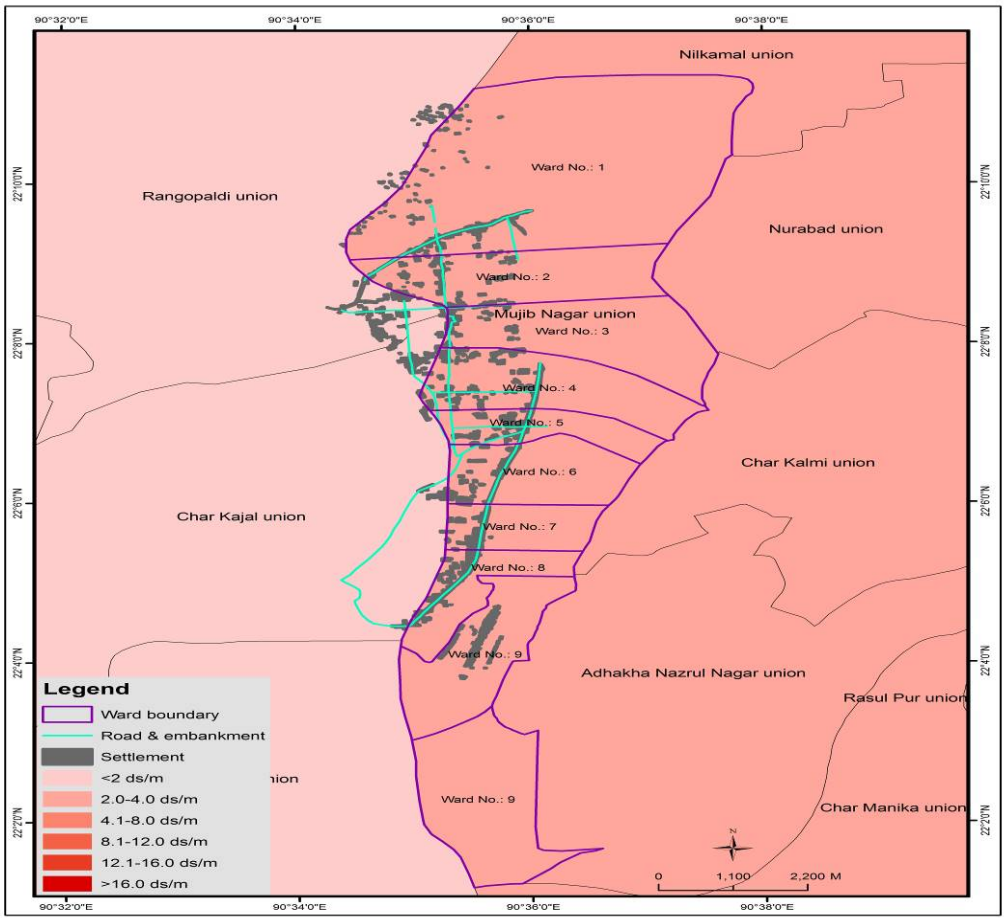


Figure 19Salinity Risk Scenario: 2050 (Mujib Nagar)

Laxmitary Union, Upazila: Gangachara
The table 2 quite clearly illustrates the vulnerability of the different sectors as observed in the Upazila of Gangachara.

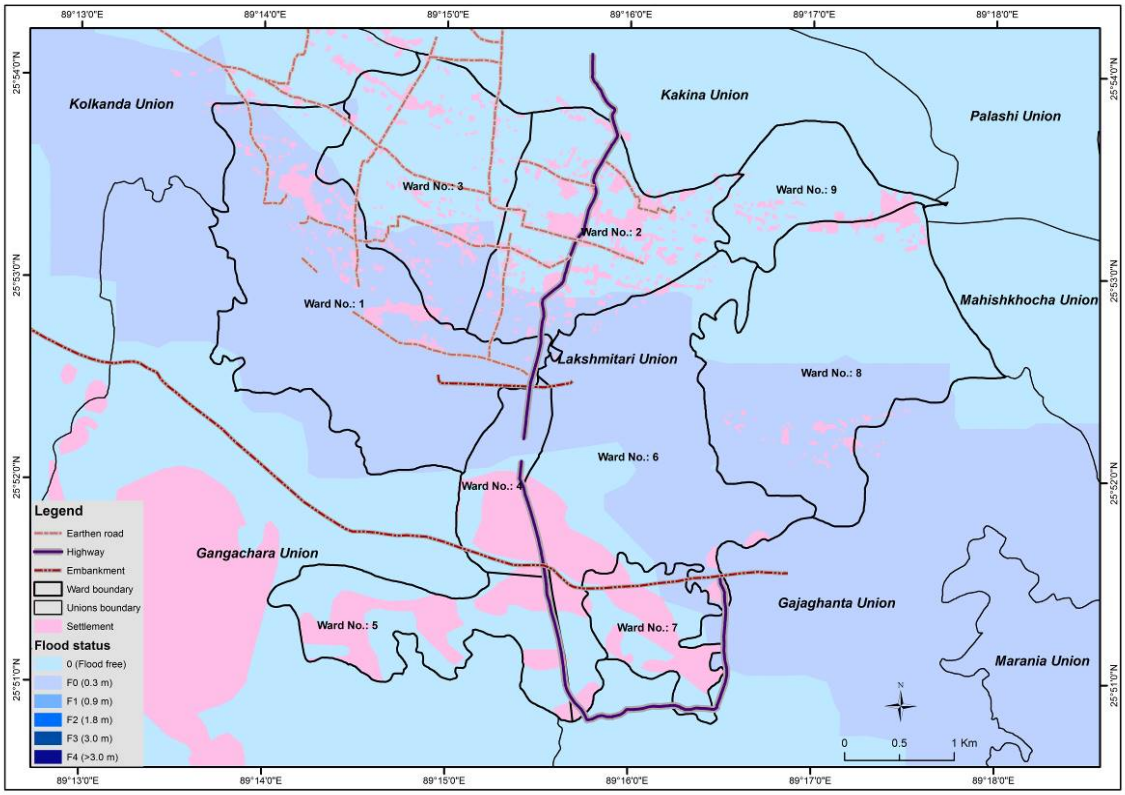
The Flood Exposure map for the baseline situations shows that currently the most vulnerable wards are clearly 1, 6 and 8 with parts of 2 and 3 also being affected by flood levels of up to 0.9m. However, looking at the 2050 scenario considering the impacts of climate change it is evident that the risk increases for the whole of the union with 2 and 3 becoming more vulnerable and the currentlysafe ward 9 becoming a high-risk area. It is important to note here that the entire Union itself is susceptible to flood levels of 0.3m height. To put the situation into context with an example, the rather dense patch of settlement in ward 2 was found to in an F2 flood status zone in 2050 while being in an F1 zone for the baseline situation.

The integrated risk scenario for Lakhsimitari Union (baseline) shows the entire union to be a high-risk region considering the vulnerabilities and the risks associated, after they have been multiplied by their respective weights for the calculation of integrated risk (see figure 16). Looking at the 2050 scenario after consideration of the impacts of climate change, it appears that Wards 1 to 3 will no longer be exposed to high risk with the other wards of Lakhsmitari being more exposed to risk. The impacts of Climate change seem to aggravate the baseline situation in Wards 8 and 9 from high-risk exposure to very high-risk exposure.

Another problem in Gangachara Upazila is drought. A study[26]showed that drought scenarios are now a day's more frequent than the past. This is due to the lack of precipitation and high rate of evaporation in the dry season. The present period of drought is longer in extending than the past ones. Unstable weather situation has been reported as the causes of the situation. The drought situation is not very severe but is of moderate intensity and interrupting agricultural activities and threatening the food security of the entire country.

Normally from late October to March is being considered as the drought periods by the native peoples of the study area. If proper measures are not taken, drought scenarios may become worse in the near future. A research showed that there is an increasing trend of annual average maximum temperature in Rangpur which may turn agricultural lands into barren lands in future.[27] Increasing trend in maximum temperature stimulating high evaporation as well as uncertainty of trans-boundary water movement is found to be strongly influencing the depletion of surface water level. These circumstances are making North-western region more vulnerable towards drought. Drought degrades fertility and moisture contents of soil which leads to the use of additional fertilizer and irrigation to maintain soil quality for cultivation. As a result, input costs are also expected to increase. Increasing input costs along with lesser soil fertility will cause less productivity of soil and thus will reduces benefits of the farmers in the region. As a result, farmers will become financially more vulnerable. Less production due to drought in the north-western districts may also influence the market price for food grains, and cause food insecurity among the poor and ultra-poor people of the country.

[26]Islam, Shakibul. (2017). Assessment of the Impact and Management of Flood, Drought and River Bank Erosion: A Case Study of Char Land Peoples of Gangachara Upazila, Rangpur District, Bangladesh. Imperial Journal of Interdisciplinary Research (IJIR) Vol-3, Issue-4, 2017 ISSN: 2454-1362.
[27] Rahaman KM, Ahmed FRS, Islam MN (2016) Modeling on climate induced drought of north-western region, Bangladesh. Model Earth Syst Environ 2(1):45. Available at: https://doi.org/10.1007/s40808-016-0089-7



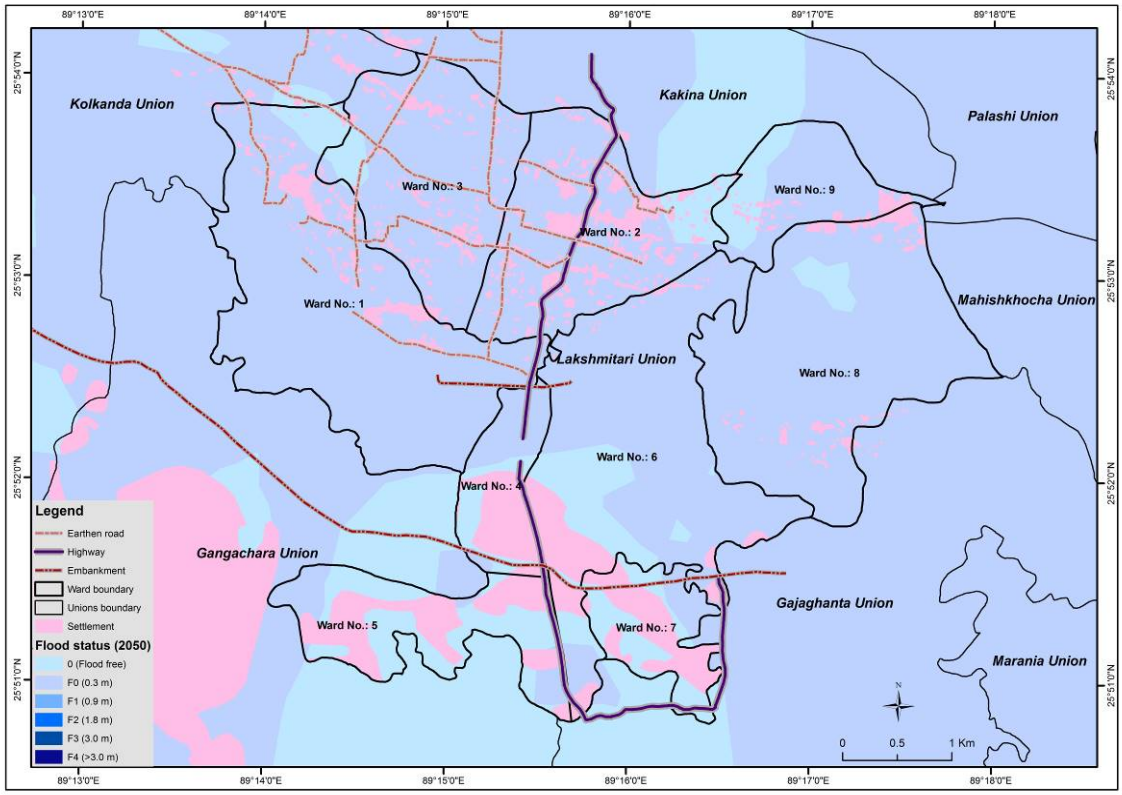


Figure 20Top: Flood Exposure Map for Lakhsmitari Union (Baseline), Bottom: Flood Exposure Map for Lakhsmitari Union (2050)

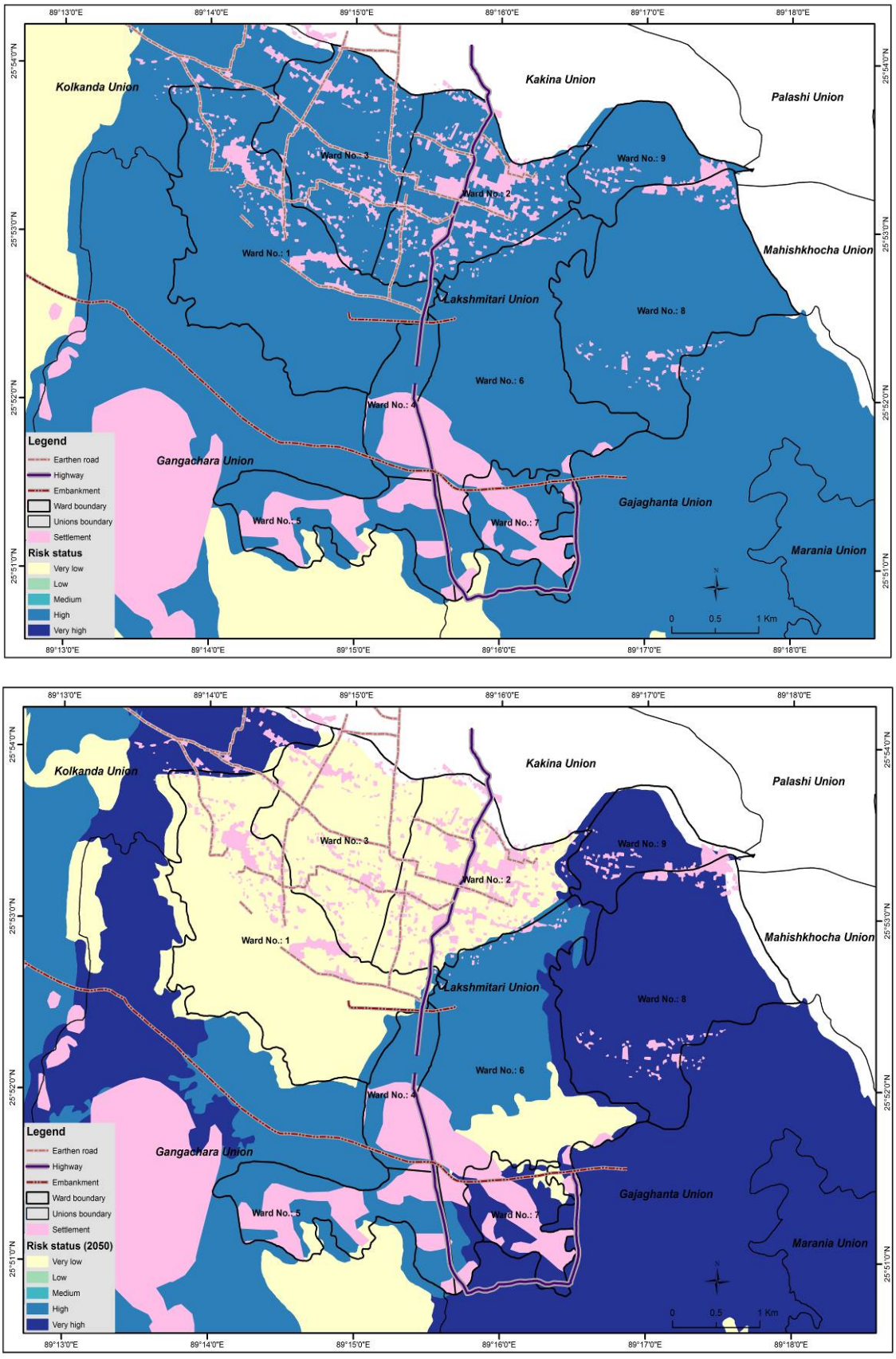


Figure 21Integrated Risk Exposure Map for Lakhsmitari Union (Baseline), Bottom: Integrated Risk Exposure Map for Lakhsmitari Union (2050)

Table 5 Table Showing the Sector wise Vulnerability ranking for Gangachara Upazila, and associated weights for calculation of the Integrated Risk

Hazard Type	Physical vulnerability				Social vulnerability						Economical vulnerability					Environmental vulnerability		
	Density	House type	Road Network	Total Physical	Household Size	Young dependents	Elder dependents	Illiteracy rate	House ownership	Total Social	Agricultural Land	Unemployment rate	Income Diversity	Electricity Coverage	Total Economical	Water Supply	Sanitation	Total Environmental
Expert Ranking (Average)																		
Flood	7.14	7.14	7.43		6.57	8.00	6.86	5.71	5.43		8.29	6.86	6.29	6.00		8.00	7.43	
Storm Surge	6.86	8.00	8.29		6.86	7.71	8.00	5.71	7.14		8.57	8.00	7.14	6.57		9.14	8.29	
Salinity	5.71	2.29	2.29		4.29	4.57	4.00	3.71	3.71		8.29	5.43	6.00	2.29		8.86	4.00	
Drought	0.00	0.00	0.00		4.29	4.57	4.29	3.43	3.14		8.57	5.71	5.71	2.57		2.43	4.00	
Individual Weight																		
Flood	0.33	0.33	0.34	0.22	0.20	0.25	0.21	0.18	0.17	0.34	0.30	0.25	0.23	0.22	0.28	0.52	0.48	0.16
Storm Surge	0.30	0.35	0.36	0.22	0.19	0.22	0.23	0.16	0.20	0.33	0.28	0.26	0.24	0.22	0.28	0.52	0.48	0.16
Salinity	0.56	0.22	0.22	0.16	0.21	0.23	0.20	0.18	0.18	0.31	0.38	0.25	0.27	0.10	0.34	0.69	0.31	0.20
Drought	0.00	0.00	0.00	0.00	0.22	0.23	0.22	0.17	0.16	0.40	0.38	0.25	0.25	0.11	0.46	0.38	0.62	0.13
Integrated Weight																		
Multihazard Multi vulnerability	0.17				0.34						0.32					0.16		

FEASIBLE ADAPTATION OPTIONS

The project will be built on extensive knowledge in community engagement to apply participatory methods developed by the team to enhance the effectiveness of outcomes and inclusiveness of those most disadvantaged. The proposed approach will integrate ecosystem-based adaptation, adaptive agro-ecology, and community-based adaption measures to address risks and vulnerability associated with climate change. The project components are designed to reduce risk to flooding and adverse impacts of flood and droughts which will help to reduce anticipated costs that will recur during future scenarios of increasing climate change disasters.

As the char areas are particularly prone to the effects of frequent climatic shocks, this increases the precariousness of poor people's lives by wiping out their assets and pushing them deeper into poverty. Higher frequency and duration of cyclones and hidden sandbars hamper the major livelihood systems in coastal char lands. During cyclones, the sea becomes turbid and makes it difficult for the fishermen to locate sandbars, hence causing their boats to crash. The dependence on limited and seasonally variable natural resource access also limits their ability to adapt. The availability of cultivable land decreases during coastal flooding and prolonged periods of droughts in the study areas lead to the char dwellers having low incomes or complete loss of income. The major livelihood of the char dwellers is agriculture which is affected by tidal or monsoon flooding, hailstorm, cold waves, heat waves, erratic rainfall etc. which leads to decline in crop yield, crop damage and ultimately causes a loss of agricultural production.

Incremental adaptation processes proposed for this project include strengthening the damaged houses through retrofitting in some areas to reduce exposure to flooding and storm surges. The people living the Char lands have to spend a significant amount of money whenever they are hit by a climatic disaster like flood, storm surge, cyclones, etc. Strengthening the damaged households will require a higher initial cost but in the long run it will be more sustainable to climatic impacts. If the houses can sustain during disaster, then it will protect the occupants as well as reduce the cost for repairing house after every disaster. Another option can be building cluster houses by comprising 4-5 households. These houses will be built in an elevated platform above the average flood level and will include all the basic needs like safe water supply, sanitary latrine, energy source etc, Also, the houses can be used to provide shelter for nearby families in times of disaster.

It is recommended that particular emphasis be placed on: i) adapt climate resilient agriculture practices; ii) installing improved sanitary latrines; iii) installing rainwater harvesting; iv) developing renewable energy options like community based nano-grid. The proposed areas are highly vulnerable to climatic disasters which possess a negative impact on agriculture. As majority people living in the Char lands depend on agriculture, they have to go through a loss of livelihood when a massive disaster strikes. Introducing climate resilient agricultural practices will help to adapt with the changing climate and protect their agricultural produces. This will ensure sustainable livelihood and improved economic. Introducing alternative livelihood options that are not affected by the impacts of climate change could be a source of sustainable income for the people living in the char lands. This type of initiative will help them to cope up with the damages caused by climatic disasters.

By assessing the adaptation needs and carrying out the necessary infrastructural development, vulnerability to the impacts of climate change can be minimized. Riverbank protection by repairing the existing embankments and constructing new embankments could minimize the climate-induced impacts upon human settlements at the char lands. It will also minimize the agricultural damage due to flood.

Development of climatic hazard maps and risk scenarios and strengthening local level climate information and dissemination framework could increase the adaptive capacity of the vulnerable population to anticipate the risk, absorb the impacts and prepare to respond accordingly. This system would deliver climate risk information to reduce exposure and increase the resilience of char dwellers to slow and sudden onset of climate extremes.

Establishment of emergency medical service like floating ambulance during disasters curriculums would act as a method of transformative adaptation. Also incorporating awareness raising activities would help them prepare for proper response strategies during and post-disaster periods. These floating ambulances could be made mobile by incorporating them into water vessels thereby increasing their utility as a disaster management module.

The expected outcomes from few activities would lead to reduction in exposure during flood and surges and increased land protection, paving the path to deal with future disasters with lesser monetary

involvement. Also, the inclusion of vulnerable segment of the community such as ultra-poor women for finalizing design, operation and maintenance, monitoring and evaluation of the project would incorporate local knowledge as well as trainings in the CBO would also help to increase cost effectiveness. By implementing this project in a community-driven and participatory manner, the impact of the project will contribute to greater abilities of local communities to 'bounce back' from climatic extremes. Training and capacity building of farmer-led cooperative would allow crop diversification with modern equipment and technology and establish community agricultural market, thus avoiding extra costs to start up the community from scratch post disasters.

Other components like Improved Climate Information Systems combined with preparedness and integrated adaptation measures, would be more effective to tackle hazards, than reactive response measures. Strengthened local level climate information and dissemination framework to be implemented in the study areas under this project will build on experiences gained elsewhere in the country, harnessing and further strengthening expertise and capacities of the communities to deal with disasters. Knowledge Management & Research and Capacity Building and Institutional Reformation would involve developing climatic hazard maps and risk scenarios in the study area which would keep the communities up-to date with risk scenarios and dissemination of lessons learned from meetings and trainings would also reduce vulnerability.

Developmental evaluation which is iterative and flexible will be used to accelerate learning, enhance locally-based innovation and encourage step changes in flood resilience practices. Design expertise will help develop a strategy with partner organizations and National policy makers for deploying innovations at scale.

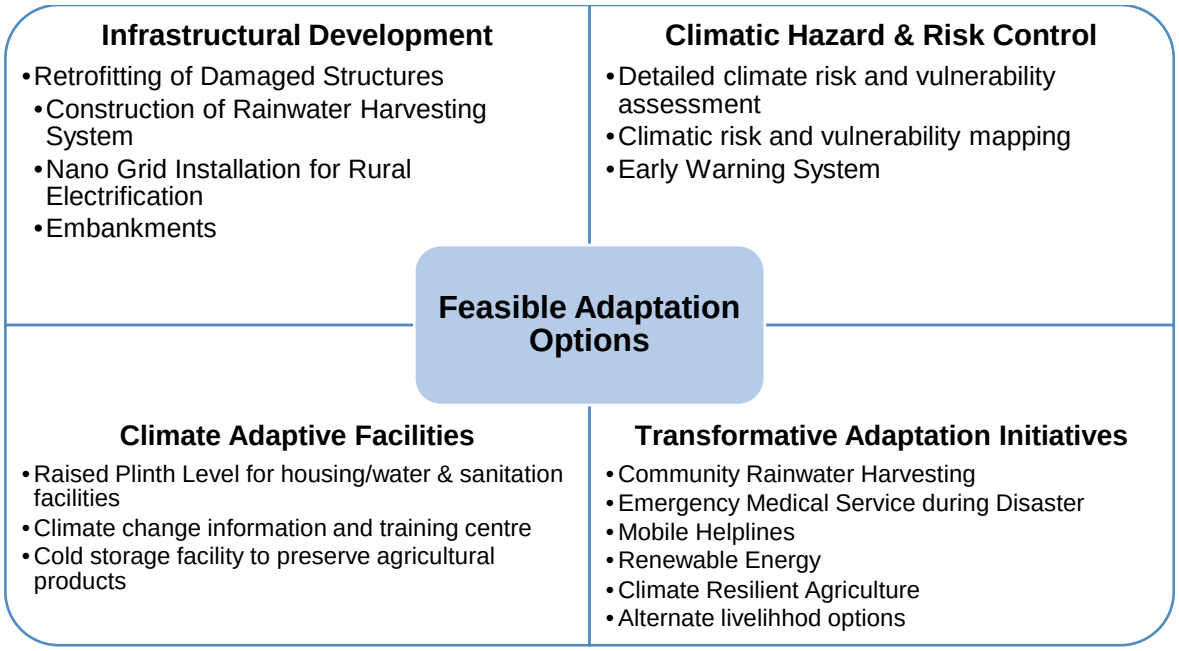


Figure 22 Feasible Adaptation Options

Annex I. Gender Assessment

Introduction

Bangladesh is a developing nation with almost half of the population being women who are involved in agriculture and economic activities. As such women bear significant share of contribution to development. Therefore, the impending impacts of climate change particularly the increasing frequency and intensity of extreme climatic events affecting agriculture, water resources and the livelihoods of poor women not only impede the development activities, but also exerts direct vulnerability to women.

Being the primary victim of climate change impacts, women can play a central role in adaptation to climate change. Women also could play a key role in mitigating climate change by optimizing energy efficiency, using low-footprint energy sources and' techniques, and influencing a household's and community's consumption patterns. Therefore, when it comes to decision-making and implementation towards building resilient communities in the face of climate change, the full and meaningful participation of women become essential.

The impacts of climate change affect women more compared to men[28]. Women living in the char are highly dependent to locally available natural resources to meet the daily needs of their families. Also, they face water, sanitation and health challenges due to unfavorable climatic conditions. For example, salinity intrusion causes unavailability of drinking water, health issues by creating itching problems, high blood pressure, loss of agricultural products, etc. On the other hand, drought can cause scarcity of drinking water, heat strokes, burning of crops, etc. Women bear the burden of fetching water for their families and spend significant amounts of time daily hauling water from distant sources. The water is rarely enough to meet the needs of the household and is often contaminated, such that women also pay the heaviest price for poor sanitation. Moreover, damage of sanitation systems creates sufferings for women. Lack of toilet facilities increases physical insecurity for them. Many women refrain from using the toilet during the day and consequently suffer from urinary tract infections. Pregnant women, lactating mothers and differently disabled women suffered the most, as they found it difficult to move before and after the cyclone hit.

Women can, however, play a central role in adaptation to climate change. In Nepal, women farmers avoid crop failure in the face of changing weather patterns by growing off-season vegetables and bananas, which are more resilient to flood and drought[29]. Gender-blind adaptation programs are potentially harmful to development; as they have a propensity for exacerbating existing inequality. Conversely, gender assessmentsarenecessary for successful gender mainstreaming and is a prerequisite for ensuring equal access tocommunity-based adaptation initiatives. Assessing the implications for women and men of any proposed intervention requires a strategy sothat women and men benefitequally. The ultimate goal isto achieve gender equality and for this, the followings are required-

- Climate change impact assessment (from bothmale and female perspectives)
- Gender-sensitive indicator development and design and implement components by incorporating a gender perspective
- Set activities to increase female participation
- Specific attention paidto gender differences in terms of capabilities to cope with climate change adaptation initiatives

This project has evaluated the impacts of climate change from both male and female perspectives in both offshore island and riverine char areas. Limited or no access to health care infrastructure inadequacy, lack of water and sanitation facilities, as well as lack of secured livelihood and income had made the condition of both men and women more vulnerable, however, these impacts affect women more than men. Furthermore, these lead to both areas experiencing socio-economic problems causing poverty, unemployment, child labour, early marriage, migration, educational instability, social unrest and finally psychosocial problems that ultimately increase the difficulties experienced by the inhabitants of these chars. From the field visit, it has been found both coastal and riverine chars are facing school dropout, which is ascribed mostly to remoteness from the mainland. As a result, in both chars, due to educational drop out, female students are getting married at an early age. The early marriage of young girls, in turn,

[28] Asaduzzaman, M. (2015). Livelihood Vulnerability of Women in the context of Climate Change Impacts: Insights from Coastal Bangladesh, Unpublished PhD thesis, The University of Newcastle

[29] ActionAid. 2007. We know what we need: South Asian women speak out on climate change adaptation. ActionAid and
Institute of Development Studies. Johannesburg, South Africa and London.

causes health hazards. The rate of maternal and child mortality are high in these areas. During the post-disaster period, women and children suffer from several diseases and one of the major reasons is the lack of water and sanitation facilities.

Gender mainstreaming in the proposed intervention (Proposed Action Plan)
This assessment provides an overview of gender inequality in offshore islands and riverine char lands, identifies gender issues relevant to the proposed interventions, as well as ensure and examine potential gender mainstreaming opportunities of the components of the proposal. The assessment is based on a field visit conducted by the Centre for Climate Change and Environmental Research (C3ER).

The proposal contains four components, which all incorporate gender considerations. Component 1, in particular, will include a strong gendered focus on supporting women-led households, improve gender equality and social inclusion. The other three components will also include gender-sensitive planning that responds to gender differences and identifies opportunities and reduces and places emphasis on women's vulnerability. For instance, component one comprises of: i) plinth raising and house strengthening for reducing flood/storm surge exposure; ii)community-level nano-grid facilities; and iii)household-level rainwater harvesting options implemented for safe drinking water supply, which will all improve the health and well-being of women and children. It is apparent from the field study that, women and children are the most vulnerable and are likely to be affected more by the impacts of climate change. All other components such as climate information system, knowledge management & research and capacity building and institutional reformation involve activities that increase the capabilities to cope with climate change adaptation. Training and capacity building program for the CBOs/WMOs on disaster emergency management, climate change adaptation, first aid, as well as capacity technical workshops on the establishment, use, and maintenance of climate early warning system, including the interpretation and application of tailored climate information services, targeting community members as well as women and children to enhance their capacity to address their adaptation deficit.

The component 2 of the proposed interventions are designed by including a gender perspective and the activities of this component are clearly set to develop the resilience of the women by ensuring their livelihood, health and by increasing their capacity. The raised platform cluster houses will provide better security to women in times of flood. Also, it will ensure improved water supply and sanitation for them. They will also be able to do homestead gardening which will enhance their economic capacity. Moreover, women can actively take part in embankment management activities. Elements of component 2 and component 3 are designed specifically to address the most pressing issues facing women in the project target areas, which include limited access to alternative livelihoods and provision of health services. These components will enhance the ability of women to influence their livelihood strategies by a) increasing livelihood and income generating opportunities b) increasing the sustainability of livelihoods; c) ensuring access to skills building for beneficiaries on non-climate sensitive livelihood diversification; and d) ensuring the provision of public health services for the most vulnerable rural inhabitants.

Alternative livelihood options are assessed, designed and implemented in the participation of the ultra-poor women for non-climate sensitive livelihood (e.g., sewing, livestock rearing, shop, poultry) through training and the provision of material to support livelihood diversification and income risk reduction. Training and capacity building of the beneficiaries on non-climate sensitive livelihood diversification and income protection will be delivered.

The floating ambulance will provide service to women during emergency especially for pregnant women. The floating ambulance will have provision for child delivery. Also, it will have an intensive care that will be able to give support to babies for a few days until better treatment is arranged. Other primary treatments and necessary medicines for women will be also available in the floating ambulance. This will help to ensure better health for mother and children.

The natural cold storage and solar powered irrigation pump will help to improve agriculture in the study area. Women will be also involved to use and maintain these facilities which will increase their capacity. Also, agricultural improvement will led to better food security that will help to ensure better health and nutrition for women.

Review of Relevant Policies and Documents
The first definitive action regarding climate change came in 1992 at the UN Conference on Environment and Development held in Rio de Janeiro. The United Nations Framework Convention on Climate Change (UNFCCC, or, Convention) was established at the conference which came into force in 1994. Finally, 192

countries signed and ratified the Convention and are called Parties (192 in number). In 1997, the Kyoto Protocol (KP) was signed which came into effect much later in 2005. This protocol is a legal instrument under which industrialized countries committed themselves to lower emission on an average of 5% below the 1990 level. The first commitment period ended in 2012. The KP has three primary market-based instruments to lower emission. In COP7 in 2001, the first decision was taken to integrate a gender-sensitive approach mandated that national adaptation programs of action be guided by gender equality.This section assesses the indicators of gender sensitivity of the key national policies and the policy consideration by adaptation fund.

Bangladesh prepared the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008 and revised it in 2009. This is now an approved document of the Government. This is expected to be the blueprint for subsequent integration of climate change issues such as mitigation, adaptation, technology transfer and development, and capacity building into the mainstream planning process. The serious consequences of climate change, including especially the consequences for Bangladesh, lead naturally to the question of what should be our response. Two types of response need to be considered. The first relates to adaptation, and the second relates to mitigation.

A review of how gender is addressed in the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) was carried out by the German international cooperation agency (GIZ) in 2012. The review noted that of the 44 BCCSAP programs, only four mentioned gender specifically. Also, the BCCSAP does not refer to women as actors in addressing climate change. The Asia Foundation (2014) noted that BCCSAP considers gender issues on the basis of specific programs. However, specific attempts to integrate or mainstream gender across all sectors and programs are not made. For example, of the nine programs with 29 activities under the BCCSAP theme “Food Security, Social Protection and Health,” only one activity has a specific linkage with “women and gender relations,” in which a comprehensive study is planned to assess the impact of climate change on women and gender relations and to develop recommendations to address these in all actions under the BCCSAP.

Bangladesh is one of the few countries that developed the **National Adaptation Plan to action (NAPA) to climate change (2005)** up to November 2009. Through the NAPAs, the UNFCCC recognizes that men and women have different roles in securing livelihoods in the developing world. The action plans include gender in a more comprehensive manner throughout the document. It was recognized in the NAPAs that climate change experience will vary by people depending on their gender, poverty levels and their location (coastal or non- coastal, rural or urban). The NAPA identified poverty reduction and security of livelihoods with a gender perspective as the most important set of criteria for prioritization of adaptation needs and activities.

The objective of the **Bangladesh Climate Change and Gender Action Plan (2013)** is ‘to mainstream gender concerns into climate change-related policies, strategies and interventions ensuring access to, participation in, contributions towards and benefits for the diverse group of stakeholders for the sustainable and equitable development of Bangladesh.’ The initiative to prepare a BCCGAP in Bangladesh was taken in 2012 by the MoEF, and it was released in November 2013 after extensive consultations with representatives of ministries, universities, civil society and development practitioners, and a thorough review of relevant national and international policies and documents. Gender considerations were integrated into four of the six main pillars as identified in the BCCSAP by the BCCGAP: a) food security, social protection and health; b) comprehensive disaster management; c) infrastructure and d) mitigation and low carbon development. The remaining two pillars of the BCCSAP- research and knowledge management and capacity building and institutional strengthening, were mainstreamed within the above four pillars throughout the document as cross-cutting topics. Clear objectivesoutlines substantive activities that are accompanied by reachable indicators were established in the BCCGAP. The objectives, activities and indicators were done within the domain of the four pillars highlighting the specific contribution women do and can make within each of these as well as the required interventions necessary to incorporate the role of women effectively over a timeframe of five years, from 2013/14-2018/19.

The Ministry of Environment and Forestry (MoEF) is reviewing the **National Environmental Policy (1992)** and the draft National Environment Policy 2013 has incorporated women’s roles and right to benefits.

Although the **National Forest Policy (1994)** states that ‘Women will be encouraged to participate in homestead and farm forestry, and participatory afforestation programs’, it does not provide specific directives to achieve the stated goal or set out other gender-specific goals (e.g. decision-making relating to forests and forest resources). The **Forestry Sector (Amendment) Rules 2009** address gender issues,

according to the 2014 national report on the implementation of the Beijing Declaration and Platform for Action (1995).

In the consultation process for the **Country Investment Plan (CIP) for agriculture, food security and nutrition (2011)** included engaging with women farmers and the Ministry of Women and Children Affairs (MoWCA). Gender is articulated throughout the CIP.

The **National Women Development Policy (2011)** briefly promotes women's role in environmental management and the importance of ensuring facilities for and the security of pregnant women in the event of natural disasters. However, the Asia Foundation noted in one of their survey's respondents indicated that National Women Development Policy missed an opportunity to highlight climate change-related risks for women.

The **Department of Environment** has drafted their gender policy in 2016 to promote gender equality. The purpose of this policy is to mainstream gender issues in the development process of the Department to enhance participation of women and men for the sustainable and equitable way. This policy is designed to improve the performance of DoE in an effective way with skills, talents and opportunities for both women and men. The objective of this policy document can be categorized into two parts. One is the organizational Objectives and Measurable Outputs, and the other one is capacity Development Objectives and Measurable Outputs. The principles are equity and equality, empowerment, management and governance, working environment. Ensuring equal rights, heading towards an increase in the degree of autonomy and participation in managerial and decision-making position, anticipating all forms of harassment are the focus points of these principles. DoE's draft Gender Policy in line with National Women Development Policy, 2011. The policy will cooperate with Government's relevant rules and regulation in order to integrate gender equity goals and objectives into its entire organizational processes and structures taking the policy principles as an outline for implementing and applying the policy. The ultimate goal of this policy is to eliminate all the discrimination against women. To attain this goal, specific strategies were followed including awareness raising initiatives,women's participation in top-level positions and providing technical and financial resources for implementation of the policy.

The vulnerabilities and needs of women are far from being mainstreamed into climate change policies and operational activity in Bangladesh. Lack of effective proactive policies is another major weakness. Policies may acknowledge the particular vulnerabilities of women, but do not necessarily have any operational planning to address the vulnerabilities. Multi-sectoral responses and collaborations to address climate change, and policies relating to disaster preparedness and response, livelihoods and health care may consider integrating gender issues into priorities (Shabib and Khan 2014). Safety and security of children, elderly people and people with special needs during the disaster and post-disaster period mostly depend on women. Hence, adaptation strategies need to bolster women's capacities, power, and social resilience. Moreover, there is a need for engagement of both women and men from a gender perspective in development and implementation of climate change related development projects.

The national policies recognize the importance of women in climate change adaptation and promotes their participation in different activities. This project is well aligned with the national policies as it highly promotes activities that will benefit both men can women equally. The project not only aims to fulfill the basic needs and safety of women in vulnerable areas, it also emphasizes on capacity and knowledge building of women so that they can equally participate in different activities like men. Including women in all the activities will further enhance the sustainability of the project.

Annex J. Environmental Impact Assessment (EIA) with Environmental Management Plan

The interventions of the proposed project could potentially have some significant impacts on the natural environment and the people living in the area. For this reason, proper environmental assessment and an environmental management plan (EMP) are essential to mitigate environmental risks. This document provides the initial environmental assessment for the project, as well as an environmental management plan. It should be read in conjunction with the relevant sections of the Project Document, namely Part II Section J: Overview of environmental and social impacts and risks; Part III Section C Environmental and social risk management; and Annex D – Social and Environmental Screening.

This document presents possible impacts of the project, mitigation, enhancement, contingency and compensation measures, an EMP, and an institutional framework for implementing the EMP. This will serve

to comply with the Adaptation Fund's environmental safeguard policies and with the Government of Bangladesh's laws and policies. The EMP will contribute to ensure environmental sustainability by:

- Preventing and/or mitigating any negative environmental impact that may emerge from the rehabilitation and improvement of embankments;
- Enhancing environmental outcomes of the activities through proper implementation of the Environmental Management Plan;
- Ensuring the long-term sustainability of benefits from afforestation, and community environment management plan by securing the natural resource base on which they are dependent; and
- Laying the groundwork for establishing an environmental management system (EMS) to achieve continuous improvement in environmental performance of the polder system from construction to operation and maintenance.

Categorization of Interventions

Pertinent environmental concerns and screening for the design and implementation of development projects in Bangladesh is guided by the Environment Conservation Act 1995 and Environment Conservation Rules 1997. The Environmental Conservation Rules (1997) classifies industrial units and projects into four groups by location, size and the severity of potential pollution: (i) Green, (ii) Orange A, (iii) Orange B, and (iv) Red.

Green Category projects are considered relatively pollution-free and hence do not require initial environmental examination (IEE) and EIA. Red Category projects would cause significant adverse environmental impacts and are, therefore, required to submit an EIA report. Orange Category projects generate low to medium impacts which are mitigable; considering the significance of impacts, Orange A require submitting a process flow diagram and Orange B requires submitting an IEE report.

The Adaptation Fund follows a similar classification, with the main difference being the categorization of projects into three major classes, namely, Category A, B, and C. While Category 'C' interventions are likely to have minimal or no adverse impacts, Category 'A' interventions are likely to have significant adverse environmental impacts and require the implementing agency preparation of an EIA. Most impacts generated through Category B projects are site-specific, and in most cases, mitigation measures can be designed more readily. Thus, these projects require the preparation of an Initial Environmental Examination (IEE), which is presented in this document and the relevant sections of the Project Document.

The interventions to be implemented under the proposed project do not involve large-scale infrastructure development (e.g., construction of high-rise apartment, sanitary landfill, large-scale wastewater treatment plant, major highways). The water management interventions, i.e., embankment repair, is large scale, but does not involve any new embankments, only repairing existing embankments. Under Bangladeshi law (Environmental Conservation Rules 1997) all water management activities are categorized as "red", i.e. high risk, by default. However, because this project focus only on repairing and rehabilitating infrastructure rather than constructing any new infrastructure, the interventions under Output 2.2 are classified as Category B under the Adaptation Fund framework, i.e. posing a low risk of causing a moderate and largely mitigatable impact. As the ecosystem-based adaptation approaches are suggested for the water management interventions, the components do not pose a risk of significant adverse environmental impacts, rather likely to cause minor to moderate impacts which are subject to environmental screening that requires preparing an Environmental Management Plan (EMP) with appropriate mitigation measures. Similarly, the proposed cluster house construction is classified as "red" under Bangladeshi law, since the cluster houses will require earth excavation works and will cost more than 10 hundred thousand taka (USD $12,500) each. However, the cluster house construction only pose very local environmental risks, which are not major and can readily be mitigated. Therefore, the cluster house construction activity is classified as Category B in the Adaptation Fund framework. Thus, given negative environmental impacts to be generated from the relatively limited scale and magnitude of construction/rehabilitation works, the proposed Adaptation Fund project is classified as Category 'B' project on an overall basis.

Proposed Interventions with Possible Environmental Concern

Most of the embankments of coastal polders were constructed many years back and has subsided naturally and therefore the existing crest level has been reduced from the design level. In addition, some parts of the embankments have been breached by storm surges during cyclones. Therefore, almost all embankments need to be raised and the breaching point should be repaired considering the present and future scenarios of cyclone storm surge levels. This will be one of the major interventions under this project. The intervention will involve mainly earthworks. It may need to re-align the existing embankment, to provide

additional setback to avoid ongoing bank erosion. This could cause additional disruption to some existing settlements, beyond the strip of land required for raising crest levels.

Environmental Management Process
The Environmental management process in the proposed project will involve the communities in the riverine islands of the Gangachara Upazilla in the Rangpur district and remote coastal islands in the Char Fasson Upazilla in the Bhola district. The project will use the following exclusion list in order to avoid damage or irreversible negative impacts on the environment, and to avoid negative impacts on people:

- No activities to be carried out within 1 km of natural protected areas recognized by national or local governments;
- Any activities that require the conversion of natural habitats (when affecting critical natural habitats and natural land contours, natural habitats for this purpose being those water or land areas where most of the original plant and animal species are still present);
- Land reclamation such as drainage of wetlands (natural pond/ beel/ baor/ haor etc.), or filling of water bodies to create land;
- Activities which would adversely affect cultural property, including archaeological and historical sites;
- Hazardous waste management and disposal as well as manufacture, transport and use of hazardous, and or toxic materials (except small amounts of solvents, degreasing materials, paints, fuels, and the like used during construction).

The proposed project interventions has been designed based on the local contexts, site characteristics, community preference, technical, and environmental considerations. The project does not include any interventions that could have significant, long-term, and irreversible negative environmental impacts. The red category interventions identified above will be subject to detailed environmental and social impact assessments during the initial stages of project implementation, prior to commencement of works.

Assessment of impacts
All orange and red category interventions are subject to an Environmental Screening and Initial Environmental Examination in order to avoid significant negative impact or prevent execution of projects with negative environmental impacts. Although most of the impacts would be localized due to the relatively small scale of the activities, there are some issues of concern that cut across the range of proposed interventions. Such potential negative impacts will be avoided by designing and implementing appropriate mitigation and enhancement measures and following some Environmental Code of Practices (ECoPs) in different phases of planning and implementation.

The project aims to repair the already existing embankments in Mujibnagar Union and no new embankments will be constructed. Therefore, the project will not involve any resettlement or land acquisition, nor long lasting disruptions to the natural environment and human settlements and activities. Excavation of soil material for the embankment crest, in variable and the required width, is done symmetrically on both sides of the existing stone material. After the excavation of soil, filling with the new material is planned together with the construction of a new road base layer by using the same material used for construction of already existing road base. Another intervention of the project will construct cluster houses which will also require land excavation and construction works. This could also result in localised impacts on the surrounding environment. The possible impacts from both embankment repair and cluster houses construction are discussed below:

a) Construction Phase

Soil and Water Pollution:
During construction activities, when using machinery, there is a possibility of soil contamination due to accidental spills of oils and fuel from construction machinery. In the area of construction works, construction waste is generated which, if not properly disposed of, may result in adverse impacts. If embankment repair work is carried out next to rivers it can result in temporary sediment pollution of the watercourse.

Flora and fauna:
Embankment repair work near rivers along with the temporary blurring of the watercourse could impact freshwater habitats. Impacts on other habitats are not expected.

Waste disposal:
Demolition debris and excessive soil are usually generated during the rehabilitation works on drainage and flood control systems;

Temporary access roads:
Impacts from temporary access roads and work areas. Establishment of temporary dirt roads to access work areas and temporary dumping sites for excavated materials can increase soil erosion and degrade the landscape.

Noise and Air pollution:
Noise and vibration disturbances during construction and temporary air pollution (dust) related to the transportation of construction materials and truck traffic. These impacts will occur during the construction and rehabilitation works but will be only short-term.

Safety hazards from construction activities:
No major hazards are expected from the construction of the proposed project elements, as long as proper construction practices and safety procedures are applied.

b) Operational Phase

Waterlogging:
Waterlogging can result if regulators and drainage cum flushing inlets/ sluices of many polders may not function properly due to natural sedimentation and poor maintenance of the structures. Also, drainage channels in the coastal polders can be silted up which will also create waterlogging in the area.

Erosion of topsoil and slopes of embankment:
Erosion from soil surfaces results from the kinetic energy of raindrops and flowing water. Raindrops dislodge soil particles, and runoff flowing down-slope can suspend and transport the loose particles. Livestock and human traffic on polders encourage erosion. Holes created by rodents in the polder also increases possibility of soil erosion. Embankment slopes can also be eroded and cause drainage problems if proper erosion control measure are not taken. With the ecosystem-based approach of strengthening embankments with grass / tree planting, as well as the use of geo-textiles there will be a low risk of erosion.

Environmental Management Plan (EMP)
The Environmental Management Plan (EMP) will cover all the red category interventions that will be implemented by the project, namely embankment repair and cluster house construction. This EMP is outlined below and the full EMP will be developed during project implementation. The major components of an EMP include Mitigation Measures, Enhancement Measures/ ECoPs, Estimation of Cost of EMP, Environmental Monitoring, and Institutional Arrangement for Implementation of EMP. Potential mitigation measures as well as ECoPs to be considered in the project are the following:

Construction/repairing of regulator and drainage cum flushing-inlet/sluice: Regulators and drainage cum flushing inlets / sluices of embankments will be rehabilitated under the project to improve the drainage system in the polders. Improvement of these structures will involve mainly civil construction works, installation of equipment and shifting drainage channel (in some cases to rehabilitate the old regulators). The improved structures are to be designed to accommodate higher precipitation and effect of sea level rise on river levels due to climate change.

Drainage channel re-excavation: Drainage channels which will be silted up need to be re-excavated to improve the drainage condition in the polder areas. The major activities for drainage channel re-excavation include dredging and disposal of spoil.

Embankment protection through ecosystem-based adaptation: The tops of embankments not routinely used as roads should be covered with grass. Embankment afforestation for protection of the embankment toe against erosion. The species for plantation should be selected appropriately. Planting of trees on the slopes of the embankment will commence after the completion of earthworks in repaired embankments. The slopes of the embankments can be covered with geo-bags.

Awareness raising and training: In order to raise awareness on environmental issues some workshops will be arranged for the local communities. Also, trainings will be organized for environmental health and safety and environmental assessment and monitoring to ensure further sustainability of the project interventions and provide better protection to the community.

Estimation of Cost of EMP

The environment specialist of the project implementing agency will estimate the cost of the environmental mitigation and enhancement measures and will incorporate with the tender document. Many of the activities to be carried out as a part of EMP would not involve any additional direct cost, e.g., employing the local workforce, where appropriate; keeping sub-project vehicles in good operating condition; good housekeeping, avoiding spills; prohibiting the use of fuelwood for heating bitumen; etc. On the other hand, some activities would require additional cost. Table 4 provides an indicative budget for the EMP and environmental management. For example, environmental monitoring during both construction and operational phases would involve direct cost. Certain mitigation measures (including health and safety precautions) will be covered as part of overall construction expenses in the project budget; these include temporary sanitation facilities, health and safety signs, awareness pamphlets, water sprinkling on aggregates and unpaved surfaces, plantation, and protective gear.

Table 6: Indicative cost for environmental management and training

Intervention/Mitigation /Enforcement/Training	No. of Unit	Unit Cost (USD)	Total cost(USD)	Funding Source	Responsibility
Environmental Mitigation and Enhancement					
Construction/repairing of regulator and drainage cum flushing-inlet/sluice	LS	LS	87,000	Government of Bangladesh	PMU, contractor, residents
Drainage channel re-excavation	LS	LS	35,000	Government	PMU, contractor,
Embankment protection through EbA	15.5 km	12,400	192,200	Adaptation	PMU, contractor,
Environmental Awareness and Training					
Environmental awareness sessions	10	250	2500	Adaptation Fund	PMU, residents, consultants
Training on environmental health and safety	10	500	5000	Adaptation Fund	PMU, consultants
Training on environmental assessment and monitoring	6	500	3000	Adaptation Fund	PMU, consultants
Environmental Monitoring and Audit					
EIA	2	10,000	20,000	Adaptation Fund	PMU
Environmental monitoring	54 person days	75	4050	Adaptation Fund	PMU, consultant, residents, contractor
Water quality monitoring (PH, turbidity, hardness, Cl, TDS, Mn, As, Fe, TC, FC)	10 samples	105	1075	Adaptation Fund	PMU, consultants
Air quality monitoring (SPM, PM10)	4 samples	200	800	Adaptation Fund	PMU, consultants
Noise level monitoring (Equivalent noise level(dBA), L_{eq}, Max Noise level(dBA), L_{max})	4 samples	268.75	1,075	Adaptation Fund	PMU, consultants

Environmental Monitoring

Environmental monitoring provides a systematic review of planning, implementation and operation of sub-project interventions and their mitigation measures to ensure that environmental concerns are addressed, environmental assets are protected, and quality is enhanced. The implementing agency Environment Specialist, PMU, Consultants, and the community will be responsible for conducting the environmental monitoring. Throughout the implementation, the project will conduct three types of monitoring: 1) compliance, 2) community, and 3) effect monitoring.

The implementing agency will conduct a Compliance Monitoring at the construction stage to check whether Environmental Mitigation Measures or Environmental Code of Practices (ECoPs) suggested in the design phase are being followed and implemented properly. Community monitoring will be conducted by the

residents or community people who reside at the project site. They will monitor various environmental issues at the both construction and post-construction stages that would cover two specific aspects: 1) Compliance of mitigation measures and 2) Effectiveness of the proposed interventions. The implementing agency and other appropriate authority (if applicable) will be responsible for effect monitoring. During the effect monitoring, they would check whether interventions are functional and served their intended purposes.

Table 7: Environmental Monitoring System

Interventions /Monitoring Issues	Monitoring Site/ Area	Monitoring Parameters/ Indicators	Types of Monitoring	Responsibilities
Housing &Community Complex	Project site	Land filling material, water logging, dust, air pollution, noise, traffic, vegetation coverage,	Compliance, Community, and Effect	Consultant, Contractor, Municipality, Community
Water supply	Project site	water quality, arsenic, coliform, GW level, water logging	Compliance, Community, and Effect	Consultant, Contractor, City Corporation/Municipality, Community
Pathways/road	Project site, surrounding area	Noise pollution, dust, water stagnation, potholes,	Compliance, Community, and Effect	Consultant, Contractor, Municipality, Community
Solid waste management	Project site, surrounding area	No. of HH waste managed properly, odor from bin, drain clogging,	Compliance, Community, and Effect	Consultant, Contractor, Municipality, Community
Demolishing of cultural heritage	Within 1 km of project site	No. of cultural heritage site fall under the area of intervention	Compliance, Community, and Effect	Consultant, Contractor, Municipality, Community
Drainage	Project site, surrounding area	Solid waste in the drain, water flow, outlet, water pollution	Compliance, Community, and Effect	Consultant, Contractor, City Corporation/Municipality, Community
Sanitation /latrine	Project site	% of Kutcha/ semi-Pucca latrine, waste discharge, water supply, health	Compliance, Community, and Effect	Consultant, Contractor, Municipality, Community

Special Environmental Clauses for Tender Document

Some special environmental clauses shall be included in the Tender Document under General / Particular Specification. These clauses are aimed at ensuring that the Contractor carries out following responsibility in implementing the EMP and other environmental and safety measures. The Contractor shall report to the Engineer promptly and in writing particulars of any accident or unusual or unforeseen occurrences on the site, whether these are likely to affect progress of the work or not.

Environmental Management Plan (EMP): The Contractor shall carry out all mitigation and enhancement measures (including those related to mitigation of air/noise/ water pollution; drainage/ traffic congestion) as specified in the Environmental Management Plan (EMP).

Temporary Works: The Contractor shall make sure that all equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, runaway, barricade, chute, lift, etc. are substantially constructed and erected, so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them.

Health and Safety: The Contractor shall observe and maintain standards of Health and Safety towards all of his employees not less than those laid down by the national standards or statutory regulations and must provide or ensure that appropriate safety and /or health signs are in place at their work sites where hazards cannot be avoided or reduced.

Where appropriate, to prevent workers falling from heights, the Contractor shall make sure that every temporary floor openings shall either have railing of at least 900mm height or shall be constantly attended; every floor hole shall be guarded by either a railing or a hinged cover, or constantly attended; every stairway floor opening shall be guarded by railing at least 900 mm high on the exposed sides; every ladder-way floor opening or platform shall be guarded by a guard railing; every open sided floor or platform 1.2m or more above adjacent ground level shall be guarded by a railing on all open sides.

The Contractor shall provide all appropriate protective clothing and equipment for the work to be done and ensure its proper use. Where required, safety nets, belts, harnesses and lines shall be provided by the contractor. The Contractor shall provide and maintain in prominent and well-marked positions all necessary first-aid equipment, medical supplies and other related facilities. A sufficient number of trained personnel will be required to be available at all times to render first aid.

Earthworks: During excavation of trenches in natural soils, the Contractor shall make sure that the first 300mm to 450mm of topsoil be excavated and stored on one side of the trench and the rest of the excavated soil is stored separately/ on the other side; during backfilling of trench, the topsoil should be placed on the top again.

Disposal and Pollution: The Contractor shall not dispose any waste, rubbish or offensive matter in any place not approved by the Engineer or Statutory Authority having jurisdiction. The Contractor shall not discharge into any water course oil, solids, noxious or floating materials. The Contractor shall take all reasonable precautions to keep public or private roads clean of any spillage or droppings from his vehicles or equipment. Any spillage or droppings which accrue shall be cleaned without delay to the satisfaction of the Engineer. The Contractor shall construct sanitary latrine or septic tank system or install portable cabin toilet for disposal of human waste in the site office and temporary labor sheds for workers/ employees; the Contractor shall provide waste bins/ cans for collection of solid waste at appropriate locations (as directed by the Engineer), and ensure proper transfer/disposal of solid waste with support from the Union Parishad or other Local Government bodies.

Review and Approval
After receiving the completed Environment Screening, IEE or EIA report of the selected community, Environment Specialist will assess the adequacy of the mitigation measures and EMP. This assessment will be conducted through desk review and field visits and concentrated on the quality of the baseline information, identification of potential impacts, effectiveness and the adequacy of the mitigation measures, and monitoring plan. This report will be submitted to the PD for approval and further action.

External Environmental Audit
An independent environment evaluation will be carried out to ensure correctness of the sub-project wise Environmental assessment and implementation of the environmental management plan (monitoring and mitigation). DOE will hire the services of a consulting firm to carry out the external monitoring/evaluation of the sub-projects. The team will include an environmental specialist who will assess the implementation of environmental mitigation and monitoring activities and also evaluate impact on environment. Based on the evaluation result, DOE will take remedial measures (if required) with IDA's concurrence.

Institutional Arrangement
The proposed project is built on existing institutional arrangements within the Department of Environment (DOE) under the Ministry of Environment and Forest. The effective implementation of environmental safeguard and management in the project will be achieved by setting up an efficient institutional framework where the DOE will design and implement sub-project interventions and ensure environmental sustainability of those interventions. The implementing body in the DOE is the Project Management Unit (PMU) which will be responsible for overall environmental management including implementation of mitigation measures and monitoring, and preparation of quarterly progress and monitoring reports. The DOE will implement the project with the active engagement of local community. Table 6 shows the institutional arrangement for implementation of environmental safeguard and management.

Grievance Redress Mechanism
DOE will establish a project level Grievance Redress Mechanism (GRM) which will be implemented by Project Implementation Unit (PIU) under the leadership of DOE Secretary who will oversee the grievance management. This mechanism will align with the standard UNDP mechanism and GRM will be implemented in two phases:1) Phase 1 to support safeguards implementation, 2) Phase, two of GRM, will cover all components and overall project implementation. A formal grievance redress process for phase two will be outlined in the project's operational manual, and a protocol will be set up and distributed to project staff and implementers. The project level protocol will build on existing institutional grievance management system which will be automated and includes a toll-free helpline service.

Capacity Building
Capacity building of DOE is required for proper implementation environmental safeguard and management. This could be done by arranging training session to educate and train existing DOE

professionals and other relevant stakeholders so that they can ensure environmental management of subprojects. Capacity building will be done by allowing application of some critical practices. Those areas following:

Site selection to reduce environmental impacts, screening environmental impacts, scoping of impact assessments, planning appropriate mitigation options and consultation with affected people, impact management during construction and operation, and monitoring effectiveness of intervention;
Monitoring and grievance redress: transparency in planning, reporting and implementation; response to complaints; record keeping. Specific training plans for each stakeholder are shown in Table 6.

Table 8: Institutional Arrangement for Implementation of Environmental Safeguard

Activities	Environmental Safeguard	Responsibilities/ Institutional Arrangement
Area Selection	Environmental Criteria/ attribute	**PMU, Consultant, DOE, Environmental Specialist, Community**
Identification of Interventions	Intervention Identification and Description	**PMU, Consultant, Community**
Designing of the Interventions	Engineering design	**PMU, Consultant, Pourashava**
Environmental Assessment	**Environmental Screening** → **Initial Environmental Examination** → **Environmental Impact Assesment**	**DOE Divisional Offices, Consultant, Community** **PMU, Environmental Specialist, Consultant**
Review and Selection of Interventions	Incorporate Environmental Mitigation Measures, Environmental Code of Practices (ECoPs), Health & Safety	**PMU, DOE, Environmental Specialist**
Construction	Compliance Monitoring Community Monitoring	**Compliance: DOE Div. Office, Consultant, Pourashava** **Community Groups**
Operation	Effect Monitoring Environmental Audit	**PMU, DOE, Environmental Specialist, Consultant**

		Consultant, Environmental Specialist, Community
Reporting	Quarterly progress report, Monitoring report	**PMU, DOE, Environmental Specialist, Consultant**

Table 9: List of suggested environmental training programs for capacity enhancement

Target Participants	Type of Training	Responsibility	Duration
Community Organization	Environmental awareness	PMU	1 day
	Environmental Concerns and Community Monitoring	PMU	2 days
Construction workers	Environmental Health and Safety	Contractor	0.5 day
PMU and DOE Divisional/Field Officers	Environmental Assessment and Monitoring	PMU	5 days
	Environmental Management Framework(EMF)		1 day
Union Parishad	Environmental Concerns and Environmental Monitoring	PMU	1 day

Public Consultation and Disclosure

Public consultation and acceptance is one of most important and difficult part of any development project. Although the main objective of this project is to improve the living situation of pro-poor settlements, there will be a particular degree of environmental impact. It is also important to know the community participation towards the problems of the locality. Which problem to address, who are the most affected groups, who are main stakeholders- such decisions should strongly reflect community views. All the steps of the projects will be finalized after extensive discussion with local community and approval of the relevant stakeholders. The key stakeholders will be considered for this project are: all the households living in the project and surrounding area, landowners and the tenants, local NGOs, officials of the local city corporation or municipalities, local government and political leaders.

The entire project related information needs to be disclosed to the community so that all the project affected persons are informed and take part in the development process. The different stages of the project will have different level of information dissemination. DOE will follow the disclosure requirement of the World Bank on environmental documentation. After the clearance from the World Bank, the draft final version of the EMF will be posted in the website of DOE along with a Bengali summary version and will be kept in the offices for further comments and inputs from non-governmental organization, civil society and general public. Newspaper advertisement will be published in two national dailies (Bengali) about the disclosure and request for comments on the EMF.

Environmental Assessment of Sub-project Interventions

The 'environmental assessment' is a mandatory requirement for the design and implementation of a sub-project intervention. Any activities or interventions funded under the project, that are assumed to have some negative impacts on the environment will be considered under this category. The project will follow a two-stage environmental assessment for identification of potential negative impacts and their mitigation measures for the red category water management interventions and other orange category interventions. Following figure shows the stages of environmental assessment in the project.

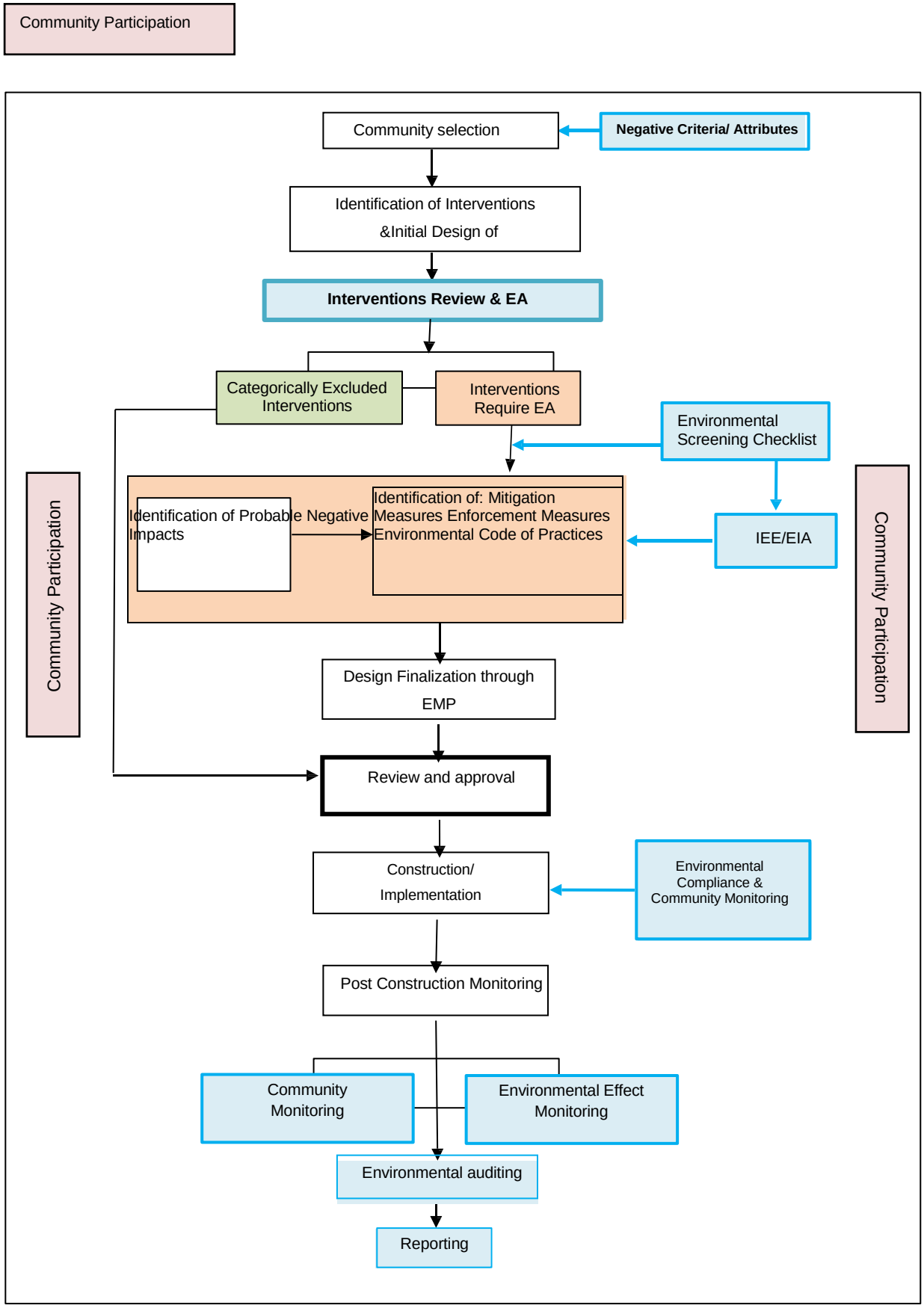


Figure 23: Flow diagram for environmental management process in the project

Annex K. Social assessment and resettlement policy framework

Brief Socio-Economic Baseline of Lakshmitari Union

Demography

According to the BBS in 2011, the total population of Lakshmitari Union was 21291. The proportion of the male to female population in the area represented as a sex ratio is 104. The overall population density is 785 people per square kilometre, and the total number of households in the area is~5100 while the average household size is ~4. Islam is the majority religion, and the literacy rate in the region is 47.5%. Registered number of male and female voters is 7389 and 7064 respectively.

Housing and Education

The proportion of households living in the Pucca[30], Semi Pucca, Kutcha, Jhupri[31] house is 0.9%, 3.1%, 89.4% and 6.6% respectively. The Union contains two pre-primary schools, 14 primary schools, 2 secondary schools (one of which is on the Char), one college and one madrassa.

Water Supply, Sanitation, and Public Health

The percentage of households having access to formal and safe water supply options, i.e., tube wells and tap water is 95.5% and 0.1% respectively. The remaining proportion (4.3%), relies on informal and unsafe water sources, including the ponds, canals, and rivers. On the chars of Lakshmitari union, in times of disasters, most of the tube wells become inundated, which causes contamination of drinking water, resulting in an increase of various water-borne diseases like diarrhoea and cholera. The proportion of households that have access to sanitary latrine facilities, including water sealed and water unsealed latrine types, is 15.6% and 28.4% respectively. The rest or 40.5% rely on non-sanitary latrine options and 15.5% have no access to any form of sanitation services. There are only 2 Community Clinics for the provision of medical treatment for the population of the union. Lakshmitari Union also has one NGO based clinic. These clinics are open for two days in a week when two paramedic doctors offer medical services to the people. In Lakshmitari, 40.5% of the total inhabitants have no sanitation facilities, which is one of the major causes of different types of diseases. A lack of government interventions, poor maintenance of infrastructure, inundation and damage to sanitary facilities during storm surges and floods affects the sustainability of the limited available sanitation facilities.

Agriculture: Crop, Livestock, and Poultry

The total arable land area is ~2340 ha. Of this fallow land amounts to 42 ha and Khas lands to ~2523 ha. The predominant crops are Ayush, Amon, Boro, Wheat, Potato, Corn, Nut, which are cultivated on 1955 ha, 300 ha, 710 ha, 40 ha, 1000 ha, 910 ha, and 115 ha land respectively. The total number of farmers is 4893 of which 2370 are tenants. There are no individual farms for livestock, but rather each family has livestock of its own, including cows, buffaloes, goat, sheep, and swine. The area is not industrialized and the cottage industry is also absent, with only 6345 people employed.

Brief Socio-Economic Baseline of Mujibnagar Union

Demography

According to the latest census in 2011 by BBS, the total population of the Mujibnagar Union is 10404. The proportion of the male and female population in the area represented as the sex ratio is 110. The overall population density is 399 people per square kilometre and there is a total of~2000 households in the area. The average household size is 5.2. The majority of the population living in the area are Muslim. Literacy rate in the region is 22.1%. Depopulation is evident in 1 of the mauzas and the registered number of male and female voters is 3353 and 3238 respectively.

Housing and Education

The proportion of households living in the Pucca, Semi Pucca, Kutcha, Jhupri house is 0.4%, 4.1%, 74.5% and 21.0% respectively. The Union has six primary schools, 1 secondary school, 1 NGO school, no high school and twomadrassas.

Water Supply, Sanitation and Public Health

The percentage of households that have access to formal and safe water supply options, i.e., tube well and tap water is almost zero. The majority of the population relies on informal and unsafe water sources like the ponds, canals, and rivers. Most of the Char dwellers in Mujibnagar practice open defecation. Only a few of the households, which are in good economic condition, have traditional pit latrines or conventional improved pit

[30]Lal, A. K. (1995). Hand book of low cost housing. New Age International

[31]Haque, M. S., & Yamao, M. (2008). Can microcredit alleviate rural poverty? A case study of Bangladesh. World Acad Sci Eng Tech, 46, 648-656.

latrines. In Mujibnagar, Among the 2000 households, only 16.5% have sanitation facilities, whereas the national sanitation coverage of Bangladesh is 56%. Most households in the area have small ponds beside their homestead which they use to serve their water demands, with rainfall replenishing the water over time. Apart from these ponds, people alternatively collect water for drinking from canals cut into the char lands. In times of disaster, people face a severe crisis of drinking water as their water sources get inundated and thus the water is contaminated. In total, 12 health centres operate at the Union level and provide general health services. In Mujibnagar there is only one Community Clinic and one paramedic doctor is available in every ward to provide preliminary medical aid to villagers.

Agriculture: Crop, Livestock, and Poultry

In total, 6000 acres of arable land and 50 acres of fallow land were found to be in use. According to the land use statistics, single crop, double crop and triple crop pattern are being cultivated in 100 acres, 5000 acres, and 850 acres land respectively. Irrigation is provided to 5500 acres of paddy land, 300 acres of wheat land, 70 acres of potato land and 1000 ha of watermelon land. The landowners cultivate 40% of the total land used, and the remaining 60% is utilized by tenants. Families own different kinds of livestock species including cows and buffaloes, goats and others, however, there are no livestock or poultry farms. The area is not industrialized and only 2260 people are currently employed in a variety of activities.

Social impacts from Construction Activities

Most of the proposed interventions are planned to be constructed on public land to avoid any negative impacts on the population near project sites. At most of the Project locations, the land belongs to GoB. At some locations access to common property resources, will get restricted due to the present interventions. As per the SIA, there are no small ethnic communities or indigenous people at the project sites. The social impacts due to project interventions are temporary resettlement (while houses are being retrofitted), inconvenience during construction as well as noise, air, and water pollution. For each of these interventions, a RAP will be prepared, where required during the planning and design stage.

A. Land acquisition and resettlement

The project will try to minimize and mitigate any adverse land acquisition and resettlement impacts to the communities to be affected by the project. Land acquisition and resettlement is unlikely to be required for the proposed interventions, but this may be the case should people be living on the embankments requiring repairs. As a mitigation measure compensation for structures at replacement cost and other cash allowances such as livelihood assistance will be provided for any people required to move and a Resettlement Action Plan (RAP) will be prepared.

B. Impact on livelihood sources

Some agriculture land could also be affected due to project activities. However, the construction of the proposed facilities will greatly improve the livelihoods of the rural business community.

C. Impact on Community Facilities

The potential impacts of the project on the community could include relocation, air quality deterioration, noise, and safety hazards during construction. For noise, air quality, and safety hazard, the Contractor will be required to ensure that activities in the vicinity of the sensitive receptors. The construction sites will be fenced near such places to minimize safety hazards. Safety signage will be placed, and coordination will be maintained with the facility management as well as with the community to minimize the risks. Finally, any complaints related to project impacts on the sensitive receptors will be addressed through a grievance redress mechanism.

D. Community Health and Safety

During the construction phase, the population living in close proximity to the construction area, the construction workforce and individuals drawn to the area in search of income opportunities will all be exposed to a number of temporary risks such as safety hazards associated with the construction activities and vehicular movement, exposure to dust, noise, pollution, infectious disease, and various hazards, including potential conflict with “outsiders” to the project influence area about employment and income.

E. Resettlement Policy Framework (RPF)

The primary objective of the RPF is to provide guidelines for preparing Resettlement Action Plans / Abbreviated Resettlement Action Plans.

The other objectives of the RPF are to

- Ensure the principles of Social Justice is adhered to at all times,
- Avoid or minimize any negative impacts on the communities,

- provide for land required for project facilities to be purchased under Willing Buyer-Willing Seller,
- Assist the affected population to improve living standards, income generation, and productivity.
- Encourage and enable community participation in planning and implementing project components
- Provide assistance to affected communities in redressing their grievances, and
- To address issues related to land acquisition and related impacts.

The RPF addresses social issues such as Land Procurement, Community Engagement, Special Attention to Women and Other Vulnerable Groups and Grievance Redressal. DOE will use the following principles to minimise adverse impacts on affected persons and their community:

- Avoid or minimise the acquisition of the private lands and use as much public land as possible.
- Avoid or minimise displacement of people from homesteads, land valued higher regarding productivity and structures that are used for permanent business and commercial activities.
- Avoid or minimize displacement of people from homesteads, land valued higher in terms of productivity and uses, structures that are used for permanent business and/or commercial activities, dislocation of squatters/encroachers; and impacts on community facilities, such as educational institutions, places of worship, cemeteries and structures that are socially and historically important.
- Where the portion of a plot remaining after acquisition becomes economically unviable, the landowner will have the option to offer the entire plot for acquisition.
- The policy principles adopted are inclusive and cover both titled and non-titled persons. The affected without the title will also be entitled to resettlement benefits.

The RPF provides the following options for land procurement:

F. Buying Land – Willing Buyer and Willing Seller

Under the willing buyer and willing seller norm, suitable land is identified by DOE. After this, the DOE representative will approach the landowner and obtain his/her consent. The willing sellers convey their readiness to sell the land in writing to DOE. The rate agreed will be on par with the existing market rate acceptable to both, and then the transaction is affected. The entire process of consultation, negotiation, agreement and transfer of land deeds will be recorded by the DOE and be available for review by UNDP.

G. Land Acquisition

When land needs to be acquired as per the Act, DOE produces Land Acquisition Proposal (LAP) to DCs with Administrative Approval from the Ministry of inland water transport on the acquisition. After a feasibility study of the acquisition and other necessary procedures, the land is acquired. Upon approval of the LAPs, DOE field office makes the payment to affected persons.

H. Compensation Payment Norms

DOE will ensure that the properties (land, structure, and non-structural assets) to be affected by the project will be compensated for their full replacement cost determined by a legally constituted Resettlement Sub-committee (RSC) as per structure and mandated outlined in the RAP. The payment of compensation and other assistance, target replacement of productive assets and restoration of loss of income and workdays by the relocated households, will be ensured by this committee. Compensation and other cash assistance will be paid through bank bills (cheques) payable to Bank accounts opened by the affected persons eligible for compensation and assistance under RAP.

I. Communication Strategy

A formal communication strategy will be prepared for the project to facilitate various communication needs and outreach tools including to convey the project impacts and its implications for various stakeholders. A key aspect of this strategy shall be the communication of any project-related impacts.

J. Community Engagement, Stakeholder participation and vulnerable groups

DOE will ensure the engagement of target communities through continued consultations for planning and full community management of implementation and monitoring of sub-project activities. Consultations will be held at regular intervals with target communities especially women. DOE recognises the fact that affected communities are primary and key stakeholders of the project.

K. Grievance Redress Mechanism

DOE will establish a project level Grievance Redress Mechanism (GRM) which will be implemented by the Project Implementation Unit (PIU) under the leadership of DOE Secretary who will oversee the grievance management. GRM will be implemented in two phases:1) Phase 1 to support safeguards implementation, 2) Phase, two of GRM, will cover all components and overall project implementation. A formal grievance redress process for phase two will be outlined in the project's operational manual, and a protocol will be set up and distributed to project staff and implementers. The project level protocol will build on existing institutional grievance management system which will be automated and includes a toll-free helpline service.

L. Institutional Arrangements

DOE will arrange implementation and monitoring mechanism. The Project Implementation Unit will have a Social Cell in the PIU. A Joint Director of DOE will head the Environmental and Social Cell of DOE. Two Deputy Directors, one each in charge of Social aspects of the project. The Deputy Director Social will be

assisted by a Senior Land Acquisition and Resettlement Specialist and two other consultants each in charge for Community Engagement and Gender. The Supervision Consultants and Contractors will have Social Specialists to supervise and implement. Also, DOE will establish a permanent Environmental, Social and Climate Change Unit in its institutional structure, which will ensure that institutionalising social safeguard measures to address adverse impacts, community engagement and prepare and implement socially inclusive investments.

M. SIA Consultants

PIU will hire SIA consultants to carry out SIA studies for the proposed interventions; in compliance with the guidelines of the GoB and UNDP.

N. Monitoring and Reporting

An M&E Consultants will be commissioned to conduct quarterly monitoring and evaluation and report to DOE. The quarterly monitoring and evaluation will be done by these consultants. They will visit about an appropriate percentage of all category sub-projects, as decided by DOE. They will prepare appropriate formats for monitoring. DOE will send quarterly Monitoring Reports on compliance to UNDP.

Institutional policy analysis

Bangladesh has a long history of natural disasters, with over 219 natural disasters taking place between 1980 and 2008, causing over US$16 billion in total damage ("Disaster Management – Institution, Policies And Legal Framework", 2014).The country has been identified as one of the most vulnerable countries in the context of climate change. A number of climate-induced hazards are already affecting many people especially in the coastal zone, low-lying areas and north-west part of the country. Its exposure to frequent and extreme climatic events such as floods and cyclones (IPCC, 2012) is a concern for policymakers and scientists. The government has taken a number of policy and institutional initiatives to adapt to the impacts of climate change. About 300 Million USD has been allocated for three years (June 2009-June 2012) to implement adaptation and mitigation actions recommended by the Bangladesh Climate Change Strategy and Action Plan (BCCSAP).

The Government of Bangladesh through Ministry of Environment and Forests (MOEF) has taken a number of policy and institutional decisions to address climate change and climate variability issues in Bangladesh. The MOEF is responsible to take the climate change issue forward at the global level as the operational focal point of United Nations Framework Convention on Climate Change (UNFCCC) and Global Environment Facility (GEF). The major responsibilities for MoEF remain preparation of national communication, formulation of adaptation programmes, providing approval of CDM projects, leading international negotiations, facilitating mainstreaming climate change at sectoral level etc. It has developed institutional instruments to reduce impacts of climate change which include the development of a National Adaptation Programmes of Action (NAPA), Bangladesh Climate Change Strategy and Action Plan (BCCSAP), establishing Climate Change Unit (CCU) under the MoEF, Climate Trust Fund. The government has set up a Climate Change Trust Fund (CCTF) in 2009, which has approved 43 government projects with USD 70 million allocations, besides 32 NGO projects with USD 3.5 million allocations. In addition, Bangladesh Climate Change Resilience Fund (BCCRF) has been put in place with development partners pledging of USD 113.5 million. The resilience fund will be managed and implemented by the Government with the World Bank's technical assistance (Change, 2017).

In the context of the project, certain standardized policies would be regarded in formulating mitigation measures and adaptation measures for the climate affected Char dwellers in the selected study areas. While maintaining these standards, adverse impacts from the project would be avoided as they would ensure that the project is sensitive to climate change risks and works towards achieving sustainable development outcomes. Although the development of national policies regarding climate change is ongoing, currently sectoral policies do not integrate climate risks systematically. The unions of Lakshmitari and Mujibnagar lack policy frameworks and building capacity of local authorities on climate change risks and adaptation techniques. Current infrastructure planning guidelines and norms, construction standard and decision making tools do not consider risks from climate change like past erratic rainfall patterns and also do not integrate new projected risks from climate change. Lack of coordination within the public sector at the local level and between officials at the national level exist, thus hindering promotion of comprehensive adaptation measures.

The project directly addresses the climate risk-related priorities identified in Bangladesh Climate Change Strategy and Action Plan (BCCSAP). It is also consistent with and aims at supporting the development of the NAPA and the 7th Five Year Plan (2016-2020) integrating climate risk and resilience into national and sectoral policy frameworks.BCCSAP focused on medium and long-term goals while the NAPA mainly listed immediate priorities. The BCCSAP aims to build the resilience and capacity of the country to fight climate change which is relatable to the objectives of the proposed project. The objectives of the project are in line with the some of the pillars included in the BCCSAP which include components such as increasing resilience of vulnerable

groups, developing climate resilient cropping system, implementing improved climate risk information systems, strengthening community based adaptation systems as well as designing and constructing infrastructure to withhold the impacts of climate change, etc. Bangladesh is committed to continuing on the pathway to climate resilient development and low carbon emission. 'Infrastructure and Mitigation and Low Carbon Development' as mentioned earlier are two distinctive pillars out of the six major pillars of BCCSAP which is in line with this project (Martin et al., 2013). NAPA provided a response to the urgent and immediate needs of adaptation and identified priority programs to fight against the adverse impacts of climate change. NAPA recognised that climate change would amplify the impacts of natural hazards and made an urgent call to integrate adaptive measures within the development process. Furthermore, both the National Adaptation Programmes of Actions (NAPA) of Bangladesh and the BCCSAP address adaptation and mitigation actions for the current decade (until 2018).

UNDP supported donor-funded projects are required to follow the mandatory requirements outlined in the UNDP Programme and Operational Policies and Procedures (UNDP POPP). UNDP's Social and Environmental Standards (SES) underpin their commitment to mainstream social and environmental sustainability in its programmes and projects to support sustainable development. The SES strengthens UNDP's efforts to attain socially and environmentally beneficial development outcomes. The SES require that all UNDP Programmes and Projects enhance positive social and environmental opportunities and benefits as well as ensure that adverse social and environmental risks and impacts are avoided, minimized, mitigated and managed ("UNDP's Social and Environmental Standards," 2017).

The 7th Five Year Plan (2016-2020) of Bangladesh puts substantial emphasis on development activities in the chars. During the 6th Plan, coastal afforestation in newly accreted chars in the coastal areas was given due importance, and about 24,646 hectares plantations were raised. 7th Five Year Plan aims to continue the successful projects in the char, implemented under the 6th Five Year Plan. For example, Char Livelihood Programme (CLP), that has improved the livelihoods security of char people within the riverine areas of the Jamuna-Brahmaputra River in the north-west of Bangladesh.Climate Change has been addressed with great importance in the 7th Five Year Plan and chars, being the hotspots for impacts of climate change, got considerable attention in the plan (Ahmed, Hassan, Nasreen, & Haq, 2015). Building on existing government institutions at different levels, the project will foster inter-ministerial and cross-sectoral coordination on climate change adaptation and disaster risk reduction issues. Cross-sectoral climate change coordination mechanisms will be created and strengthened for flood and drought management in the study area for replication and use nation-wide. The project in this context will be fundamental to advancing the national legal and regulatory framework to systematically promote investment, build capacity and strengthen relevant institutions.

Poverty analysis

According to the World Bank, Bangladesh has the potential to end extreme poverty by 2030 if it takes firm steps to make growth more inclusive to the entire population. More than 16 million people in Bangladesh graduated from extreme poverty between 2000 and 2010 (bdnews24.com, 2017).In October 2015, the international poverty line was updated from $1.25 a day at 2005 PPPs to $1.90 a day at 2011 PPPs for most countries. Bangladesh was one of five countries which retained the $1.25 poverty line. For the 2016 update of the global poverty monitoring, the World Bank, in collaboration with the Bangladesh Bureau of Statistics and the Asian Development Bank, recommended that poverty for Bangladesh be estimated using the updated international extreme poverty line of $1.90 per day at 2011 Purchasing Power Parities (PPP). Accordingly, the entire series of extreme poverty numbers from 1980 to 2013 has been revised(BANGLADESH DEVELOPMENT UPDATE, 2016). Based on the updated international extreme poverty line of $1.90 per day, the poverty rate was 18.5 percent in 2010, which corresponds to an estimated 28 million extreme poor. Compared with other countries at a similar income level, Bangladesh's extreme poverty rate using the $1.90 international poverty line was lower than the global average (World Bank, 2016).

According to the Bangladesh Poverty Maps 2010, Rangpur and Barisal divisions have the highest incidence of poverty while Chittagong and Sylhet division has the lowest. The average poverty rate in Rangpur division is 42% followed by Barisal with a poverty rate of 38.3%, Khulna 31.9%, Dhaka 30.5%, Rajshahi 27.4%, Chittagong 26.1% and Sylhet 25.1%. The four divisions, which recorded monthly household income below the national average, were Barisal at Tk. 9158, Khulna at Tk. 9569 and Rajshahi at Tk.9342 and Rangpur on Tk. 8359 ("Latest Bangladesh Poverty Maps Launched," 2014).

Research indicates that losses of income per rural household due to external shocks are equivalent to almost two months of income. This vulnerability is probably one of the main factors hindering the poor, often landless, to increase their income, invest in productive activities and eventually graduate from poverty. General inflation and food inflation are positively associated with income inequality of the population. This indicates an increase in both general inflation and food inflation has been contributing to rising income inequality in Bangladesh.

There is a strong argument that persistent and fair economic growth helps in poverty reduction. The poverty situation in Bangladesh has not improved as it should be as the country had steady growth since 2000. The number of people living in poverty has increased due to rising disparities in the distribution of resources within the country (Rukunujjaman, 2016).

Social analysis

The root causes of poverty are found in social, economic, cultural, traditional and other barriers that hinder the broad participation of the poor in society and reduce their access to public services and potential for utilization of their own productive capacities. The livelihood of the poor is negatively affected by regular natural disasters as they to a high degree depend on natural resources such as land and water for their survival. In addition to income levels, poverty includes social inferiority, isolation, physical weakness, vulnerability, seasonal deprivation and structural factors at all levels of society. These factors in society are all interrelated. Thus some major sectors of society affect the overall development of Bangladesh such as Parliamentary Democracy, Local Politics, and Governance, the Regional Context (Country Analysis Bangladesh, 2001). Analyzing the overall condition of the Chars at Bhola and Rangpur, societal degradation was found to be interconnected with the absence of governance, education and infrastructure and as well as lack of required livelihood options. All these issues lead to socio-political problems, unemployment, poverty, child labor, early marriage, migration, educational instability, social unrest and finally psychosocial incongruity worsening the misery of the people. It has been found that in both the coastal and riverine chars the problem of children dropping out of school is a common scenario, albeit one that the local governmental agencies have failed to properly address.

The locally elected politicians and the local administration are weak both in terms of human and financial resources and still heavily supervised and controlled by the central government and the system of patronage. The democratic process is fragile and to a large extent dependent on the local power structure, where patron-client structures, kinship, and quasi-feudal systems prevail in some areas. The rural elite in control of political power has access to administrative institutions, including the police and judicial system which hinders social equity. Weak land and governance policies in the char areas and absence of laws leave the inhabitants more vulnerable during disaster periods. Corruption within institutions also undermine adaptation effort, and a key role that institutions play in facilitating adaptation which is through legal and regulatory responsibilities and authorities is also missing for these regions. A significant proportion of the population affected by climate change is left landless and opts to start life afresh on the new char lands, which again lack almost all basic services. Lack of education, skills and livelihood alternatives, underestimation of cyclone and flood occurrence and poverty and coercion of fishermen, all contribute to the social degradation of the selected study area.

References

Ahmed, A., Hassan, A., Nasreen, M., &Haq, S. (2015). Sectoral inputs towards the formulation of the Seventh Five Year Plan (2016 – 2021) CLIMATE CHANGE AND DISASTER MANAGEMENT (1st ed.). Retrieved from http://www.plancomm.gov.bd/wp-content/uploads/2015/02/11a_Climate-Change-and-Disaster-Management.pdf

BANGLADESH DEVELOPMENT UPDATE. (2016) (1st ed.). Retrieved from http://documents.worldbank.org/curated/en/579721475673660627/pdf/108745-WP-SAREC-PUBLIC-FinalBangladeshDevelopmentUpdateOctober.pdf

bdnews24.com, (2017). Bangladesh's extreme poverty rate drops to 12.9 percent, says the World Bank. Retrieved from http://bdnews24.com/economy/2016/10/03/bangladesh-s-extreme-poverty-rate-drops-to-12.9-percent-says-world-bank

Change, U. (2017). Bangladesh experiences with the NAPA process. Unfccc.int. Retrieved 24 January 2017, from http://unfccc.int/adaptation/knowledge_resources/ldc_portal/bpll/items/6497.php

Country Analysis Bangladesh. (2001) (1st ed., pp. 11-16). Retrieved from http://www.sida.se/contentassets/c3da5764cc0c4daf8a457598b94326a9/country-analysis-bangladesh-january-2001_573.pdf

Disaster Management – Institution, Policies, And Legal Framework. (2014). Albd.org. Retrieved 24 January 2017, from https://www.albd.org/index.php/en/resources/special-reports/1387-disaster-management-institution-policies-and-legal-framework

Field, C. B. (Ed.). (2012). *Managing the risks of extreme events and disasters to advance climate change adaptation: special report of the intergovernmental panel on climate change*. Cambridge University Press.

Latest Bangladesh Poverty Maps Launched. (2014). World Bank. Retrieved 24 January 2017, from http://www.worldbank.org/en/news/press-release/2014/08/27/latest-bangladesh-poverty-maps-launched

Martin, M., Kniveton, D., Black, R., Siddiqui, T., Billah, M., & Kang, Y. (2013). Policy analysis: Climate change and migration Bangladesh (1st ed., pp. 12-14). Retrieved from http://migratingoutofpoverty.dfid.gov.uk/files/file.php?name=wp4-ccrm-b-policy.pdf&site=354

Rukunujjaman, M. (2016). Poverty Level of Bangladesh: Special Case, Rangpur and Rajshahi Division (1st ed.). Retrieved from http://ijsrm.humanjournals.com/wp-content/uploads/2016/12/18.Md_.-Rukunujjaman.pdf

UNDP's Social and Environmental Standards. (2017). UNDP. Retrieved 24 January 2017, from http://www.undp.org/content/undp/en/home/operations/social-and-environmental-sustainability-in-undp/SES.html

Annex L. Feasible adaptation and other livelihood options

Introduction

Bangladesh is highly vulnerable to natural hazards, and the extreme effects of climate change add a new dimension to community risk and vulnerability (NPDM, 2010-2015[32]). According to (Pender, 2008[33]), if the country's sea level rises slightly due to effects of climate change, a major portion of coastal area will become inundated and may displace about 33 million people within the coastal zone, and especially the people living in the coastal islands and riverine chars. Besides this, different socio-economic and political factors limit people's access to available resources and perpetuate risks and climate-induced vulnerabilities of coastal inhabitants (Shamsuddoha & Chowdhury, 2009[34]). Field observations from the chars of Bhola and Rangpur, also specify that the living standard, per capita farming land, access to education, health, water, sanitation and other basic amenities, social security, etc. in the areas are substandard compared to the national average, and that is why the areas suffer from adaptation and development deficiencies. As a result, it has been requisite to limit the vulnerabilities of the affected offshore islands and riverine chars to enhance the standard of living and to strengthen the adaptive capacity and resilience. Feasible adaptation options have been identified by considering two steps- integrated risk assessment of existing livelihood and alternative livelihood options identification for livelihood sustenance.

Identification of Existing Livelihoods

Focus group discussion, In-depth interviews and key informant interview were used to identify the existing livelihood of hotspot locations. These discussions allowed the research team to understand the condition of livelihood and their vulnerabilities. These tools also were also used to assess their actual livelihood status regarding more frequent hazards in the coastal and riverine area, to find out the opinion of the community that what alternative livelihood options will be more feasible in their living place. The process also involved identifying adaptation measures and alternative livelihood options for livelihood sustenance. After the identification of risks on existing livelihood of the offshore islands and riverine areas, measures to increase their adaptive capacity and alternative livelihood options have been explored as an adaptation strategy to combat with the climate change induced hazards.

Baseline of the Study Area

Heavy rains throughout the monsoon leave thousands of people in northern Bangladesh homeless or in dire straits as the mighty Brahmaputra, Dharla and Teesta rivers burst their banks, spilling out over the countryside. In 2014 heavy monsoon rainfall in Bangladesh and river catchment areas pushed levels of several of the country's major rivers and one of the worst affected districts was Rangpur (Davies, 2014[35]). The country's vulnerability to floods and natural disasters greatly impacts the coastal population and the poor, affecting the development of those communities ("Building Resilience of the Coastal Population of Bangladesh to Climate Change", 2013[36]). The adaptive capacity of human and natural systems is linked to many characteristics of the physical environment. The degradation of environmental quality is a significant source of constraint to adaptation measures and environmental degradation also reduces the availability of ecosystem goods and services for human populations (IPCC, 2014[37]). Dramatic ecological changes in the study areas have altered the physical environment which has limited adaptation possibilities. Tidal flooding in the region has been observed to be worsening with locals reporting an increase in the highest flood level over the past years. This corresponds to the IPCC's AR5 findings which indicate that the Average Sea Level has risen over the last century and establishes a correlation between climate change and the increased highest tidal flood level in the study area. Apart from tidal flooding the increased frequency of extreme weather events like cyclones, hailstorms and storm surges also contribute to the list of natural hazards that peril the human population of the study area in Mujibnagar. As the char areas are particularly prone to the effects of frequent climatic shocks, this increases the precariousness of poor people's lives by wiping out their assets and pushing them deeper into poverty. Higher frequency and duration of cyclones and hidden sandbars hamper the major livelihood systems in coastal char lands. During cyclones, the sea becomes turbid and makes it difficult for the fishermen

[32] National Plan for Disaster Management 2010-2015 (2010), Ministry of Food and Disaster Management, Government of the People's Republic of Bangladesh

[33]Pender, J.S., 2008. What is climate change? And how will it affect Bangladesh? Briefing Paper. Dhaka, Bangladesh: Church of Bangladesh Social Development Programme.

[34]Shamsuddoha, M., & Chowdhury, R. K. (2009). Climate Change Induced Forced Migrants: in need of dignified recognition under a new Protocol. EquityBd, Bangladesh.

[35] Davis, P., & Ali, S. (2014). Exploring local perceptions of climate change impact and adaptation in rural Bangladesh. Chicago

[36] World Bank, Featured Article: ("Building Resilience of the Coastal Population of Bangladesh to Climate Change" Retrieved from: http://www.worldbank.org/en/news/feature/2013/06/26/bangladesh-building-resilience-coastal-population-climate-change Last Accessed: January, 2017

[37] Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S., Seyboth, K., & Kriemann, B. (2014). IPCC, 2014: summary for policymakers. Climate change.

to locate sandbars, hence causing their boats to crash. The dependence on limited and seasonally variable natural resource access also limits their adaptive capacity.

The availability of cultivable land decreases during coastal flooding and prolonged periods of droughts in the study areas lead to the char dwellers having low incomes or complete loss of income. The major livelihood of the char dwellers is agriculture which is affected by tidal or monsoon flooding, hailstorm, cold waves, heat waves, erratic rainfall etc. which leads to decline in crop yield, crop damage and ultimately causes a loss of agricultural production. Poverty and development deficits in these areas also act as barriers to adaptive capacity.

Losing livelihoods and assets due to climatic and non-climatic factors combined, most char dwellers take loans and become indebted, and this often happens to be a contributing factor for their migration to different areas in the quest for work or a source of income only to come back to the char in order to repay the loan as well as to recover from the damages afflicted by a disaster event. Being in a state of debt, circumstances often lead to these indebted individuals engaging in criminal activity. This likely leads to a state of social unrest and fosters sociocultural dissonance in the area studied. The inhabitants' lack of access to credit to invest in alternative livelihood activities is a key barrier to improving adaptive capacity. Char dwellers lack access to formal sources of credit (banks and NGOs micro-credit) that could provide the credit needed in their regular livelihood businesses such as fishing, farming, livestock rearing, etc. Due to lack of access to formal credit with low interest, the char dwellers tend to invest their own savings and take informal credit with high-interest rates from local lenders to run their businesses. This system fails during aggravated natural disasters, leaving them in a poor economic state and unable to cope during disaster periods. Lack of government outreach programmes and insufficient capacity in char lands also add to already existing barriers to adaptive capacity.

In Bhola, it is the unavailability of agro-inputs especially fertilizers due to syndication of fertilizer dealers decreasing the input efficiency of farmers in crop production. In both, the areas, lack of modern technologies along with insufficient extension and support from the agriculture sector and inadequate land equipment results in high production cost for the crops which has far-reaching consequences, chief among those being the loss in income. No strong or effective backward and forward market linkages were observed in the char areas. An ineffective early warning system is likely responsible for the loss of livelihood and household assets. While agriculturists are facing the direct consequences of the climatic stressors, the nonagricultural wage workers have become vulnerable due to the fluctuating nature of their livelihoods, which correlates with the status of the agriculture of the respective areas. The char dwellers also have very limited access to safe drinking water infrastructure and are not familiar with or have access to alternative irrigation techniques and practices. As agricultural commodities are highly perishable and post-harvest losses are too high after climate disasters, it all leads to a decreasing yield of different crops due to slow expansion of modern technology as well as the unplanned use of soil and water. There also exists an uncertainty of fair price of agricultural commodities due to underdeveloped marketing system. The inadequacy of appropriate technology considering farmers' socio-economic conditions and the absence of efficient as well as effective farmers' organization at the grass root level creates barriers to adaptation during adverse climatic situations.

Delving further into the root of the problems, for example when considering the irregular and high cost of maintenance and the unavailability of construction materials and land for construction, inundation and erosion of roadways due to tidal flooding, storm surges and cyclones are key drivers. Changes in the intensity and frequency of these key drivers have been correlated to climate change in the IPCC's 5th Assessment Report, which implies that climate change has been a contributing factor to the inadequacy of transportation and communication infrastructure. The coastal study area of the Mujibnagar union (at Char Fasson, Bhola), which consisted of Char Motahar, Char Lewlin and Char Monohar, has certain wards which fall outside the existing embankment/bund protection system which skirts the shores. This shows a distinct lack of coastal protection infrastructure in the region which is aggravated by the high cost of implementation of projects. Cultural preferences and beliefs regarding the value of traditional versus scientific forms of knowledge regarding climate change influence what types of knowledge, and therefore adaptation options the local people are willing to accept. Individual, institutional, and societal knowledge influence the capacity to develop and use technologies to achieve adaptation objectives. Therefore, strengthening knowledge and capacities of local people is very important to increase the adaptive capacity in the study areas. Three types of knowledge are important in dealing with community-based adaptation (CBA): local knowledge, scientific knowledge and knowledge about rights. Local knowledge enables people to gain a practical understanding of their situation during climate enhanced disasters. Adaptation must also draw on scientific knowledge to ensure an understanding of climate change and its causes. Adaptation initiatives must also provide people with knowledge about their rights and how to demand them. There is an absence of this knowledge among the char dwellers and this hampers in building their adaptive capacity.

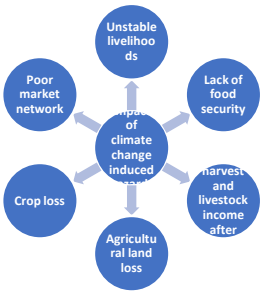


Figure 24 Impacts of climate change induced hazards on livelihood

Due to high exposure to climate change countries like Bangladesh the intensity, duration and frequency of the cyclone, storm surge, drought, salinity intrusion and abnormal flooding put enormous stress to the people who reside on the hazard-prone areas as they lost their housing, homestead, livestock and overall crop production. The cumulative effects of such losses lead to income erosion of poor people that ultimately pushes affected community people tomigrate seasonally from their place of origin and as well as very poor expenditure in the sectors of food consumption, education and health. The economic condition of the rural women of Bangladesh is poor that force them to sustain a poor livelihood status and the consequence of climatic disturbances means climate change persuaded hazard risk and vulnerability makes the existing status more vulnerable.

Adaptation measures and alternative livelihood options for livelihood sustenance
Identification and promotion of non-climate sensitive livelihood options based on fair income and sustainability will support improved adaptive capacity in the affected areas. To protect livelihood assets, mobile banking and insurance are essential. Livelihood diversification of ultra-poor women can act as appropriate interventions. The following options are recommended as alternative livelihood options:

Small-medium enterprises (SMEs)
A recommended example would be the development of small-medium enterprises (SMEs).This will help to secure the livelihood from the impacts of climate change. The majority of the people living in the charlands are dependent on agriculture and are mostly affected by the impacts of climate change. Alternate livelihood options which are not affected by climate change can help to ensure a sustainable source of income. Hence, a small-medium enterprise (SME) is designed and implemented in the participation of the ultra-poor women for non-climate sensitive livelihood (e.g., sewing, handicrafts, livestock rearing, shop, poultry, family orchards, crab farming, beekeeping, shrimp culture, trees outside forest (ToF), nurseries) through seed finance support for livelihood diversification and income risk reduction. Through sewing and handicrafts local knowledge and culture can be promoted as well. For livestock buffalo rearing can be introduced as well as rearing cows and goats. Trees outside forest and family orchards can play an important role by providing wood, and fruits which can be a good source of livelihood. Crab culture and shrimp culture is suitable for coastal area (i.e, Mujibnagar) whereas beekeeping is more suitable in Lakshmitari Union, Rangpur. The project will provide financial support of USD $ 450 to each family so that they can adopt to a suitable alternative livelihood option. Under this assistance, a total 900 families will be covered. Training and capacity building of the SME members on non-climate sensitive livelihood diversification and income protection will be delivered. Reliable and sustainable market system will act as an adaptation measure for both climatic and non-climatic shocks in the char areas. As these char communities make a significant contribution to the total agriculture and dairy value chain, effective forward-backwards market linkage (input cost management, pre- and post-production facilities) should be established.

Climate resilient agriculture practices
To help overcome the risks and impacts of climate change upon the Agriculture and Food Security, climate resilient cropping patterns based on the geophysical location including crop diversification can be one of the major adaptation approaches. Other relevant initiatives include ensuring the availability of seeds, fertilizers and pesticides to increase input efficiency. Initiatives such as training, awareness building, and knowledge dissemination will help the local farmers to build the capacity become familiar with the modern techniques. To increase the lead-time for disaster preparedness, hazard wise-early warning information and its dissemination with an effective monitoring mechanism are required. Increasing the water storage capacity of soils, improving the management of potable water, and introducing more efficient/alternative irrigation techniques and practices would increase the adaptive capacity and resilience of rural farming systems.Capacity building and training for the agriculture extension staffs of the Bangladesh government to support community resilience could include training and capacity building program for the CBOs, agricultural cooperatives, etc. Training sessions should include insight about the international and national scenario concerning climate change to make the participants aware about the various concept and terminologies associated with climate change, thus further strengthening their adaptive capacity through knowledge extension. Community-based

organizations can also be established and engaged effectively to ensure participatory process, operation and maintenance, monitoring and evaluation, sustainability activities related to these initiatives. People from CBOs will be for trained to adopt the climate resilient agriculture practices which in turn will enhance the increase the adaptive capacity of the community.

Climate-resilient agriculture should also be provided to at least 5000 households (71.5%) in the regions under the project. Design of climate resilient cropping patterns, crop diversification, solar irrigation system; improvement of forward-backwards market linkage; and provision of post-processing facilities significant economic benefits. The establishment of the community-based agricultural market with efficient backwards-forward linkages in an economy would also create a direct inter-relationship between the extent of development and the level of such linkages in the study region. Agricultural diversification into non-traditional products, by increasing the range of agricultural products available and by producing quantities in excess of fresh market requirements, could contribute the to the development of local agro-industries. By reducing climate risks to the long-term sustainability of natural resources use, this project could provide significant support to quality of life and livelihoods in the study area. Within the targeted 6,000 rural households, approximately 81.74% are estimated to be impoverished, marginal farmers' or landless households, who are prone to critical losses of livelihood assets from recurring droughts and crop failures. They will derive advantage from the project through investments in natural and productive capital. The development of diversified livelihood opportunities will be implemented focusing upon empowerment of the women. Through vulnerability analysis of the project, core women's work groups will be recognized, and associative mechanisms will be strengthened to reinforce alternative livelihoods. Landless people will also benefit from these diversified livelihood opportunities and development of homestead gardens to expand micro-scale agro-forestry practices, improved ecosystem services.

Annex M: Economic Analysis

FINANCIAL AND ECONOMIC ANALYSIS

Introduction
The economic analysis also appraises the benefit of an investment, but the concept of the economic benefit is different from the financial benefit. The economic analysis measures the effects on the both private and social economic benefits accruing to the national economy whereas the financial analysis assesses the financial profitability of the Project operating entity. In addition, economic analysis captures the positive externalities, appropriately measured, The calculated economic benefit streams are discounted by social discounting rate to calculate the Economic Internal Rate of Return (EIRR).As for the decision rule, if EIRR is above the threshold of the social discounting rate, the project can be considered as economically viable.

In order to calculate the EIRR, it is essential to identify the economic costs and the benefits. In particular, a comparison of the without-project and with-project situations is at the heart of the estimation of the net economic benefits of the Project. Then, those costs and benefits are quantified as much as possible, and are valued. In the case that EIRR is higher than the social discount rate which can be derived from the long-term treasury bond, the economic viability of the Project can be ensured.

Key Assumptions for the Analysis
For the present study, the following general assumptions have been adopted:

- All costs, benefits and revenues are expressed as on, 2018 prices
- The implementation period of this project is five years covering all the interventions proposed within the project
- The project life for economic analysis is assumed to be 30 years
- The real opportunity cost of the capital investment adopted in this analysis is assumed as 12% per annum, which represents the social opportunity cost of capital (SOCC) for Bangladesh. A Standard Conversion Factor of 0.90 and other specific conversion factors used in the study have been developed in the recent studies
- The foreign exchange rates used for the analysis is US$ 1= BDT 83.00
- The Shadow Exchange Rate Factor (SERF) used for analysis is 1.0128
- For Civil works VAT,TAX and Duties used 15%
- For Consultancy service VAT,TAX and Duties used 27%
- For Other activities VAT,TAX and Duties used 10%
- Physical contingencies are not included for all development programmes; and
- Price contingencies are not included for all civil works and development programmes

Part A: Economic Analysis

Methodology
Economic assessment refers to valuing and comparing costs and benefits of investment package at economic prices. Investment costs and O&M costs of the project are incurred over a period of time and benefits are

derived as a consequence of project interventions over the project life. Usually the costs and benefits are expressed in financial prices. But financial price is the market price involving a number of imperfections like distortions in demand and supply or monopolies in the market. To reflect economic values of costs and benefits, the financial prices of tangible items have to be adjusted using Conversion Factors to eliminate transfer payments and distortions. In this assessment, financial and economic values have been computed, processed and analyzed using standard procedures.

Decision Criteria

- **NPV:** The most basic economic criterion for accepting a project is the Net Present Value (NPV) as reflected in the net cash flow become positive.
- **EIRR:** The other economic decision-making criterion is the Economic Internal Rate of Return (EIRR). EIRR is that discount rate which, when applied to the stream of incremental benefits and costs as reflected in the net cash flow of the project produces a zero net present value. It is the maximum (real, non-inflationary) annual rate of interest that the project could pay for the resources used, if the project is to recover all costs. For the project to be economically feasible, the EIRR must be equal to or greater than the opportunity cost of capital in Bangladesh. Besides, Economic Benefit-Cost Ratios (B/C Ratio) have been worked out.

Project Costs

The Consultant Engineers and the subject specialists have prepared cost estimates of the project. Costs have been tabulated in **COSTAB**, World Bank software for project costing

Capital Costs

Total Financial investment cost is estimated as BDT 829.62 million and US$ 10.00 million. Financial Costs used in the analysis are given in **Table- 8.1** and detailed in Annex AI to Annex AV

Table 1: Expenditure Accounts Project Cost Summary

Bangladesh
Adaptation Fund: Pre-Concept for a Regional Project/Programme
Expenditure Accounts Project Cost Summary

	(BDT Million)			(US$ Million)			% Foreign Exchange	% Total Base Costs
	Local	Foreign	Total	Local	Foreign	Total		
I. Investment Costs								
A. Enhanced climate resilience of households								
1. Cyclone and flood resilient houses	126.99	-	126.99	1.53	-	1.53	-	15
2. Community level nano-grid facility	12.27	-	12.27	0.15	-	0.15	-	1
3. Locally appropriate rainwater harvesting	21.17	-	21.17	0.26	-	0.26	-	3
4. Project Technical Support	6.23	-	6.23	0.08	-	0.08	-	1
Subtotal Enhanced climate resilience of households	166.65	-	166.65	2.01	-	2.01	-	20
B. Increased climate resilience of communities								
1. Climate resilient mini-cyclone shelter/cluster houses built to protect life and prevent asset loss	66.40	-	66.40	0.80	-	0.80	-	8
2. Embankment/drainage facility improvement @ 30,000 USD per km	31.13	-	31.13	0.38	-	0.38	-	4
3. Embankment / river bank strengthening through EbA @ 12,400 USD per km	17.33	-	17.33	0.21	-	0.21	-	2
4. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.	1.33	-	1.33	0.02	-	0.02	-	-
5. CPP Equipment 7 packs @ 40,000 USD per pack	31.96	-	31.96	0.39	-	0.39	-	4
6. Cost to procure and equip mobile ambulance 8 ambulance @ 26,522 USD	17.61	-	17.61	0.21	-	0.21	-	2
7. Project Technical Support	26.62	-	26.62	0.32	-	0.32	-	3
Subtotal Increased climate resilience of communities	192.37	-	192.37	2.32	-	2.32	-	23
C. Improved income and food security of communities								
1. Establish and maintain demonstration site 8 emonstration sites @ 3,000 USD per plot	2.37	-	2.37	0.03	-	0.03	-	-
2. Farmer fieldschools 65 trainings @ 2,500 per fieldschool	13.49	-	13.49	0.16	-	0.16	-	2
3. Cold storage facilities + installation 4 facilities @ 50,000 USD (Unit cost)	16.60	-	16.60	0.20	-	0.20	-	2
4. Solar powered pump and associated equipment /surface water preservation for irrigation 6 units @ 85,500 USD per unit	42.58	-	42.58	0.51	-	0.51	-	5
5. Financial assistance to provide inputs for alternative livelihoods 6500 @350 USD	188.83	-	188.83	2.28	-	2.28	-	23
6. Project Technical Support	18.09	-	18.09	0.22	-	0.22	-	2
Subtotal Improved income and food security of communities	281.96	-	281.96	3.40	-	3.40	-	34
D. Enhanced knowledge and capacity of communities, government and policymakers								
1. Workshops to increase capacity of local government and extension officers 25 workshops @ 1,500 per workshop	3.11	-	3.11	0.04	-	0.04	-	-
2. Materials and construction of climate resiliant innovation centres 4 centres @ 45,000 USD per centre	14.94	-	14.94	0.18	-	0.18	-	2
3. Cost of disseminating information (e.g radio broadcasts, public billboards, pamflets) and advocacy	8.22	-	8.22	0.10	-	0.10	-	1
4. 6 presentations at regional workshops/seminars @ 4,500 USD per presentation	2.24	-	2.24	0.03	-	0.03	-	-
5. 16 exhange vists between different communities 16 exhange visits @ 2,000 USD per visit	2.66	-	2.66	0.03	-	0.03	-	-
6. Project Technical Support	19.85	-	19.85	0.24	-	0.24	-	2
Subtotal Enhanced knowledge and capacity of communities, government and policymakers	51.02	-	51.02	0.61	-	0.61	-	6
E. Project Management (9.5% of Project cost)	72.63	-	72.63	0.88	-	0.88	-	9
F. Implementing Entity Fee (8.5% of Project cost)	64.99	-	64.99	0.78	-	0.78	-	8
Total BASELINE COSTS	829.62	-	829.62	10.00	-	10.00	-	100
Physical Contingencies	-	-	-	-	-	-	-	-
Price Contingencies	-	-	-	-	-	-	-	-
Total PROJECT COSTS	829.62	-	829.62	10.00	-	10.00	-	100

Source: Consultant's Estimates and Calculations using COSTAB package

Total investment cost at economic prices is estimated as BDT 636.77 Million. Economic Costs used in the analysis are given in **Table-2** and detailed in Annex AVI.

Table 2: Year wise Economic Investment Cost

Bangladesh
Adaptation Fund: Pre-Concept for a Regional Project/Programme
Expenditure Accounts by Years -- Base Costs
Economic Costs

	Base Cost (BDT Million)					
	2019	**2020**	**2021**	**2022**	**2023**	**Total**
I. Investment Costs						
A. Enhanced climate resilience of households						
1. Cyclone and flood resilient houses	38.99	29.24	29.24	-	-	97.47
2. Community level nano-grid facility	1.88	3.77	3.77	-	-	9.42
3. Locally appropriate rainwater harvesting	3.25	6.50	6.50	-	-	16.25
4. Project Technical Support	0.96	0.96	0.96	0.96	0.96	4.78
Subtotal Enhanced climate resilience of households	45.08	40.46	40.46	0.96	0.96	127.91
B. Increased climate resilience of communities						
1. Climate resilient mini-cyclone shelter/cluster houses built to protect life and prevent asset loss	10.19	20.39	20.39	-	-	50.97
2. Embankment/drainage facility improvement @ 30,000 USD per km	7.17	9.56	7.17	-	-	23.89
3. Embankment / river bank strengthening through EbA @ 12,400 USD per km	3.99	5.32	3.99	-	-	13.30
4. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.	0.41	0.15	0.15	0.15	0.15	1.02
5. CPP Equipment 7 packs @ 40,000 USD per pack	4.91	4.91	4.91	4.91	4.91	24.53
6. Cost to procure and equip mobile ambulance 8 ambulance @ 26,522 USD	3.38	3.38	3.38	3.38	-	13.52
7. Project Technical Support	4.09	4.09	4.09	4.09	4.09	20.43
Subtotal Increased climate resilience of communities	34.13	47.79	44.07	12.52	9.15	147.65
C. Improved income and food security of communities						
1. Establish and maintain demonstration site 8 emonstration sites @ 3,000 USD	0.73	0.27	0.27	0.27	0.27	1.82
2. Farmer fieldschools 65 trainings @ 2,500 per fieldschool	2.07	2.07	2.07	2.07	2.07	10.35
3. Cold storage facilities + installation 4 facilities @ 50,000 USD (Unit cost)	-	6.37	6.37	-	-	12.74
4. Solar powered pump and associated equipment /surface water preservation for irrigation 6 units @ 85,500 USD per unit	-	16.34	16.34	-	-	32.68
5. Financial assistance to provide inputs for alternative livelihoods 6500 @350	28.99	28.99	28.99	28.99	28.99	144.93
6. Project Technical Support	2.78	2.78	2.78	2.78	2.78	13.89
Subtotal Improved income and food security of communities	34.56	56.82	56.82	34.11	34.11	216.42
D. Enhanced knowledge and capacity of communities, government and policym						
1. Workshops to increase capacity of local government and extension officers 25 workshops @ 1,500 per workshop	-	1.19	0.60	0.60	-	2.39
2. Materials and construction of climate resiliant innovation centres 4 centres @ 45,000 USD per centre	4.59	1.72	1.72	1.72	1.72	11.47
3. Cost of disseminating information (e.g radio broadcasts, public billboards, pamflets) and advocacy	2.52	0.95	0.95	0.95	0.95	6.31
4. 6 presentations at regional workshops/seminars @ 4,500 USD per	0.41	0.33	0.33	0.33	0.33	1.72
5. 16 exhange vists between different communities 16 exhange visits @ 2,000 USD per visit	0.41	0.41	0.41	0.41	0.41	2.04
6. Project Technical Support	3.05	3.05	3.05	3.05	3.05	15.24
Subtotal Enhanced knowledge and capacity of communities, government and p	10.98	7.64	7.05	7.05	6.45	39.16
E. Project Management (9.5% of Project cost)	11.15	11.15	11.15	11.15	11.15	55.74
F. Implementing Entity Fee (8.5% of Project cost)	9.98	9.98	9.98	9.98	9.98	49.89
Total BASELINE COSTS	145.87	173.84	169.52	75.76	71.78	636.77
Physical Contingencies	-	-	-	-	-	-
Price Contingencies						
Inflation						
	-	-	-	-	-	-
	-	-	-	-	-	-
Subtotal Inflation	-	-	-	-	-	-
Devaluation	-	-	-	-	-	-
Subtotal Price Contingencies	-	-	-	-	-	-
Total PROJECT COSTS	145.87	173.84	169.52	75.76	71.78	636.77
Taxes	-	-	-	-	-	-
Foreign Exchange	-	-	-	-	-	-

Source: Consultant's Estimates and Calculations using COSTAB package

Project Cost Phasing: Each project component has its own schedule for implementation. This has been incorporated in the COSTAB calculation of costs. The overall project cost phasing is shown in Table 8.3.

Table 3: Overall Project Cost Phasing *(Million BDT)*

Year	Financial Costs	In Percentage
1	190.05	22.91
2	226.48	27.30
3	220.86	26.62
4	98.70	11.90
5	93.52	11.27
Total	829.62	100

Source: Consultant's Estimates and Calculations using COSTAB package.

Project O&M Costs

The estimated annual Operation and Maintenance (O&M) Financial costs of the project facilities stand at Tk. 37.69 Million. The economic value of O&M cost is calculated on economic prices and stands at Tk. 28.83 Million. O&M cost is shown in **Table 8.4**

Table 4: Operation & Maintenance Cost *(Million BDT)*

	Description	Investment Cost	%	O&M Cost		
				Financial	C.F	Economic
1	Enhanced climate resilience of households	166.65	5%	8.33	0.765	6.37
2	Increased climate resilience of communities	192.37	5%	9.62	0.765	7.36
3	Improved income and food security of communities	281.96	7%	19.74	0.765	15.10
4	Enhanced knowledge and capacity of communities, government and policymakers	51.02	0%	0.00	0.765	0.00
	Total	692.00		37.69		28.83

Project Benefits

Identification of Economic Benefits

The project will be bringing both the direct & indirect benefits for the Community. The direct and indirect benefits which are discussed briefly below:

- ***Ecosystem based adaptation***
- ***Social Protection and Health***
- ***Climate Information System***
- ***Knowledge Management &Research***
- ***Capacity Building and Institutional Reformation***

These incremental benefits have been considered in the benefit stream of the project for the economic and financial analysis. Total incremental benefit is 215.05 Million BDT and detailed in the Benefit Analysis.

Financial and Economic Cost – Benefit and Cost-Effective Analysis

The Financial and Economic Cost – Benefit and Cost-Effective Analysis are computed for the Project to judge its economic and financial viability. These indicators include are shown in Table 8.5.;

Table 5: Results of Financial and Economic Cost-Benefit *(Million BDT)*

Viability Indicator	Financial	Economic
1. Capital Cost	829.62	636.77
2. Operation and Maintenance Cost	37.69	28.83
3. Benefit Cost Ratio (BCR @ 12%)	1.21	1.58
4. Net Present Value (NPV @ 12%)	166	350
5. Internal Rate Return (IRR %)	14.70%	18.72%

The analytical results of economic and financial Internal Rate of Return (EIRR and FIRR) are shown in Table 8.6 and Table 8.7. Details of analytical computations are presented in Annex-AVII and Annex-AVIII

Table 6: ***Economic Internal Rate of Return (EIRR)*** **(Million BDT)**

Year	Cost			Total Incremental Benefits	Cash flow
	Investment Cost	O & M	Total Cost		
1	145.87	0.00	145.87	0.00	-145.87
2	173.84	0.00	173.84	0.00	-173.84
3	169.52	0.00	169.52	0.00	-169.52
4	75.76	0.00	75.76	0.00	-75.76
5	71.78	0.00	71.78	0.00	-71.78
6	0.00	28.83	28.83	215.07	186.24
7	0.00	28.83	28.83	215.07	186.24
8	0.00	28.83	28.83	215.07	186.24
9	0.00	28.83	28.83	215.07	186.24
10	0.00	28.83	28.83	215.07	186.24
11	0.00	28.83	28.83	215.07	186.24
12	0.00	28.83	28.83	215.07	186.24
13	0.00	28.83	28.83	215.07	186.24
14	0.00	28.83	28.83	215.07	186.24
15	0.00	28.83	28.83	215.07	186.24
16	0.00	28.83	28.83	215.07	186.24
17	0.00	28.83	28.83	215.07	186.24
18	0.00	28.83	28.83	215.07	186.24
19	0.00	28.83	28.83	215.07	186.24
20	0.00	28.83	28.83	215.07	186.24
21	0.00	28.83	28.83	215.07	186.24
22	0.00	28.83	28.83	215.07	186.24
23	0.00	28.83	28.83	215.07	186.24
24	0.00	28.83	28.83	215.07	186.24
25	0.00	28.83	28.83	215.07	186.24
26	0.00	28.83	28.83	215.07	186.24
27	0.00	28.83	28.83	215.07	186.24
28	0.00	28.83	28.83	215.07	186.24
29	0.00	28.83	28.83	215.07	186.24
30	0.00	28.83	28.83	215.07	186.24
NPV @12%	478.36	128.31	606.68	957.15	350.47

All calculations are based on project period of 30 years

EIRR base case	18.72%
Benefit Cost Ratio	1.58
NPV @12% (Million BDT)	350.47

Table 7: ***Financial Internal Rate of Return (FIRR)*** **(Million BDT)**

Year	Cost			Total Incremental Benefits	Cash flow
	Investment Cost	O & M	Total Cost		
1	190.05	0.00	190.05	0.00	-190.05
2	226.48	0.00	226.48	0.00	-226.48
3	220.86	0.00	220.86	0.00	-220.86
4	98.70	0.00	98.70	0.00	-98.70
5	93.52	0.00	93.52	0.00	-93.52
6	0.00	37.69	37.69	215.07	177.38
7	0.00	37.69	37.69	215.07	177.38
8	0.00	37.69	37.69	215.07	177.38
9	0.00	37.69	37.69	215.07	177.38
10	0.00	37.69	37.69	215.07	177.38
11	0.00	37.69	37.69	215.07	177.38
12	0.00	37.69	37.69	215.07	177.38
13	0.00	37.69	37.69	215.07	177.38
14	0.00	37.69	37.69	215.07	177.38
15	0.00	37.69	37.69	215.07	177.38
16	0.00	37.69	37.69	215.07	177.38
17	0.00	37.69	37.69	215.07	177.38
18	0.00	37.69	37.69	215.07	177.38
19	0.00	37.69	37.69	215.07	177.38
20	0.00	37.69	37.69	215.07	177.38
21	0.00	37.69	37.69	215.07	177.38
22	0.00	37.69	37.69	215.07	177.38
23	0.00	37.69	37.69	215.07	177.38
24	0.00	37.69	37.69	215.07	177.38
25	0.00	37.69	37.69	215.07	177.38
26	0.00	37.69	37.69	215.07	177.38
27	0.00	37.69	37.69	215.07	177.38
28	0.00	37.69	37.69	215.07	177.38
29	0.00	37.69	37.69	215.07	177.38
30	0.00	37.69	37.69	215.07	177.38
NPV @12%	623.23	167.73	790.96	957.15	166.19

All calculations are based on project period of 30 years	
FIRR base case	14.70%
Benefit Cost Ratio	1.21
NPV @12% (Million BDT)	166.19

The results indicate that the Project is economically and financial viable, as it secures a rate of return that exceeds 12%, i.e. the opportunity cost of capital, presently used by all sectors of the economy in Bangladesh

Financial & Economic Risk Assessment, Sensitivity and Switching Values

The Financial & Economic Risk Assessment and Switching Values analysis of projects is generally based on uncertain future events and imperfect data. Also certain risks are inherent in project planning and implementation. So a Risk Assessment, Sensitivity Indicator and Switching Values of the project, EIRR has been conducted for the Project, based on variations in the level of costs and benefits, due to various uncertainties and risks involved in the project investment. By switching values it can be indicate that EIRR will remain same for the opportunity cost of capital (12%) if the cost increases up to the indicated percent in the Table 8.8 and Table 8.9, and IRR will remain same for the opportunity cost of capital (12%) if the benefit decreases up to the indicated percent in the Table 8.8.and Table 8.9.

The findings of Risk Assessment and Switching Values are summarized in Table 8.8 and Table 8.9. Details of analytical computations are presented in Appendix-AIX to Appendix-AXIV

Table 8: ***Results of Financial Risk Assessment and Switching Values***

Sl no.	Variables	Variance	FIRR	NPV (Million BDT)	Sensitivity Indicator (SI)	Switching Values (SV) %

1	**Base Case**	-	14.70%	166	-	-
2	Investment Cost Increased by + 10%	10%	13.58%	104	3.75	26.67
3	O & M Cost Increased by + 10%	10%	14.44%	149	1.01	99.08
4	Total Project Cost Increased by + 10%	10%	13.33%	87	4.76	21.01
5	Climate-resilient households Benefit decreased by -10%	-10%	14.12%	129	2.25	44.39
6	Community-level adaptation interventions decreased by -10%	-10%	14.28%	139	1.64	60.81
7	Climate-resilient livelihoods promoted decreased by -10%	-10%	14.52%	155	0.69	144.79
8	Capacity Building and Knowledge Management decreased by -10%	-10%	14.40%	147	1.17	85.35
11	Total Benefit decreased by -10%	-10%	13.19%	70	5.76	17.36
12	Both Total Project Cost Increased by + 10% and Total Benefit decreased by -10%	Both	11.86%	-9	10.52	9.51

Table 9: ***Results of Economic Risk Assessment and Switching Values***

Sl no.	Variables	Variance	EIRR	NPV (Million BDT)	Sensitivity Indicator (SI)	Switching Values (SV) %
1	**Base Case**	-	18.72%	350	-	-
2	Investment Cost Increased by + 10%	10%	17.44%	303	1.36	73.27
3	O & M Cost Increased by + 10%	10%	18.51%	338	0.37	273.14
4	Total Project Cost Increased by + 10%	10%	17.23%	290	1.73	57.77
5	Climate-resilient households Benefit decreased by -10%	-10%	18.09%	313	1.07	93.62
6	Community-level adaptation interventions decreased by -10%	-10%	18.26%	323	0.78	128.24
7	Climate-resilient livelihoods promoted decreased by -10%	-10%	18.53%	339	0.33	305.35
8	Capacity Building and Knowledge Management decreased by -10%	-10%	18.39%	331	0.56	180.00
11	Total Benefit decreased by -10%	-10%	17.08%	255	2.73	36.62
12	Both Total Project Cost Increased by + 10% and Total Benefit decreased by -10%	Both	15.64%	194	4.46	22.41

The results of sensitivity analysis presented above, show that in all cases, the Project is not sensitive to any of the above assumptions, as the calculated EIRR is above 12 percent. Based on the results of the sensitivity analysis, it can be concluded that the Project is economically viable, and therefore, recommended for implementation.

Annex-AI: Year wise Financial Investment Base Cost (BDT Million)

Bangladesh

Adaptation Fund: Pre-Concept for a Regional Project/Programme

Expenditure Accounts by Years -- Base Costs	**Base Cost (BDT Million)**					
	2019	**2020**	**2021**	**2022**	**2023**	**Total**
I. Investment Costs						
A. Enhanced climate resilience of households						
1. Cyclone and flood resilient houses	50.80	38.10	38.10	-	-	126.99
2. Community level nano-grid facility	2.45	4.91	4.91	-	-	12.27
3. Locally appropriate rainwater harvesting	4.23	8.47	8.47	-	-	21.17
4. Project Technical Support	1.25	1.25	1.25	1.25	1.25	6.23
Subtotal Enhanced climate resilience of households	58.73	52.72	52.72	1.25	1.25	166.65
B. Increased climate resilience of communities						
1. Climate resilient mini-cyclone shelter/cluster houses built to protect life and prevent asset loss	13.28	26.56	26.56	-	-	66.40
2. Embankment/drainage facility improvement @ 30,000 USD per km	9.34	12.45	9.34	-	-	31.13
3. Embankment / river bank strengthening through EbA @ 12,400 USD per km	5.20	6.93	5.20	-	-	17.33
4. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.	0.53	0.20	0.20	0.20	0.20	1.33
5. CPP Equipment 7 packs @ 40,000 USD per pack	6.39	6.39	6.39	6.39	6.39	31.96
6. Cost to procure and equip mobile ambulance 8 ambulance @ 26,522 USD	4.40	4.40	4.40	4.40	-	17.61
7. Project Technical Support	5.32	5.32	5.32	5.32	5.32	26.62
Subtotal Increased climate resilience of communities	44.47	62.26	57.41	16.32	11.91	192.37
C. Improved income and food security of communities						
1. Establish and maintain demonstration site 8 emonstration sites @ 3,000 USD per plot	0.95	0.36	0.36	0.36	0.36	2.37
2. Farmer fieldschools 65 trainings @ 2,500 per fieldschool	2.70	2.70	2.70	2.70	2.70	13.49
3. Cold storage facilities + installation 4 facilities @ 50,000 USD (Unit cost)	-	8.30	8.30	-	-	16.60
4. Solar powered pump and associated equipment /surface water preservation for irrigation 6 units @ 85,500 USD per unit	-	21.29	21.29	-	-	42.58
5. Financial assistance to provide inputs for alternative livelihoods 6500 @350 USD	37.77	37.77	37.77	37.77	37.77	188.83
6. Project Technical Support	3.62	3.62	3.62	3.62	3.62	18.09
Subtotal Improved income and food security of communities	45.03	74.03	74.03	44.44	44.44	281.96
D. Enhanced knowledge and capacity of communities, government and policyma						
1. Workshops to increase capacity of local government and extension officers 25 workshops @ 1,500 per workshop	-	1.56	0.78	0.78	-	3.11
2. Materials and construction of climate resiliant innovation centres 4 centres @ 45,000 USD per centre	5.98	2.24	2.24	2.24	2.24	14.94
3. Cost of disseminating information (e.g radio broadcasts, public billboards, pamflets) and advocacy	3.29	1.23	1.23	1.23	1.23	8.22
4. 6 presentations at regional workshops/seminars @ 4,500 USD per presentation	0.54	0.43	0.43	0.43	0.43	2.24
5. 16 exhange vists between different communities 16 exhange visits @ 2,000 USD per visit	0.53	0.53	0.53	0.53	0.53	2.66
6. Project Technical Support	3.97	3.97	3.97	3.97	3.97	19.85
Subtotal Enhanced knowledge and capacity of communities, government and po	14.30	9.96	9.18	9.18	8.40	51.02
E. Project Management (9.5% of Project cost)	14.53	14.53	14.53	14.53	14.53	72.63
F. Implementing Entity Fee (8.5% of Project cost)	13.00	13.00	13.00	13.00	13.00	64.99
Total BASELINE COSTS	190.05	226.48	220.86	98.70	93.52	829.62
Physical Contingencies	-	-	-	-	-	-
Price Contingencies						
Inflation						
L	-	-	-	-	-	-
F	-	-	-	-	-	-
Subtotal Inflation	-	-	-	-	-	-
Devaluation	-	-	-	-	-	-
Subtotal Price Contingencies	-	-	-	-	-	-
Total PROJECT COSTS	190.05	226.48	220.86	98.70	93.52	829.62
Taxes	28.51	33.97	33.13	14.81	14.03	124.44
Foreign Exchange	-	-	-	-	-	-

Annex-AII: Year wise Investment Base Cost (US$ Million))

Bangladesh
Adaptation Fund: Pre-Concept for a Regional Project/Programme
Table 1. Pre-Concept for a Regional Project/Programme
Detailed Costs

	Unit	Quantities Total	Unit Cost (US$)	Base Cost (US$ Million) 2019	2020	2021	2022	2023	Total	Breakdown of Totals Incl. Cont. (US$ Million) For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total
I. Investment Costs													
A. Adaptation													
1. Enhanced climate resilience of households													
a. Cyclone and flood resilient houses for the most vulnerable households.	no	900	1,700	0.61	0.46	0.46	-	-	1.53	-	1.30	0.23	1.53
b. Community-level nano-grids installed for electrification to enhance adaptive capacity	no	30	4,927.6	0.03	0.06	0.06	-	-	0.15	-	0.13	0.02	0.15
c. Locally appropriate rainwater harvesting systems for safe drinking water and home-garden irrigation.	no	500	510	0.05	0.10	0.10	-	-	0.26	-	0.22	0.04	0.26
d. Project Technical Support	Ls	1	75,000	0.02	0.02	0.02	0.02	0.02	0.08	-	0.06	0.01	0.08
Subtotal Enhanced climate resilience of households				0.71	0.64	0.64	0.02	0.02	2.01	-	1.71	0.30	2.01
2. Increased climate resilience of communities													
a. Climate resilient mini-cyclone shelter/cluster houses built to protect life and prevent asset loss	no	16	50,000	0.16	0.32	0.32	-	-	0.80	-	0.68	0.12	0.80
b. Embankment/drainage facility improvement @ 30,000 USD per km	km	12.5	30,000	0.11	0.15	0.11	-	-	0.38	-	0.32	0.06	0.38
c. Embankment / river bank strengthening through EbA @ 12,400 USD per km	km	14.5	14,400	0.06	0.08	0.06	-	-	0.21	-	0.18	0.03	0.21
d. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.	no	8	2,000	0.01	0.00	0.00	0.00	0.00	0.02	-	0.01	0.00	0.02
e. CPP Equipment 7 packs @ 40,000 USD per pack	no	7	55,000	0.08	0.08	0.08	0.08	0.08	0.39	-	0.33	0.06	0.39
f. Cost to procure and equip mobile ambulance 8 ambulance @ 26,522 USD	no	8	26,522	0.05	0.05	0.05	0.05	-	0.21	-	0.18	0.03	0.21
g. Project Technical Support	Ls	1	320,750	0.06	0.06	0.06	0.06	0.06	0.32	-	0.27	0.05	0.32
Subtotal Increased climate resilience of communities				0.54	0.75	0.69	0.20	0.14	2.32	-	1.97	0.35	2.32
3. Improved income and food security of communities													
a. Establish and maintain demonstration site 8 emonstration sites @ 3,000 USD per plot	no	8	3,571	0.01	0.00	0.00	0.00	0.00	0.03	-	0.02	0.00	0.03
b. Farmer fieldschools 65 trainings @ 2,500 per fieldschool	no	65	2,500	0.03	0.03	0.03	0.03	0.03	0.16	-	0.14	0.02	0.16
c. Cold storage facilities + installation 4 facilities @ 50,000 USD (Unit cost)	no	4	50,000	-	0.10	0.10	-	-	0.20	-	0.17	0.03	0.20
d. Solar powered pump and associated equipment /surface water preservation for irrigation 6 units @ 85,500 USD per unit	no	6	85,500	-	0.26	0.26	-	-	0.51	-	0.44	0.08	0.51
e. Financial assistance to provide inputs for alternative livelihoods 6500 @350 USD	no	6,500	350	0.46	0.46	0.46	0.46	0.46	2.28	-	1.93	0.34	2.28
f. Project Technical Support	Ls	1	218,000	0.04	0.04	0.04	0.04	0.04	0.22	-	0.19	0.03	0.22
Subtotal Improved income and food security of communities				0.54	0.89	0.89	0.54	0.54	3.40	-	2.89	0.51	3.40
4. Enhanced knowledge and capacity of communities, government and policy													
a. Workshops to increase capacity of local government and extension officers 25 workshops @ 1,500 per workshop	no	25	1,500	-	0.02	0.01	0.01	-	0.04	-	0.03	0.01	0.04
b. Materials and construction of climate resiliant innovation centres 4 centres @ 45,000 USD per centre	no	4	45,000	0.07	0.03	0.03	0.03	0.03	0.18	-	0.15	0.03	0.18
c. Cost of disseminating information (e.g radio broadcasts, public billboards, pamflets) and advocacy	Ls	1	99,000	0.04	0.01	0.01	0.01	0.01	0.10	-	0.08	0.01	0.10
d. 6 presentations at regional workshops/seminars @ 4,500 USD per presentation	no	6	4,500	0.01	0.01	0.01	0.01	0.01	0.03	-	0.02	0.00	0.03
e. 16 exhange vists between different communities 16 exhange visits @ 2,000 USD per visit	no	16	2,000	0.01	0.01	0.01	0.01	0.01	0.03	-	0.03	0.00	0.03
f. Project Technical Support	Ls	1	239,200	0.05	0.05	0.05	0.05	0.05	0.24	-	0.20	0.04	0.24
Subtotal Enhanced knowledge and capacity of communities, government and				0.17	0.12	0.11	0.11	0.10	0.61	-	0.52	0.09	0.61
5. Project Management (9.5% of Project cost)	Ls	1	875,000	0.18	0.18	0.18	0.18	0.18	0.88	-	0.74	0.13	0.88
6. Implementing Entity Fee (8.5% of Project cost) /a	Ls	1	783,047	0.16	0.16	0.16	0.16	0.16	0.78	-	0.67	0.12	0.78
Total				2.29	2.73	2.66	1.19	1.13	10.00	-	8.50	1.50	10.00

Annex-AIII: Detailed Financial Investment Cost (Million BDT)

Bangladesh
Adaptation Fund: Pre-Concept for a Regional Project/Programme
Table 1. Pre-Concept for a Regional Project/Programme
Detailed Costs

	Unit	Quantities Total	Unit Cost (BDT)	Base Cost (BDT Million) 2019	2020	2021	2022	2023	Total	Breakdown of Totals Incl. Cont. (BDT Million) For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total
I. Investment Costs													
A. Adaptation													
1. Enhanced climate resilience of households													
a. Cyclone and flood resilient houses for the most vulnerable households.	no	900	141,100	50.80	38.10	38.10	-	-	126.99	-	107.94	19.05	126.99
b. Community-level nano-grids installed for electrification to enhance adaptive capacity	no	30	408,990.8	2.45	4.91	4.91	-	-	12.27	-	10.43	1.84	12.27
c. Locally appropriate rainwater harvesting systems for safe drinking water and home-garden irrigation.	no	500	42,330	4.23	8.47	8.47	-	-	21.17	-	17.99	3.17	21.17
d. Project Technical Support	Ls	1	6,225,000	1.25	1.25	1.25	1.25	1.25	6.23	-	5.29	0.93	6.23
Subtotal Enhanced climate resilience of households				58.73	52.72	52.72	1.25	1.25	166.65	-	141.65	25.00	166.65
2. Increased climate resilience of communities													
a. Climate resilient mini-cyclone shelter/cluster houses built to protect life and prevent asset loss	no	16	4,150,000	13.28	26.56	26.56	-	-	66.40	-	56.44	9.96	66.40
b. Embankment/drainage facility improvement @ 30,000 USD per km	km	12.5	2,490,000	9.34	12.45	9.34	-	-	31.13	-	26.46	4.67	31.13
c. Embankment / river bank strengthening through EbA @ 12,400 USD per km	km	14.5	1,195,200	5.20	6.93	5.20	-	-	17.33	-	14.73	2.60	17.33
d. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.	no	8	166,000	0.53	0.20	0.20	0.20	0.20	1.33	-	1.13	0.20	1.33
e. CPP Equipment 7 packs @ 40,000 USD per pack	no	7	4,565,000	6.39	6.39	6.39	6.39	6.39	31.96	-	27.16	4.79	31.96
f. Cost to procure and equip mobile ambulance 8 ambulance @ 26,522 USD	no	8	2,201,326	4.40	4.40	4.40	4.40	-	17.61	-	14.97	2.64	17.61
g. Project Technical Support	Ls	1	26,622,250	5.32	5.32	5.32	5.32	5.32	26.62	-	22.63	3.99	26.62
Subtotal Increased climate resilience of communities				44.47	62.26	57.41	16.32	11.91	192.37	-	163.52	28.86	192.37
3. Improved income and food security of communities													
a. Establish and maintain demonstration site 8 emonstration sites @ 3,000 USD per plot	no	8	296,393	0.95	0.36	0.36	0.36	0.36	2.37	-	2.02	0.36	2.37
b. Farmer fieldschools 65 trainings @ 2,500 per fieldschool	no	65	207,500	2.70	2.70	2.70	2.70	2.70	13.49	-	11.46	2.02	13.49
c. Cold storage facilities + installation 4 facilities @ 50,000 USD (Unit cost)	no	4	4,150,000	-	8.30	8.30	-	-	16.60	-	14.11	2.49	16.60
d. Solar powered pump and associated equipment /surface water preservation for irrigation 6 units @ 85,500 USD per unit	no	6	7,096,500	-	21.29	21.29	-	-	42.58	-	36.19	6.39	42.58
e. Financial assistance to provide inputs for alternative livelihoods 6500 @350 USD	no	6,500	29,050	37.77	37.77	37.77	37.77	37.77	188.83	-	160.50	28.32	188.83
f. Project Technical Support	Ls	1	18,094,000	3.62	3.62	3.62	3.62	3.62	18.09	-	15.38	2.71	18.09
Subtotal Improved income and food security of communities				45.03	74.03	74.03	44.44	44.44	281.96	-	239.66	42.29	281.96
4. Enhanced knowledge and capacity of communities, government and policy													
a. Workshops to increase capacity of local government and extension officers 25 workshops @ 1,500 per workshop	no	25	124,500	-	1.56	0.78	0.78	-	3.11	-	2.65	0.47	3.11
b. Materials and construction of climate resiliant innovation centres 4 centres @ 45,000 USD per centre	no	4	3,735,000	5.98	2.24	2.24	2.24	2.24	14.94	-	12.70	2.24	14.94
c. Cost of disseminating information (e.g radio broadcasts, public billboards, pamflets) and advocacy	Ls	1	8,217,000	3.29	1.23	1.23	1.23	1.23	8.22	-	6.98	1.23	8.22
d. 6 presentations at regional workshops/seminars @ 4,500 USD per presentation	no	6	373,500	0.54	0.43	0.43	0.43	0.43	2.24	-	1.90	0.34	2.24
e. 16 exhange vists between different communities 16 exhange visits @ 2,000 USD per visit	no	16	166,000	0.53	0.53	0.53	0.53	0.53	2.66	-	2.26	0.40	2.66
f. Project Technical Support	Ls	1	19,853,600	3.97	3.97	3.97	3.97	3.97	19.85	-	16.88	2.98	19.85
Subtotal Enhanced knowledge and capacity of communities, government and				14.30	9.96	9.18	9.18	8.40	51.02	-	43.37	7.65	51.02
5. Project Management (9.5% of Project cost)	Ls	1	72,625,000	14.53	14.53	14.53	14.53	14.53	72.63	-	61.73	10.89	72.63
6. Implementing Entity Fee (8.5% of Project cost) /a	Ls	1	64,992,901	13.00	13.00	13.00	13.00	13.00	64.99	-	55.24	9.75	64.99
Total				190.05	226.48	220.86	98.70	93.52	829.62	-	705.17	124.44	829.62

Annex-AIV: Detailed Economic Investment Cost (Million BDT)

Bangladesh
Adaptation Fund: Pre-Concept for a Regional Project/Programme
Table 1. Pre-Concept for a Regional Project/Programme
Detailed Costs
Economic Costs

	Economic Costs (BDT Million)						Breakdown of Economic Costs (BDT Million)			
	2019	2020	2021	2022	2023	Total	For. Exch.	Local (Excl. Taxes)	Duties & Taxes	Total
I. Investment Costs										
A. Adaptation										
1. Enhanced climate resilience of households										
a. Cyclone and flood resilient houses for the most vulnerable households.	38.99	29.24	29.24	-	-	97.47	-	97.47	-	97.47
b. Community-level nano-grids installed for electrification to enhance adaptive capacity	1.88	3.77	3.77	-	-	9.42	-	9.42	-	9.42
c. Locally appropriate rainwater harvesting systems for safe drinking water and home-garden irrigation.	3.25	6.50	6.50	-	-	16.25	-	16.25	-	16.25
d. Project Technical Support	0.96	0.96	0.96	0.96	0.96	4.78	-	4.78	-	4.78
Subtotal Enhanced climate resilience of households	45.08	40.46	40.46	0.96	0.96	127.91	-	127.91	-	127.91
2. Increased climate resilience of communities										
a. Climate resilient mini-cyclone shelter/cluster houses built to protect life and prevent asset loss	10.19	20.39	20.39	-	-	50.97	-	50.97	-	50.97
b. Embankment/drainage facility improvement @ 30,000 USD per km	7.17	9.56	7.17	-	-	23.89	-	23.89	-	23.89
c. Embankment / river bank strengthening through EbA @ 12,400 USD per km	3.99	5.32	3.99	-	-	13.30	-	13.30	-	13.30
d. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.	0.41	0.15	0.15	0.15	0.15	1.02	-	1.02	-	1.02
e. CPP Equipment 7 packs @ 40,000 USD per pack	4.91	4.91	4.91	4.91	4.91	24.53	-	24.53	-	24.53
f. Cost to procure and equip mobile ambulance 8 ambulance @ 26,522 USD	3.38	3.38	3.38	3.38	-	13.52	-	13.52	-	13.52
g. Project Technical Support	4.09	4.09	4.09	4.09	4.09	20.43	-	20.43	-	20.43
Subtotal Increased climate resilience of communities	34.13	47.79	44.07	12.52	9.15	147.65	-	147.65	-	147.65
3. Improved income and food security of communities										
a. Establish and maintain demonstration site 8 emonstration sites @ 3,000 USD per plot	0.73	0.27	0.27	0.27	0.27	1.82	-	1.82	-	1.82
b. Farmer fieldschools 65 trainings @ 2,500 per fieldschool	2.07	2.07	2.07	2.07	2.07	10.35	-	10.35	-	10.35
c. Cold storage facilities + installation 4 facilities @ 50,000 USD (Unit cost)	-	6.37	6.37	-	-	12.74	-	12.74	-	12.74
d. Solar powered pump and associated equipment /surface water preservation for irrigation 6 units @ 85,500 USD per unit	-	16.34	16.34	-	-	32.68	-	32.68	-	32.68
e. Financial assistance to provide inputs for alternative livelihoods 6500 @350 USD	28.99	28.99	28.99	28.99	28.99	144.93	-	144.93	-	144.93
f. Project Technical Support	2.78	2.78	2.78	2.78	2.78	13.89	-	13.89	-	13.89
Subtotal Improved income and food security of communities	34.56	56.82	56.82	34.11	34.11	216.42	-	216.42	-	216.42
4. Enhanced knowledge and capacity of communities, government and										
a. Workshops to increase capacity of local government and extension officers 25 workshops @ 1,500 per workshop	-	1.19	0.60	0.60	-	2.39	-	2.39	-	2.39
b. Materials and construction of climate resiliant innovation centres 4 centres @ 45,000 USD per centre	4.59	1.72	1.72	1.72	1.72	11.47	-	11.47	-	11.47
c. Cost of disseminating information (e.g radio broadcasts, public billboards, pamflets) and advocacy	2.52	0.95	0.95	0.95	0.95	6.31	-	6.31	-	6.31
d. 6 presentations at regional workshops/seminars @ 4,500 USD per presentation	0.41	0.33	0.33	0.33	0.33	1.72	-	1.72	-	1.72
e. 16 exhange vists between different communities 16 exhange visits @ 2,000 USD per visit	0.41	0.41	0.41	0.41	0.41	2.04	-	2.04	-	2.04
f. Project Technical Support	3.05	3.05	3.05	3.05	3.05	15.24	-	15.24	-	15.24
Subtotal Enhanced knowledge and capacity of communities, governme	10.98	7.64	7.05	7.05	6.45	39.16	-	39.16	-	39.16
5. Project Management (9.5% of Project cost)	11.15	11.15	11.15	11.15	11.15	55.74	-	55.74	-	55.74
6. Implementing Entity Fee (8.5% of Project cost) /a	9.98	9.98	9.98	9.98	9.98	49.89	-	49.89	-	49.89
Total	145.87	173.84	169.52	75.76	71.78	636.77	-	636.77	-	636.77

Annex-AV: Detailed Economic Internal Rate of Return (EIRR) Calculation (Base case)

(Million BDT)

Description	Year																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A. Project Cost																														
a. Implementation Cost	146	174	170	76	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. O and M Cost	0	0	0	0	0	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
Total Project Cost	**146**	**174**	**170**	**76**	**72**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**
B. Incremental Project Benefit																														
i. Climate-resilient households	0	0	0	0	0	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84
ii. Community-level adaptation interventions	0	0	0	0	0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
iii.Climate-resilient livelihoods promoted	0	0	0	0	0	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
iv.Capacity Building and Knowledge Management	0	0	0	0	0	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Incremental Project Benefit	**0**	**0**	**0**	**0**	**0**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**
C. Cash flow	**-146**	**-174**	**-170**	**-76**	**-72**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**	**186**

All calculations are based on project period of 30 years	
EIRR base case	18.72%
Benefit Cost Ratio	1.58
NPV @12% (Million BDT)	350

Annex-AVI: Detailed Financial Internal Rate of Return (FIRR) Calculation (Base case)

(Million BDT)

Description	Year																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A. Project Cost																														
a. Implementation Cost	190	226	221	99	94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. O and M Cost	0	0	0	0	0	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Total Project Cost	**190**	**226**	**221**	**99**	**94**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**
B. Incremental Project Benefit																														
i. Climate-resilient households	0	0	0	0	0	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84
ii. Community-level adaptation	0	0	0	0	0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
iii.Climate-resilient livelihoods promoted	0	0	0	0	0	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
iv.Capacity Building and Knowledge Man	0	0	0	0	0	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Incremental Project Benefit	**0**	**0**	**0**	**0**	**0**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**
C. Cash flow	**-190**	**-226**	**-221**	**-99**	**-94**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**	**177**

All calculations are based on project period of 30 years	
FIRR base case	14.70%
Benefit Cost Ratio	1.21
NPV @12% (Million BDT)	166

Annex-AVII: Financial Risk Assessment (Total project Cost Increased by 10%)

(Million BDT)

Description	Year																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A. Project Cost																														
a. Implementation Cost	209	249	243	109	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. O and M Cost	0	0	0	0	0	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41
Total Project Cost	**209**	**249**	**243**	**109**	**103**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**
B. Incremental Project Benefit																														
i. Climate-resilient households	0	0	0	0	0	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84
ii. Community-level adaptation	0	0	0	0	0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
iii.Climate-resilient livelihoods promoted	0	0	0	0	0	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
iv.Capacity Building and Knowledge Man	0	0	0	0	0	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Incremental Project Benefit	**0**	**0**	**0**	**0**		**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**
C. Cash flow	**-209**	**-249**	**-243**	**-109**	**-103**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**

All calculations are based on project period of 30 years	
FIRR base case	13.33%
Benefit Cost Ratio	1.23
NPV @12% (Million BDT)	87

Annex-AVIII: Financial Risk Assessment (Total Benefit decreased by -10%)

(Million BDT)

Description	Year																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A. Project Cost																														
a. Implementation Cost	190	226	221	99	94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. O and M Cost	0	0	0	0	0	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Total Project Cost	**190**	**226**	**221**	**99**	**94**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**
B. Incremental Project Benefit																														
i. Climate-resilient households	0	0	0	0	0	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
ii. Community-level adaptation	0	0	0	0	0	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
iii.Climate-resilient livelihoods promoted	0	0	0	0	0	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
iv.Capacity Building and Knowledge Man	0	0	0	0	0	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Incremental Project Benefit	**0**	**0**	**0**	**0**	**0**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**
C. Cash flow	**-190**	**-226**	**-221**	**-99**	**-94**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**	**156**

All calculations are based on project period of 30 years	
FIRR base case	13.19%
Benefit Cost Ratio	1.09
NPV @12% (Million BDT)	70

Annex-AIX: Financial Risk Assessment (Both Total Project Cost Increased by + 10% and Total Benefit decreased by -10%)

(Million BDT)

Description	Year																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A. Project Cost																														
a. Implementation Cost	209	249	243	109	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. O and M Cost	0	0	0	0	0	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41
Total Project Cost	**209**	**249**	**243**	**109**	**103**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**
B. Incremental Project Benefit																														
i. Climate-resilient households	0	0	0	0	0	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
ii. Community-level adaptation	0	0	0	0	0	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
iii.Climate-resilient livelihoods promoted	0	0	0	0	0	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
iv.Capacity Building and Knowledge Man	0	0	0	0	0	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Incremental Project Benefit	**0**	**0**	**0**	**0**	**0**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**
C. Cash flow	**-209**	**-249**	**-243**	**-109**	**-103**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**	**152**

All calculations are based on project period of 30 years	
FIRR base case	11.86%
Benefit Cost Ratio	0.99
NPV @12% (Million BDT)	-9

Annex-AX: Economical Risk Assessment (Total project Cost Increased by 10%)

(Million BDT)

Description	Year																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A. Project Cost																														
a. Implementation Cost	160	191	186	83	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. O and M Cost	0	0	0	0	0	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Total Project Cost	**160**	**191**	**186**	**83**	**79**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
B. Incremental Project Benefit																														
i. Climate-resilient households	0	0	0	0	0	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84
ii. Community-level adaptation interventions	0	0	0	0	0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
iii.Climate-resilient livelihoods promoted	0	0	0	0	0	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
iv.Capacity Building and Knowledge Management	0	0	0	0	0	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Incremental Project Benefit	**0**	**0**	**0**	**0**		**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**	**215**
C. Cash flow	**-160**	**-191**	**-186**	**-83**	**-79**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**	**183**

All calculations are based on project period of 30 years	
EIRR base case	17.23%
Benefit Cost Ratio	1.61
NPV @12% (Million BDT)	290

Annex-AXI: Economical Risk Assessment (Total Benefit decreased by -10%)

(Million BDT)

Description	Year																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A. Project Cost																														
a. Implementation Cost	146	174	170	76	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. O and M Cost	0	0	0	0	0	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
Total Project Cost	**146**	**174**	**170**	**76**	**72**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**
B. Incremental Project Benefit																														
i. Climate-resilient households	0	0	0	0	0	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
ii. Community-level adaptation interventions	0	0	0	0	0	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
iii.Climate-resilient livelihoods promoted	0	0	0	0	0	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
iv.Capacity Building and Knowledge Management	0	0	0	0	0	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Incremental Project Benefit	**0**	**0**	**0**	**0**	**0**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**
C. Cash flow	**-146**	**-174**	**-170**	**-76**	**-72**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**

All calculations are based on project period of 30 years

EIRR base case	17.08%
Benefit Cost Ratio	1.42
NPV @12% (Million BDT)	255

Annex-AXII: Economical Risk Assessment (Both Total Project Cost Increased by + 10% and Total Benefit decreased by -10%)

(Million BDT)

Description	Year																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A. Project Cost																														
a. Implementation Cost	160	191	186	83	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. O and M Cost	0	0	0	0	0	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Total Project Cost	**160**	**191**	**186**	**83**	**79**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
B. Incremental Project Benefit																														
i. Climate-resilient households	0	0	0	0	0	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
ii. Community-level adaptation interventions	0	0	0	0	0	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
iii.Climate-resilient livelihoods promoted	0	0	0	0	0	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
iv.Capacity Building and Knowledge Management	0	0	0	0	0	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Incremental Project Benefit	**0**	**0**	**0**	**0**	**0**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**	**194**
C. Cash flow	**-160**	**-191**	**-186**	**-83**	**-79**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**	**162**

All calculations are based on project period of 30 years

EIRR base case	15.64%
Benefit Cost Ratio	1.29
NPV @12% (Million BDT)	194

Annex-XIII: Estimation of Standard Conversion Factor (SCF)

SCF = M+X/(M+Tm)+(X-Tx)

where T_m and T_x are the revenue from taxes on imports and exports, respectively

(BDT. Crore)

Items	2012-13	2013-14	2014-15	2015-16	2016-17	5 years average
1. Value of Total Imports (M)	268380	284240	284640	310810	223120	274238
2. Value of Total Exports (X)	212350	231340	238970	261710	175250	223924
3. M + X (1+2)	480730	515580	523610	572520	398370	498162
4. Import Duty	14528	13433	15103	17119	22450	16527
5. VAT on Imports & Supp. Duty	28326	32114	34701	37739	50935	36763
6. Total Tax on Imports (4+5)Tm	42854	45547	49804	54858	73385	53290
7. Average Tax on Imports (6/1)	0.160	0.160	0.175	0.177	0.329	0.194
8. Export Duty	40	41	31	34	44	38
9. Sales Tax/VAT on Exports	0	0	0	0	0	0
10. Total Tax on Exports(8+9)Tx	40	41	31	34	44	38.000
11. Average Tax on Exports (10/2)	0.0002	0.0002	0.0001	0.0001	0.0003	0.0002
12. SCF (3/(3+6-10))	**0.918**	**0.919**	**0.913**	**0.913**	**0.845**	**0.903**

B: Benefits Analysis

Summary of Benefits

Project Components	Expected Outputs	Expected Outcomes	Assessed Benefits per year (US$)
Output 1.1. Cyclone and flood resilient houses for the most vulnerable households.	Output 1.1. Cyclone and flood resilient houses for the most vulnerable households.	*900 families are resilient in terms of reduced exposure from flood/storm surge*	259,861.45
	Output 1.2. Community-level nano-grids installed for electrification to enhance adaptive capacity	*450 no of households are covered by the renewable energy option*	27,325.30
	Output 1.3. Locally appropriate rainwater harvesting systems for safe drinking water and home-garden irrigation.	***5000** household are connected to safe water supply network*	726,265.06
Sub Total Value of Component 1 (US$)			**1,013,451.81**
Sub Total Value of Component 1 (Million BDT)			**84.12**
2. Community-level adaptation interventions	Output 2.1. Climate resilient infrastructure built to protect life and prevent asset loss	***16** raised plinth cluster houses that will support **64 households** and act as emergency shelter to support **200 families***	2,136.67
	Output 2.2. Embankments repaired and innovative model for community embankment management introduced.		172,891.57
	Embankment/drainage facility improvement @ 30,000 USD per km	***50 hector** land protected by coastal embankment*	
	Embankment / river bank strengthening through EbA @ 14,400 USD per km	***50 hector** land protected by coastal embankment*	
	Output 2.3. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.	8 climate hazard and vulnerability maps covering selected islands in the Bay of Bengal	362,123.49
	Output 2.4. Cyclone Preparedness Programme (CPP) modernized and expanded to provide timely cyclone early warning and response at scale.		32,820.78
	CPP Equipment 7 packs @ 55,000 USD per pack	***8500** CPP volunteers trained (increase female representation in CPP by at least 25%)* ***108,965 beneficiaries** will be affected under CPP activity*	
	Cost to procure and equip mobile ambulance 8 ambulance @ 26,522 USD	8 mobile floating medical unit procured and provisioned	**169,879.52**

Sub Total Value of Component 2 (US$)			**737,715.36**
Sub Total Value of Component 2 (Million BDT)			**61.41**
3. Climate-resilient livelihoods promoted	Output 3.1 Climate-resilient agriculture implemented, and diversified livelihoods supported at the village level.		82,228.92
	Establish and maintain climate resilient livelihood demonstration site 8 demonstration sites @ 3,000 USD per plot	Quarterly field school trainings held in Mujibnagar and Lakshmitari for a total of 64 field school trainings. (include at least 25% female representation, but aim is for minimum of 50%)	
	Farmer field schools 65 trainings @ 2,500 per field school	~7,500 farmers trained on climate-resilient agricultural practices.	
	Cold storage facilities + installation 4 facilities @ 50,000 USD (Unit cost)	2 cold storage units installed in Mujibnagar and 2 cold storage units installed in Lakshmitari	
	Solar powered pump and associated equipment /surface water preservation for irrigation 6 units @ 85,500 USD per unit	80 hectares of land irrigated in Lakshmitari	
	Financial assistance to provide inputs for alternative livelihoods 6500 @350 USD	~6,500 people provided with technology, skills and materials to make their livelihood climate resilient. (minimum 50% female beneficiaries)	228,433.73
Sub Total Value of Component 3 (US$)			**310,662.65**
Sub Total Value of Component 3 (Million BDT)			**25.79**
4. Capacity Building and Knowledge Management	Output 4.1. Local government institutions are capable of climate risk informed planning and implementation.		527,057
	Workshops to increase capacity of local government and extension officers 20 workshops @ 2,500 per workshop	250 staff from local government institutions, Bangladesh Water Board and Department of Agriculture trained to incorporate climate risk into their decisions and activities.	
	Output 4.2. Knowledge and awareness generated to promote climate resilient approaches and strategies.		
	Materials and construction of climate resilient innovation centres 4 centres @ 45,000 USD per centre	4 Adaptation innovation centres established in each of the project locations	
	Cost of disseminating information (e.g radio broadcasts, public billboards, pamphlets) and national level advocacy	75% of the population in the target areas reached by awareness campaigns (minimum 50% women)	
	6 presentations at regional workshops/seminars @ 4,500 USD per presentation	200 people trained on climate change information, impacts and adaptive strategies	
	16 exchange visits between different communities 16 exchange visits @ 2,000 USD per visit		
Sub Total Value of Component 4 (US$)			**527,057**
Sub Total Value of Component 4 (Million BDT)			**43.75**
Grand Total Value of the Project (US$)			**2,588,886.45**
Grand Total Value of the Project (Million BDT)			**215.05**

Detailed description of benefits

Output 1.1. Cyclone and flood resilient houses for the most vulnerable households are supported.

Sl.	Contents		Loss (BDT)	Damage Adjustment (%)	Benefit (BDT)
i)	House Construction		30,000	60	18,000.00
ii)	House Assets				
		Bed	1000	20	200.00
		Bed Items	1000	70	700.00
		Stove (mud)	200	100	200.00
		Utensils	2000	20	400.00

		Cloths	500 * 5 (avg. HH) = 2500		30	750.00
		Furniture	Cloths rack	800	50	400.00
			Table	300	50	150.00
			Chair	450	50	225.00
			Almirah	2000	20	400.00
iii)	Homestead Gardening			1000	50	500.00
iv)	Livestock/Poultry			2,000	20	400.00
v)	Sanitation			2000	50	1,000.00
vi)	Tube well			2,000	20	400.00
ii)	Rainwater Harvesting (health benefit)			1,200	20	240.00
					Total Benefit Derived per family (BDT)	**23,965.00**
					Total Benefit Derived per 900 family (BDT)	**21,568,500.00**
					Total Benefit Derived per 900 family (USD)	**259,861.45**

Output 1.2. Community-level nano-grids installed for electrification to enhance adaptive capacity.

Sl.	Contents	Total Household	Adjustment (%)	Total Benefitted HH	Per unit Cost	Benefit (BDT)
i)	Fuel (kerosene)	450	100	450	4800	2,160,000.00
ii)	Mobile charge	450	40	180	600	108,000.00
				Total Benefit (BDT)		**2,268,000.00**
				Total Benefit (USD)		**27,325.30**

Output 1.3. Locally appropriate rainwater harvesting systems for safe drinking water and home-garden irrigation installed.

Sl.	Contents	No. of household	No. of Working People	Adjustment (%)	Total Benefitted People	Per unit Benefit (BDT)	Benefit (BDT)
i)	Health Benefit	5000	-	20	1000	280.00	280,000.00
ii)	Income support	0	5,000	20	1000	60,000.00	60,000,000.00
					Total Benefit (BDT)		**60,280,000.00**
					Total Benefit (USD)		**726,265.06**

Output 2.1. Climate-resilient infrastructure built to protect life and prevent asset loss.

Sl.	Contents		Loss (BDT)	Damage Adjustment (%)	Benefit (BDT)
ii)	House Assets				
	Bed		1000	20	200.00
	Bed Items		1000	70	700.00
	Stove(mud)		200	100	200.00
	Utensils		2000	20	400.00
	Cloths		320	30	96.00
	Furniture	Cloths rack	800	50	400.00
		Table	300	50	150.00
		Chair	450	50	225.00
		Almirah	2000	20	400.00
			Total Benefit Derived per family (BDT)		**2,771.00**
			Total Benefit Derived per 64 family (BDT)		**177,344.00**
			Total Benefit Derived per 64 family (USD)		**2,136.67**

Output 2.2. Embankments repaired and innovative model for community embankment management introduced.

Sl.	Contents	Total lands (hectare)	Cost of crop per hectare (BDT)	Benefit (BDT)
ii)	Crop loss protection from river bank erosion	50	40,000	2,000,000.00
iii)	Land loss	50	247,000	12,350,000.00
	Total Benefit (BDT)			**14,350,000.00**
	Total Benefit (USD)			**172,891.57**

Output 2.3. Climate-resilient investment on chars promoted through climate hazard maps and expanded cyclone early warning systems.

Sl.	Contents	No. of household	Per HH Loss (BDT)	Total loss (BDT)	Adjustment (%)	Total Benefit Derived
i)	Housing	5000	22,325	111,625,000	25	27,906,250.00

ii)	Sanitation	5000	1,000	5,000,000	25	1,250,000.00
iii)	Water source	5000	240	1,200,000	25	300,000.00
iv)	Health	5000	1200	6,000,000	10	600,000.00
	Total Benefit (BDT)					**30,056,250.00**
	Total Benefit (USD)					**362,123.49**

Output 2.4. Cyclone Preparedness Programme (CPP) modernised, made gender-responsive, and expanded to provide timely cyclone early-warning and response at scale.

Sl.	Contents	No. of people	Per capita Benefit/month (BDT)	Benefit (BDT)	Adjustment (%)	Total Benefit Derived (BDT)/year
iii)	Early Warning and Response	108,965	500	54,482,500	5%	2,724,125.00
	Total Benefit (BDT)					**2,724,125.00**
	Total Benefit (USD)					**32,820.78**

Sl.	Contents	Total Household	Adjustment (%)	Total Benefitted Household/People	Benefit per unit (BDT)	Total Benefit per year (BDT)
i)	Health benefit	5000	10	500	1200	600,000.00
ii)	Labor cost	5000	30	1500	9000	13,500,000.00
	Total Benefit (BDT)					**14,100,000.00**
	Total Benefit (USD)					**169,879.52**

Output 3.1 Climate-resilient agriculture implemented and supported at a community level.

Sl.	Contents	Total land (acre)	Amount of crops per acre (m.ton)	Cost per m.ton (BDT)	Adjustment (%)	Total Benefit (BDT)
i)	Production benefit (paddy mainly)	5000	1.82	2500	10	2,275,000.00
ii)	Crop diversification	5000	1.82	2500	10	2,275,000.00
iii)	Market Linkage	5000	1.82	2500	10	2,275,000.00
	Total Benefit (BDT)					**6,825,000.00**
	Total Benefit (USD)					**82,228.92**

Output 3.2 Diversified livelihoods developed and supported for the most vulnerable households.

Sl.	Contents	No. of benefitted woman	Benefit per woman/year (BDT)	Total Benefit derived (BDT)
i)	Sewing machine	150	75,000	11,250,000.00
ii)	Handicrafts	150	15,000	2,250,000.00
iii)	Livestock	200	3000	600,000.00
iv)	Poultry	100	30,000	3,000,000.00
v)	Shop	100	10,000	1,000,000.00
vi)	Homestead gardens	100	3,600	360,000.00
vii)	Net making	50	10,000	500,000.00
	Total Benefit (BDT)			**18,960,000.00**
	Total Benefit (USD)			**228,433.73**

Output 4.2. Knowledge and awareness generated to promote climate resilient approaches and strategies.

Sl.	Contents	No. of people	Per capita Benefit/month (BDT)	Benefit (BDT)	Adjustment (%)	Total Benefit Derived (BDT)/year
i)	Employment benefit	30	12,000	-	-	360,000
ii)	Time saving benefit	30	6000	-	-	180,000
iii)	Awareness campaign	144019	3,000	432,057,000	10%	43,205,700
	Total Benefit (BDT)					**43,745,700**
	Total Benefit (USD)					**527,057**

Annex N: UNDP Fees for Support to Adaptation Fund Project

Category	Services Provided by UNDP	UNDP Fee (8.5%)
Identification, Sourcing and Screening of Ideas	Provide information on substantive issues in adaptation associated with the purpose of the Adaptation Fund (AF). Engage in upstream policy dialogue related to a potential application to the AF. Verify soundness & potential eligibility of identified idea for AF.	$ 39,152
Feasibility Assessment / Due Diligence Review	Provide up-front guidance on converting general idea into a feasible project/programme. Source technical expertise in line with the scope of the project/programme. Verify technical reports and project conceptualization. Provide detailed screening against technical, financial, social and risk criteria and provide statement of likely eligibility against AF requirements. Determination of execution modality and local capacity assessment of the national executing entity. Assist in identifying technical partners. Validate partner technical abilities. Obtain clearances from AF.	$ 117,457
Development & Preparation	Provide technical support, backstopping and troubleshooting to convert the idea into a technically feasible and operationally viable project/programme. Source technical expertise in line with the scope of the project/programme needs. Verify technical reports and project conceptualization. Verify technical soundness, quality of preparation, and match with AF expectations. Negotiate and obtain clearances by AF. Respond to information requests, arrange revisions etc.	$ 156,609
Implementation	Technical support in preparing TORs and verifying expertise for technical positions. Provide technical and operational guidance project teams. Verification of technical validity / match with AF expectations of inception report. Provide technical information as needed to facilitate implementation of the project activities. Provide advisory services as required. Provide technical support, participation as necessary during project activities. Provide troubleshooting support if needed. Provide support and oversight missions as necessary. Provide technical monitoring, progress monitoring, validation and quality assurance throughout. Allocate and monitor Annual Spending Limits based on agreed work plans. Receipt, allocation and reporting to the AFB of financial resources. Oversight and monitoring of AF funds. Return unspent funds to AF.	$ 352,371
Evaluation and Reporting	Provide technical support in preparing TOR and verify expertise for technical positions involving evaluation and reporting. Participate in briefing / debriefing. Verify technical validity / match with AF expectations of all evaluation and other reports Undertake technical analysis, validate results, and compile lessons. Disseminate technical findings	$ 117,457
Total		$783,047

Annex O: Letter of Endorsement from Bangladesh Government