# POST DISASTER NEEDS ASSESSMENT

## BANGLADESH: FLOODS 2022

JANUARY 2023

**Ministry of Disaster Management and Relief**
Government of the People's Republic of Bangladesh

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# FOREWORD

I am pleased to see the results of this Post-Disaster Needs Assessment (PDNA) that has been carried out to estimate the damage and loss that occurred due to the floods that devastated the north-eastern districts of Bangladesh during May and June 2022. The PDNA not only estimates the costs associated with the floods but also assesses the recovery and reconstruction needs required to help the region get back on its feet and improve its future resilience to the impacts of climate change.

The haor region that bore the brunt of the floods represents a critical ecosystem that provides value both in terms of its economic and environmental productivity. The more than 1-in-100-year floods of 2022 dramatically reduced agricultural output in the worst affected districts, washed out thousands of tube-wells on which people depend for their drinking water supplies, caused extensive damage to embankments and culverts that help manage the flow of water, and seriously affected the rural road network that people rely on for their livelihoods and access to services.

The recovery framework presented in the PDNA provides a basis on which all government agencies can work together with bilateral and multilateral partners, as well as national and international non-governmental organizations, and local communities to develop infrastructure, livelihoods, and services that are more resilient to the increased intensity and variability of floods brought about by rising global temperatures due to climate change.

The Government has already prepared comprehensive plans for accelerating progress towards achieving greater resilience to disasters and the impact of climate change through the *National Plan for Disaster Management, National Adaptation Plan (2023-2050), Bangladesh Delta Plan 2100, and the Master Plan of Haor Area*. I look forward to working with all concerned partners to see that as we enhance the economic, environmental, and social sustainability of the region, we also ensure no one is left behind in these efforts.

I would like to thank Mr. Edimon Ginting, Country Director, Asian Development Bank for the generosity of providing the technical support.

**Dr. Md. Enamur Rahman, MP**
Honorable State Minister
Ministry of Disaster Management and Relief

# FOREWORD

Bangladesh is a disaster prone country due to its unique geographical location, geological setting and low-lying topography. The country faces numerous disasters including flood, cyclone, tidal surge, riverbank erosion, earthquake and landslide on a regular basis. The unprecedented floods that struck the north-eastern region of the country, including haor wetland area, in May and June 2022 caused loss of life, properties and environment.

The progress and actions Bangladesh has taken to improve disaster preparedness and response to disasters in coastal areas is globally recognized. Our efforts to mobilize, support, and empower Cyclone Preparedness Program (CPP) volunteers along with other volunteers mean that communities are warned in advance of disasters and, as a result, far fewer people get affected by disasters. We now have the knowledge and experience to bring the same capacity to bear in our inland communities at growing risk from the effects of climate change.

Minimizing the loss of human life following a disaster is an important step in building disaster preparedness; however, it is not sufficient to ensure timely and adequate recovery from the loss of income and reconstruction of damaged physical assets. To determine the size and scope of a recovery program, we must carefully gather and analyze available information on the damage and loss caused by each disaster and determine the needs for recovery and reconstruction.

Furthermore, we cannot simply put back what existed before a disaster as we know that status quo was not able to cope with the disaster that happened. We must instead adopt a Build Back Better (BBB) approach that strengthens resilience by adopting a 'whole-of-society' approach with a view to rebuilding assets, restoring livelihoods, and strengthening governance and capacity, especially at the local level. This approach supports one of the four priority action plans we have set in the National Plan for Disaster Management that was published in 2020.

This is why, I am glad to see the release of this Post-Disaster Needs Assessment (PDNA) for the floods of 2022. It builds on the efforts of the Ministry of Disaster Management and Relief to collect and collate information immediately after the disaster struck and goes further by carrying out a detailed in-depth analysis of the damage, loss, and needs resulting from the disaster. The PDNA adds important analysis of the broader macroeconomic impacts and assesses the human impacts. The PDNA concludes with presentation of a Recovery Framework that puts the principle of BBB at the centre of our recovery effort and will guide the 'whole-of-society' approach needed across all levels of government, local communities, civil society, the private sector, and the international community.

**Md. Kamrul Hasan, ndc**
Secretary
Ministry of Disaster Management and Relief

# ACRONYMS

| | |
|---|---|
| **ADB** | Asian Development Bank |
| **BHWDR** | Bangladesh Haor and Wetland Development Board |
| **BR** | Bangladesh Railway |
| **BUET** | Bangladesh University of Engineering and Technology |
| **BWDB** | Bangladesh Water Development Board |
| **CBO** | Community-based organization |
| **CReLIC** | Climate Resilient Local Infrastructure Centre |
| **DAE** | Department of Agricultural Extension |
| **DDM** | Department of Disaster Management |
| **DPHE** | Department of Public Health Engineering |
| **DTW** | Deep tube-well |
| **EAL** | Emergency Assistance Loan |
| **ERD** | Economic Relations Division |
| **EU** | European Union |
| **HCTT** | Humanitarian Coordination Task Team |
| **IFAD** | International Fund for Agricultural Development |
| **JICA** | Japan International Cooperation Agency |
| **km** | Kilometer |
| **LGED** | Local Government Engineering Department |
| **MoDMR** | Ministry of Disaster Management and Relief |
| **NAWG** | Needs Assessment Working Group |
| **NGO** | Non-governmental organization |
| **PDNA** | Post-Disaster Needs Assessment |
| **RAP** | Recovery Assessment and Plan |
| **RF** | Recovery Framework |
| **SOD** | Standing Orders on Disaster |
| **STW** | Shallow tube-well |
| **UNDP** | United Nations Development Programme |
| **WASH** | Water Supply, Sanitation, and Hygiene |

**CURRENCY UNIT**

United States Dollar ($) 1 = 103.81 Bangladeshi Taka (Tk) (3 December 2022)
Bangladeshi Taka (Tk)1 = 0.0096 United States Dollar ($)

# GLOSSARY OF TERMS

- Damage is defined in the PDNA as the direct costs of destroyed or damaged physical assets valued in monetary terms, with costs estimated based on replacing or repairing physical assets and infrastructure at the pre-crisis replacement cost. Based on the reported level of damage, the status of each asset was assigned as either undamaged, partially damaged, or completely damaged. For the damage estimation, costs were computed based on the number of damaged facilities, their physical condition (partially damaged or completely damaged), and the estimated pre-crisis unit cost of each asset class.

- Loss is defined as the monetary value of changes in economic flows caused by the disaster. Damage and loss collectively constitute the overall effects of the disaster. Typical loss consists of the decline in output in productive sectors and the decrease in revenues and increase in operational expenses in the provision of services, e.g., in the social and infrastructure sectors.

- Reconstruction and recovery needs are derived from the estimated monetary value of damage and loss, but they are not equal to the sum of these estimates. Recovery and reconstruction needs are calculated in terms of replacement costs at current prices and adding a premium related to the principle of build back better, including climate proofing, modernized designs, and sustainability standards. Recovery requirements may include non-physical factors, such as personnel, equipment, and materials necessary to restore assets and services to their pre-disaster level. The rate of inflation, price spikes caused by the volume of construction materials, and/or increased insurance premiums are also considered when determining requirements. While the needs estimated include a build back better premium for rebuilding, overall needs are greater because the estimate does not include the full set of investments required to achieve long-term resilience to future climate shocks, nor does it include provision for the full recovery and reconstruction needs of affected private entities, though options for how the government can assist are suggested.

# ACKNOWLEDGEMENTS

The Post-Disaster Needs Assessment (PDNA) for the 2022 floods in Bangladesh has been prepared under the leadership of the Ministry of Disaster Management and Relief, supported by the Asian Development Bank. The report has been guided and informed by government agencies and departments including the Economic Relations Division of the Ministry of Finance, Local Government Division of the Ministry of Local Government, Rural Development and Co-operatives, Ministry of Water Resources, Ministry of Agriculture, and Ministry of Railways and their respective implementing departments. We are indebted to the Asian Development Bank for providing the technical support for this PDNA. The Ministry of Disaster Management and Relief would specially thank Mr. Edimon Ginting, Country Director, Bangladesh Resident Mission for the generosity of providing the technical support. The Ministry also thanks Mr. Tika Limbu, Principal Portfolio Management Specialist and Ms. Marjana Chowdhury, Water Resource Specialist for the lead support to the PDNA process. Other PDNA team members included Mr. Andrew Parker, Team Leader; Mr. Golam Mahabub Sarwar Deputy Team Leader; Mr. Luthfur Rahman, Road Specialist; Mr. Fahim Istiaque, WASH Specialist; Mr. Makbul Hossain, Water Resources Management Specialist; Mr. S M Atikullah, Agriculture Specialist; Mr. Asif Zaman, Economist. Mr. Sifayet Ullah, Mr. Mahbub Rabbani, Mr. Soon Chan Hong, Mr. Jiangbo Ning, Ms. Nasheeba Selim, Ms. Farhat Chowdhury, Ms. Kazi Akhmila Mr. Amrita Das, Mr. Sohel Rana, Mr. Masahiro Nishimura, Ms. Kyla Matias, Mr. Rabindra Osti, Mr. Pushkar Srivastava, and Mr. Parimal Sarkar from Asian Development Bank have reviewed and provided input to the PDNA, which is highly appreciated.

Special efforts of agency focal persons Mr. Prabir Kumar Goshwami (BWDB), Mr. Areef Anowar Khan (DPHE), Mr. Taufiqur Rahman (DAE), Mr. Md. Ali Akhtar Hossain (LGED), and Mr. Mohammad Mohiuddin Hossain Arif (BR) are highly commended.

Support from field officers of different agencies is recognized, especially, Mr. Md. Abul Kasem, Executive Engineer, Sunamganj, DPHE; Mr. Musharraf Hussain Khan, Additional Director, DAE, Sylhet Division; Mr. Mohammad Khayer Uddin Mollah, Deputy Director, DAE, Sylhet District; Mr. Mohammad Anisuzzaman, Additional Deputy Director, Sylhet District, DAE; Mr. Mamun Howlader, Executive Engineer, Sunamganj District, BWDB; Mr. Pritam Paul, Sub-divisional Engineer, Sunamganj, BWDB; Mr. Anil Kumar Biswash, Superintending Engineer, LGED, Sylhet, Mr. Mohammad Faruq Ahmaed, Executive Engineer, LGED, Sylhet; and Mr. Md. Shah Alam, Executive Engineer, Sylhet, LGED; and Mr. Jewel of BR.

The PDNA also benefited from valuable inputs from bilateral and multilateral partners, UN agencies, NGOs, and community members from areas affected by the disaster. The contribution and support of UNRC and NAWG for providing the data and analytics is highly appreciated. The PDNA team also gratefully acknowledges all those who have contributed to produce this document but are not mentioned above.

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# EXECUTIVE SUMMARY

## Context

Devastating floods during May–June 2022 severely affected 7.2 million people in 9 north-eastern districts of Bangladesh: Sylhet, Sunamganj, Moulvibazar, Habiganj, Kishoreganj, Netrakona, Brahmanbaria, Mymensingh and Sherpur.[1] The floods caused loss of lives, severe damage to infrastructure and other assets, and disrupted economic activities, inflicting heavy loss on agriculture and aquaculture. About 9 million people were stranded and became homeless without electricity, food, and water due to the floods and water congestion.[2] According to the Bangladesh Water Development Board (BWDB), 2,458 mm of rainfall was recorded in just three days from 15–17 June 2022 upstream in Cherapunji in India, which is situated near north-east Bangladesh. This is the highest precipitation in 122 years history since the rainfall recording has started. Among the 9 districts affected by the major floods in 2022, Sylhet and Sunamganj experienced major damage. The government's Flood Forecasting and Warning Centre (FFWC) estimated about 94% of Sunamganj and 84% of Sylhet districts were submerged, leaving more than 2 million people near the Surma-Kushiyara riverbanks in the two districts homeless with widespread loss of property and assets. Between 17 May to 22 August 2022, the floods killed 141 people in Bangladesh and 80 deaths were from Sylhet division.[3]

Bangladesh has already taken critical steps to develop long-term policies and plans to respond to disaster risks and climate change. However, the intensity of the 2022 floods and extent to which their impacts fell on some of the poorest areas, whose people are highly dependent on agriculture for their livelihood, underlines the countries continuing vulnerability to weather- and climate-related disasters. These extreme events underscore the urgent need to redouble efforts and accelerate efforts to prioritize, finance, and implement high-impact investments that strengthen adaptation to climate and disaster risks. Simultaneous multiple shocks, including natural hazards, COVID-19, rising inflation, an energy crisis, and fiscal challenges, continue to compound the impacts. Enhanced climate resilience is critical to breaking the nation's recurring cycle of disaster-induced poverty.

## Humanitarian response

Immediately following the disaster, the government distributed $7 million worth of rice, food baskets, tin roofs, children's meals, and animal food. Cash and housing allowances were also provided. In June 2022, the Humanitarian Coordination Task Team (HCTT), co-chaired by the Ministry of Disaster Management and Relief (MoDMR) and the UN Resident Coordinator's office conducted a preliminary impact assessment through the Needs Assessment Working Group (NAWG).[7] The NAWG assessment prioritized restoring farmers' livelihoods after the floods and recommended an early recovery and reconstruction effort to repair damaged houses, embankments, roads, safe drinking water sources, and sanitation facilities. The HCTT created a Flash Flood Humanitarian Response Plan 2022 (July–December 2022) in July 2022, calling for $58.4 million in humanitarian aid for 1.5 million flood-affected persons in five districts. The response strategy focused on food security and nutrition, shelter, water supply, sanitation, and hygiene (WASH), and flood protection in the five most heavily affected districts: Sunamganj, Netrokona, Sylhet, Habiganj, and Moulvibazar. As of 22 December 2022, the Humanitarian Response Plan 2022 has raised $20.45 million out of $58.4 million requested.

[1] The first flood occurred in May 2022 for 10 days affecting Zakiganj, Kanaighat, Beanibazar and Gowainghat upazilas (subdistricts) of Sylhet; and the second wave started on 15 June 2022 that hit Sylhet and Sunamganj districts. An estimated 7.2 million people of nine districts in north-east Bangladesh- Sylhet, Sunamganj, Moulvibazar, Habiganj, Kishoreganj, Netrakona, Brahmanbaria, Mymensingh and Sherpur were severely affected.

[2] Situation Report of World Health Organization 1 July 2022.

[3] Dhaka Tribune 22 August 2022 https://www.dhakatribune.com/bangladesh/2022/08/22/flood-death-toll-rises-to-141-in-bangladesh.

[7] Under the HCTT, a NAWG has been formed to act as a platform for government and nongovernment humanitarian agencies on flood responses.

## Summary of damage, loss, and needs

Immediately following the floods, the provisions of the *Standing Orders on Disaster 2019*[8] were triggered and MoDMR led a bottom-up process using the D-Form system to generate an initial estimate of the financial cost of damage caused by the disaster. Information from each ward and upazila was aggregated at the district level based on data collected across 13 sectors.[9] Based on the D-Form submissions an initial estimate of total damage at Tk564,984 lac ($547.6 million) across all 18 districts affected by the floods.

To provide an up-to-date and more detailed analysis of priority sectors in highly-affected areas, the Government has conducted a post-disaster needs assessment (PDNA) between November 2022–January 2023, with support from the Asian Development Bank. The PDNA assessed the impact of the 2022 floods on 4 major sectors that accounted for 62% of total damage and have substantial recovery needs—transport (rural roads and railways); water resources management; WASH; and agriculture and livestock—with a geographic focus on 9 contiguous north-eastern districts, which together accounted for approximately 68% of total damage.[10]

Quantitative data provided by the sector agencies was supplemented by field visits and stakeholder consultations with some communities affected by the floods, development partners, and civil society organizations. Based on the in-depth, field-level validation and updating process that was conducted for the PDNA, damage, loss, and needs for the 4 sectors in 9 districts totaled Tk420,944 lac ($405.5 million), Tk232,026 lac ($223.5 million), and Tk602,709 lac ($580.6 million) respectively (Figure 1).

## Macroeconomic and human impact

Economic activity was disrupted, and livelihoods severely impacted, with poverty expected to increase. The economic impact of the disaster will be strongly felt in the most affected districts. However, the size and duration of shocks varies across locations and households depending on the intensity of the flooding, their existing socioeconomic status, as well as the quality and speed of relief and reconstruction efforts. Even in the best-case scenario, reversing these negative shocks will take considerable time, and various losses, such as losses to human capital and loss of land productivity, could set in motion more long-lasting declines in welfare that will require specific attention. Vulnerable groups, such as women, children, elderly, and people with disabilities, are likely to be disproportionally affected by the floods due to their limited access to social protection and coping mechanisms.

The Government is providing immediate relief to the impacted communities and supporting early recovery, while aiming to maintain macroeconomic stability and fiscal sustainability. The value of lost output can be mitigated by the anticipated increase in recovery and reconstruction spending; however, significant international support will be needed to realize the full extent of the country's commitment to strengthening the resilience. Evidence from previous disasters in Bangladesh suggests that economic impacts may persist for an extended period, damaging the productive capacity of the economy and reducing growth prospects over the medium term.

Even before the 2022 floods, many of the disaster-affected areas had higher levels of monetary and non-monetary deprivation, particularly among households in north-eastern districts, where more than 40% of upazilas have high or very high poverty rates. Poverty will worsen for households that were already impoverished before the floods.

[8] Government of Bangladesh. 2019. Standing Orders on Disasters. Dhaka.
[9] The sectors are *infrastructure* – roads, bridges, and culverts; WASH; water resources management; electricity; telecoms; *productive* – agriculture, livestock, and fisheries; industry; *social* – housing; education; health; religious institutions; *cross-cutting* – forestry; environment.
[10] The 9 districts are: Sylhet, Sunamganj, Moulvibazar, Habiganj, Mymensingh, Netrokona, Sherpur, Kishoreganj, and Brahmanbaria.

**Household welfare is likely to suffer in at least four ways:**

(i) loss of household income, employment, and livelihoods because of destroyed crops, livestock death, or inactive businesses;

(ii) loss of assets such as homes, livestock, productive equipment, and household durables;

(iii) rising food prices because of shortages from lost food stocks and lower harvests; and

(iv) lower human development outcomes because of disease outbreaks and disrupted learning.

## Bangladesh's green, inclusive, resilient recovery framework

The devastating floods serve as a wake-up call to strengthen ongoing efforts to address underlying vulnerabilities related to natural disasters, climate change, and their intersection with other shocks. Accelerated action is required to intensify efforts to integrate natural disaster and climate change resilience into development planning, budgeting, and asset management. This necessitates a collaborative and inclusive approach that unites civil society, government, the private sector, academia, think tanks, and the international community around a shared vision. Stakeholders will be consulted to help shape the scope, design, institutional arrangements, and a framework for monitoring and accountability for a comprehensive resilient recovery program. Such a program will prioritize the affected population's urgent needs while ensuring that results are delivered in an efficient, equitable, and transparent manner. Building on global recovery best practices and incorporating Bangladesh's specific socioeconomic, cultural, and institutional context through a people-centric approach will be critical.

The recovery and reconstruction process will help the country achieve its long-term goal of becoming a climate resilient Bangladesh, as outlined in the National Plan for Disaster Management (NPDM), Bangladesh Delta Plan 2100 (BDP2100), Mujib Climate Prosperity Plan (MCPP) 2021, and National Adaptation Plan (NAP) 2022. The framework is intended to achieve a green, inclusive, and resilient recovery by taking a whole-of-society approach, resulting in long-term development for people and the country. It is supported by three major pillars and an underlying foundation. The recovery framework's underlying foundation is to Rebuild Back Better (BBB) using a people-centric socioeconomic recovery and promoting systematic resilience to the effects of climate change and disasters.

**The BBB foundation will support three pillars:**

(i) critical infrastructure, services, and assets recovery and reconstruction;

(ii) livelihood and job restoration; and

(iii) strengthening governance and stakeholder capacity for recovery and reconstruction, particularly community capacity.

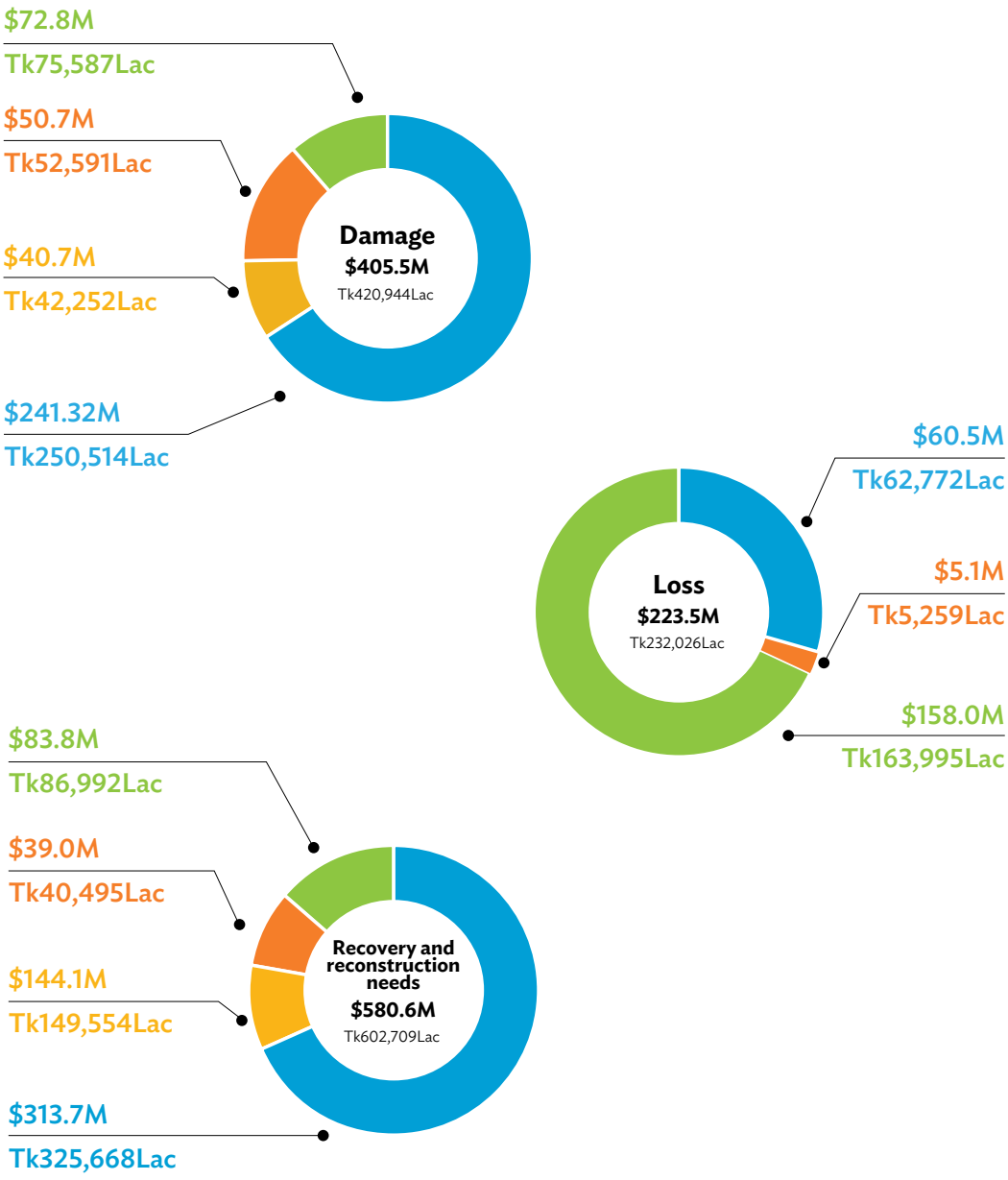
## Next actions

The recovery framework outlines how to respond to the PDNA findings, including the operationalization and prioritization of plans and strategies to ensure that interventions are targeted at the most affected sectors. Sector-based and programmatic approaches will be implemented in affected areas from mid-2023 to mid-2026, while long-term recovery and reconstruction activities lasting more than three years will be integrated into national development planning.

Further work will be prioritized based on the urgency of needs, institutional capacity, and financing feasibility, including the development of detailed recovery action plans, financing plans, and institutional arrangements. This will ensure that the Government leads an efficient, equitable, coordinated, and transparent delivery that is supported by the international community. Despite being area-specific, the PDNA and the development of the recovery framework provide an opportunity to embed resilience to climate change and disasters more broadly within Bangladesh's overall planning and budgeting systems.

Figure 1

Damage, loss, and needs




**Legends**

- Rural roads, bridges, culverts, and railways
- Water resources
- Water supply, sanitation, and hygiene
- Agriculture and livestock

**Note:** Damage, loss, and needs are estimated for 4 sectors covering 9 districts - Sylhet, Sunamganj, Moulvibazar, Habiganj, Mymensingh, Netrokona, Sherpur, Kishoreganj, and Brahmanbaria.

**Note:** Source: PDNA team estimates based on inputs from government agencies

## Development partner coordination

The needs identified in the PDNA constitute a part of the overall needs to build long-term resilience in the nine northeastern districts. There are ongoing programs of key development partners (DPs), including IFAD, JICA and WB, that have committed financial resources in the affected areas which are also contributing to efforts to enhance resilience in the short-, medium- and long-term. In addition, UNDP completed a needs assessment in December 2022 on community-led housing recovery costing an estimated $296 million. The government is also supporting privately-owned shelter recovery and social protection payments from its own resources.

Given the ongoing efforts of other DPs, the PDNA focused on sectors and geographical areas (4 priority sectors and 9 districts) support, which are not being covered by the programs of other DPs. The needs identified by the PDNA will be partially addressed by ADB's proposed EAL, which is expected to provide $230 million of the estimated $580.6 million scope of needs. Other development partners are expected to contribute to the PDNA needs by repurposing their ongoing programs or through new assistance, including:

- WB is expected to repurpose some parts of its $500 million Resilient Infrastructure for Adaptation and Vulnerability Reduction project, approved on 25 May 2022. The project directly supports the flood-damaged areas through the construction of climate-resilient flood shelters and community infrastructure and capacity development on disaster preparedness and response.

- JICA has provisioned for a quick recovery fund to rehabilitate the damaged infrastructure after the disaster through its ongoing program ($150 million) on flood management, rural infrastructure, agriculture, and fishery in five flood-affected districts and it is also considering for a new project.

- IFAD's Haor Infrastructure and Livelihood Improvement Project ($133.3 million) is expected to cover some support for flood affected road infrastructure in the five floods affected Haor districts before its completion in late 2023.

# 1 BACKGROUND

**BACKGROUND**

Topography, geography, and socioeconomic factors make Bangladesh vulnerable to floods, cyclones, and storms. The country was ranked as the seventh most disaster-affected country from 2000–2019 by the Global Climate Risk Index.[11] Annually, weather- and climate-related disasters cost the country about 2% of GDP. Floods and riverbank erosion affect more than a million people annually. Every three to five years, floods inundate up to two-thirds of the country. These extreme disaster events have a significant impact on people and the economy through their direct effect on loss of human and animal life and destruction of property and infrastructure, as well as indirect effects such as job loss and income interruption, and the opportunity cost of resources that must be diverted to relief and rehabilitation. Repeated extreme weather events worsen the poverty cycle making it more difficult for poor households to return quickly to their pre-disaster standard of living. The Intergovernmental Panel on Climate Change (IPCC) predicts "wetter rainy seasons and drier dry seasons" and more violent monsoon floods in the South Asia region.[12] Responding to hazard risks is therefore critical for supporting the nation's pathway to sustainable economic development, while ensuring that the most vulnerable communities are not left behind as exposures and vulnerabilities to climate change and natural hazards increase.

As one of the 10 most climate-affected countries, climate change exacerbates Bangladesh's human and economic development challenges. Extreme weather has become more unpredictable and intense, affecting ecosystems, people, settlements, and infrastructure. With climate change, the magnitude and intensity of floods are increasing. The country is vulnerable to natural disasters and is ranked 28th most vulnerable and 35th least ready to address climate change by the ND-GAIN Index.[13]

Despite Bangladesh's significant achievement in reducing the human toll from the climate induced disasters, the country continues to face severe and increasing climate risks. Without urgent action, including further adaptation and resilience measures, the country's strong growth potential could be at risk, according to the World Bank Group's Country and Climate Development Report for Bangladesh.[14] The report estimates that by 2050, without the urgent action on adaptation and resilience measures, a third of agricultural GDP could be lost and 13 million people could become internal climate migrants. In case of a severe flooding, GDP could fall by as much as 9%. Average tropical cyclones cost Bangladesh about $1 billion annually.

## A. The *haor* region

The haor region comprises seven north-eastern districts of Sylhet, Sunamganj, Moulvibazar, Habiganj, Netrokona, Kishoreganj, and Brahmanbaria.[15] It accounts for 13% (2.0 million hectares) of country's total area and 12% (20 million) of country's total population. Agriculture (mainly boro rice) and aquaculture are the main source of livelihoods in the region. Farmers cultivate only one crop annually (boro rice during November–May) as land remains under water during the monsoon season (June–October). Boro rice production in the haor region is critical for food security and livelihoods of the haor region and beyond to the whole country. Rice production in the haor region accounts for 18% of the country's total boro rice production and 17% of country's total rice production. Frequent pre-monsoon floods (March–April) and floods negatively affect the harvesting and/or storage of boro rice, causing loss of food, income, and employment resulting in increased poverty, food insecurity, malnutrition, short-term outmigration, and more precarious livelihoods. Poverty and food insecurity problems in the haor region are severe compared to other parts of Bangladesh.

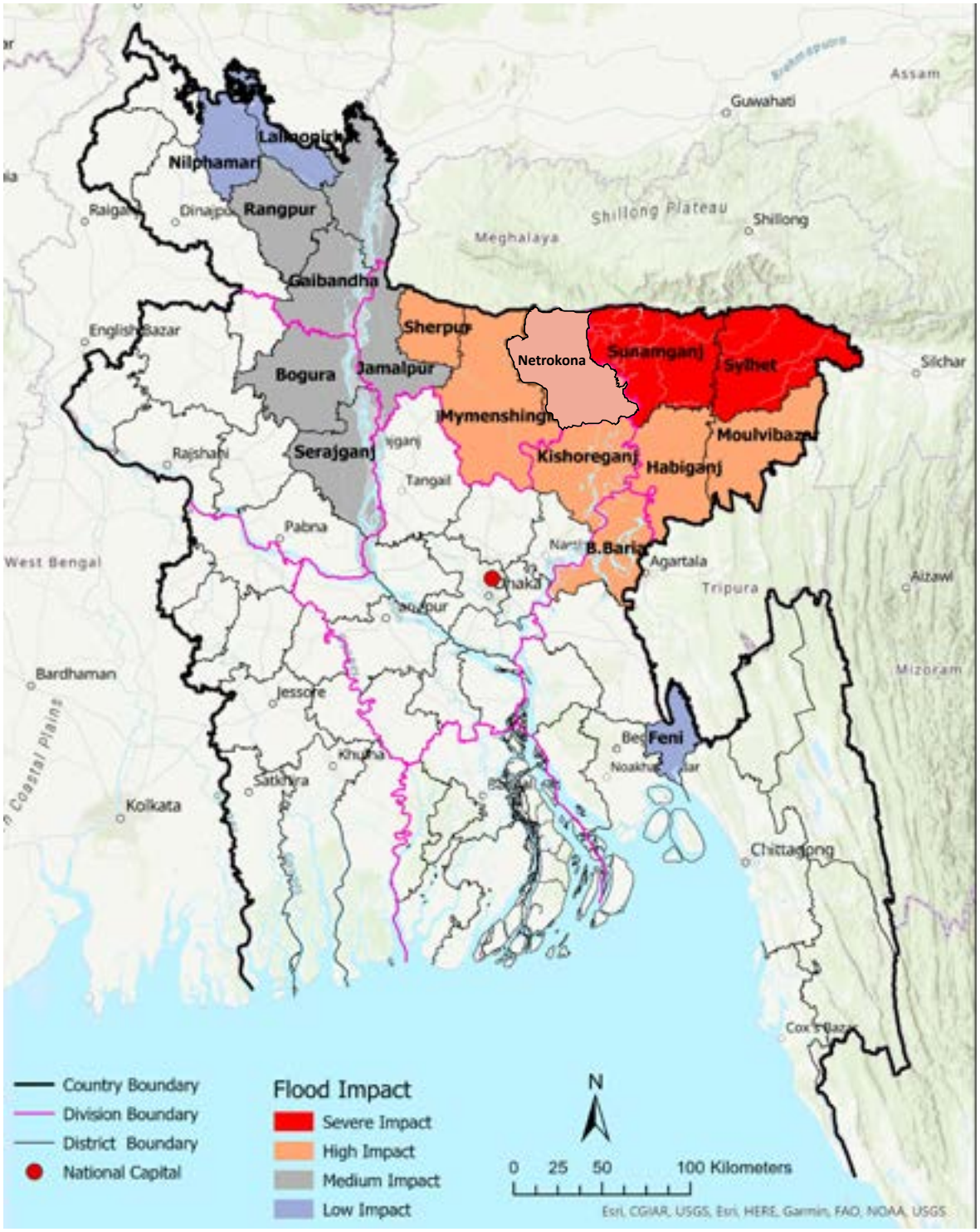
[11] Eckstein, D., Kunzel, V., and Schafer, L. 2021. *Global Climate Risk Index 2021*. Germanwatch, Bonn.
[12] Accessible at: https://www.ipcc.ch/report/ar6/wg1/chapter/atlas/.
[13] ND-GAIN Index (dataset). "Bangladesh." *https://gain-new.crc.nd.edu/country/bangladesh.*
[14] The World Bank Group, 2022. Bangladesh Country Climate and Development Report. Washington DC.
[15] Haors are bowl-shaped depressions between the natural levees of a river subject to monsoon flooding every year. They are mostly found in the north-eastern region of Bangladesh, known collectively as haor basin covering an area of approximately 24,500 square km, within which there are altogether 411 haors comprising an area of about 8,000 square km (Chakraborty, T. (2005). *Management of Haors, Baors, and Beels in Bangladesh.* International Lake Environment Committee Foundation, Shiga.

## B. The 2022 floods

Bangladesh experienced record-breaking floods with flash floods in May compounded by further flooding in June 2022 that affected 7.2 million people.[16] According to the Bangladesh Water Development Board (BWDB), rainfall of 2,458mm, which fell in only 3 days from 15–17 June 2022, was recorded upstream in Cherrapunji in India, located near north-east Bangladesh—the highest 3-day precipitation in 122 years since rainfall records began. The Bangladesh Flood Forecasting and Warning Centre estimated that about 94% of Sunamganj and 84% of Sylhet districts were submerged, displacing more than 2 million people living near the Surma-Kushiyara river (Figure 2).

Figure 2

Flood affected districts



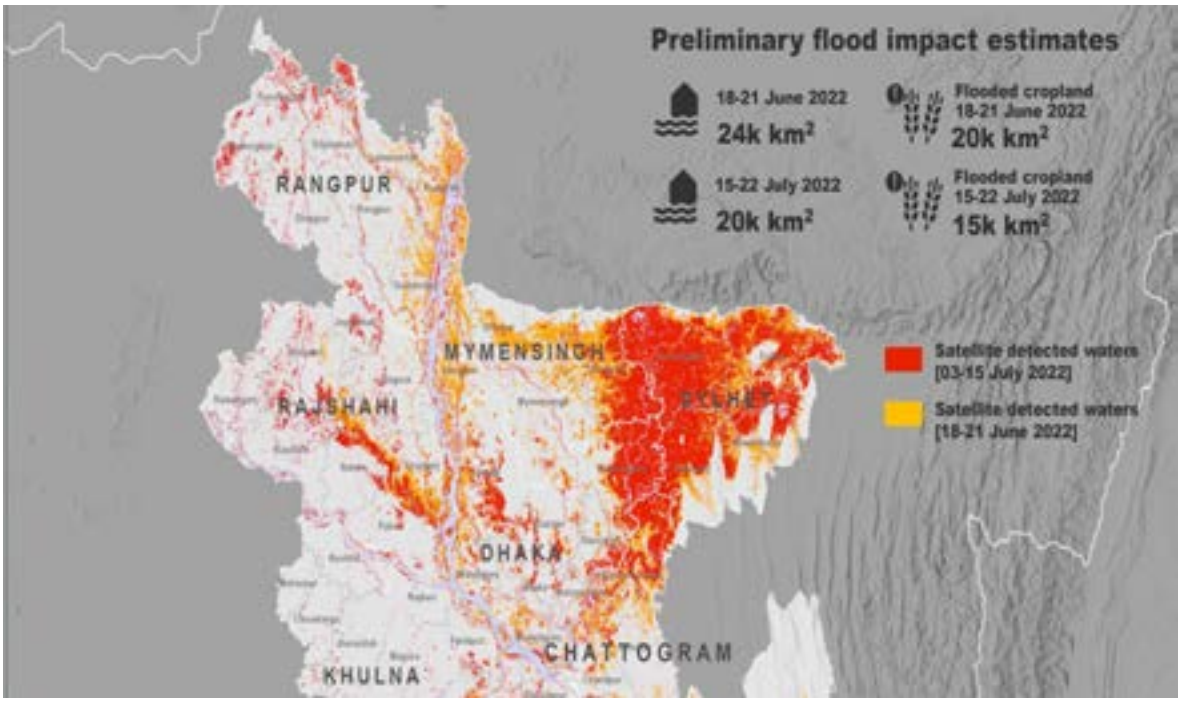

**Source:** Local Government Engineering Department, LGED

[16] Office of the UN Resident Coordinator Situation Update # 2; dated 22 June 2022.

A large area of north-east Bangladesh was inundated due to the floods (Figure 3). The disaster resulted in 141 fatalities;[17] damage to infrastructure, housing stock, and other physical assets; crop, livestock, and fishery loss; and disruption to basic services, earnings, and jobs.[18]

Figure 3

Extent of inundated area based on satellite-detected water




Source: UNITAR/UNOSAT

## C. Immediate response

Following the disaster, the government distributed $7 million worth of rice, food baskets, tin roofs, children's meals, and animal food; cash and housing allowances were also provided. During May 2022, various rapid assessments were undertaken by the Government and humanitarian agencies to assess immediate priorities for response. The main needs identified were for food security and nutrition covering food assistance, livelihoods support and cash for work; shelter due to the makeshift construction of many houses; and WASH with many tube-wells and latrines that were washed away. Other needs identified included: women and child protection, early recovery, education, health, and management of facilities for people displaced by the disaster.

Based on these initial assessments, the Humanitarian Coordination Task Team (HCTT), co-chaired by the Ministry of Disaster Management and Relief (MoDMR) and the UN Resident Coordinator's office through the Needs Assessment Working Group (NAWG)[19] issued a Flash Flood Humanitarian Response Plan 2022 (July–December 2022) in July 2022, calling for $58.4 million in humanitarian aid for 1.5 million flood-affected persons in five districts. The response strategy prioritized food security and nutrition, shelter, WASH, and flood protection in five districts: Sunamganj, Netrokona, Sylhet, Habiganj, and Moulvibazar. As of 22 December 2022, the Humanitarian Response Plan 2022 has raised $20.45 million out of $58.4 million.

[17] https://www.daily-sun.com/post/639559/Flood-death-toll-rises-to-141.
[18] See footnote 3.
[19] Under the HCTT, a NAWG has been formed to act as a platform for government and nongovernment humanitarian agencies on flood responses. CARE Bangladesh acts as a secretariat to the NAWG

# 2 OVERVIEW OF POST-DISASTER NEEDS ASSESSMENT

## A. Objectives, scope, and approach

The objectives of the PDNA for the 2022 floods in Bangladesh are to assess the cost and impacts of the damage and loss resulting from the disaster and the associated recovery and reconstruction needs required to restore the economy in the affected areas to their pre-disaster situation while ensuring greater resilience to future disasters. The PDNA presents a broad assessment of the macroeconomic and human impacts of the disaster; estimates of damage, loss, and needs with a defined sectoral and geographic focus; and a framework for recovery.

The PDNA follows a recognized methodology for assessing damage, loss, and needs that was jointly developed by the European Union (EU), the World Bank Group (WBG), and the United Nations (UN), which has been widely applied in post-disaster contexts to inform recovery and reconstruction planning. The recovery and reconstruction process outlined in the PDNA is intended to contribute to the country's long-term plans to achieve a climate-resilient Bangladesh—guided by existing plans of the Government, which include the National Plan for Disaster Management, Bangladesh Delta Plan 2100, Mujib Climate Prosperity Plan 2021, and National Adaptation Plan 2022. The PDNA serves as a foundation for future analytical assessments and reports, including a resilient recovery and reconstruction strategy and enabling a coordinated national and international effort for building back a more resilient Bangladesh.

**Geographic scope:**

The geographic coverage of the assessment provides an in-depth assessment of the 7 haor districts of Sylhet, Sunamganj, Moulvibazar, Habiganj, Netrokona, Kishoreganj, and Brahmanbaria, as well as Mymensingh and Sherpur districts that also experienced damage and loss from the disaster. These 9 districts accounted for 68% of overall damage estimated by MoDMR in the D-Forms.[20]

[20] The D-Forms are part of the Government's Standing Orders on Disaster 2019 that agencies are required to compile and submit to MoDMR and DDM as soon as possible after a disaster has struck. As the D-Form data were collected shortly after the 2022 floods and before a full assessment could be carried out in all areas, especially in remote areas, the data are likely to underestimate the overall damage and loss.

**Sectoral scope:**

In addition to a macroeconomic and human impact analysis, the PDNA focuses on damage, loss, and needs in 4 main sectors: rural roads, culverts, bridges, and railways; WASH; water resources management; and agriculture and livestock. These sectors accounted for 62% of overall damage estimated by MoDMR in the D-Forms.

**Estimation of damage, loss, and needs:**

Damage and loss were calculated relative to a pre-flood baseline, and the calculation of needs was based on the principle of build back better that incorporated consideration of improved designs based on climate adaptation and disaster resilience. In-depth analytical work was undertaken for selected sectors by specialists for a comparative pre- and post-disaster assessment of the infrastructure and services affected, which is summarized in Section 5. Damage, loss, and needs assessments are provided for the 4 sectors covered in the PDNA.

## B. Methodology

**Data collection:**

Two sources of data were used to develop the PDNA. First, data was used from MoDMR's D-Forms as an estimate of the total damage caused by the floods. D-Form information is generated through a bottom-up process that is based on collecting data on a wide range of indicators relating to physical damage to assets caused by the disaster. Second, in-depth analysis was conducted on selected sectors. Sector specialists mobilized by ADB coordinated with line agencies at the national level, including Local Government Engineering Department (LGED), Bangladesh Railway (BR), Bangladesh Water Development Board (BWDB), Department of Public Health Engineering (DPHE), and Department of Agriculture Extension (DAE). Subsequently, data were collected and validated at the district level from the five line agencies, together with field visits to selected sites to observe damage in situ. Data was collected from mid-November to mid-December 2022.

**Temporal scope:**

The PDNA analysis and recommendations focus on the impact and recovery and reconstruction needs directly related to the 2022 floods. The PDNA approach is time-bound, so overall damage, loss, and needs may be higher than what is reported in the PDNA as assessments continue to be updated based on more complete information. It is not expected, however, that the PDNA estimates on infrastructure and service delivery will increase significantly over time.

## C. Stakeholder engagement

The PDNA process adopted a whole-of-society approach, engaging with representatives and stakeholders from various segments of Bangladeshi society. Diverse participants from local communities, national and local government authorities, UN agencies, local and international NGOs, civil society organizations (CSOs), the private sector, academia, and development partner agencies participated in these engagements. This approach helped to inform the PDNA's findings, analyses, and recommendations on the emerging needs and priorities of the affected population, as well as the resilient recovery strategy outlined in this report. Special care was taken to involve stakeholders actively in the process of assessing damages, delivering aid, and reconstructing Bangladesh.[21]

[21] See Annex 1.

## D. Limitations and assumptions

**Data availability:**

The D-Form data was collected as soon as possible after the floods hit. Some remote areas were difficult to reach, with many areas remaining under water until September 2022. There was also substantial variation in how local agencies and officials generated estimates of damage—e.g., differences in unit costs for similar infrastructure across different areas. The D-Form data also focused mainly on physical damage to assets and does not include estimates of loss resulting in changes to economic flows caused by the disaster, nor does it include any estimate of recovery needs. In contrast, the in-depth assessment for four sectors benefited from being able to obtain the most up-to-data from the line agency offices at the district level based on field assessment. For rural roads, WASH, and agriculture and livestock, the value of economic loss was estimated.

Many of the assets damaged by the floods are in public ownership, e.g., roads, bridges, embankments; however, others are more under private ownership, e.g., agriculture, livestock, fisheries, tube-wells for water supply. Current data do not indicate the breakdown between public and private ownership.

**Inadequate baseline information:**

The absence of detailed baseline information at the district level made it challenging to systematically assess the effects of the disaster across all sectors and services. The PDNA addressed this where possible by working closely with line agencies at the district level to build up a picture of the pre-disaster situation.

**Data disaggregation:**

Sex-disaggregated data related to the disaster impacts was not available for the PDNA. It is nonetheless important to highlight that the disaster has created different challenges for recovery and access to services for women and girls, which is discussed further in Section 4.

# 3 MACROECONOMIC IMPACT ASSESSMENT

## A. Macroeconomic situation

Before the corona virus disease (COVID-19) pandemic, the economy of Bangladesh had recorded robust growth with 6.6% annual average GDP growth rate during FY2010-FY2019 (7.9% in FY2019). After suffering an economic slowdown in FY2020 at 3.4% GDP growth, economic activities quickly revived, resulting in 6.9% and 7.2% GDP growth in FY2021 and FY2022. The agriculture sector grew 2.2% in FY2022, driven by the growth of forestry and related services (5.1%) and animal farming (3.1%) subsectors, while the crops and horticulture subsector grew modestly by 1.1% mainly due to lower production of the boro rice crop. Meanwhile, industry and services sector output grew by 10.4% and 6.3% in FY2022. Within industry, manufacturing output growth reached its pre-COVID-19 level of over 12%.

However, the Russia Ukraine conflict, which has caused a significant increase in international energy prices and contributed to a global economic slowdown, has impacted the Bangladesh economy through widening external imbalance and rising inflation on top of the impact of the 2022 floods on food production. These negative impacts are expected to worsen in FY2023, as growth in the US and Europe, Bangladesh's main export destinations, are projected to fall further. Based on economic indicators early in FY2023, the Government has lowered its GDP growth target for FY2023 from 7.5% to 6.5%. Development partners such as ADB, World Bank and IMF have also revised down their GDP growth forecast for FY2023 between 6.0% to 6.6%. In coming months growth forecasts could be further revised down from their earlier projections of 6.7% to 7.2% made in early 2022 due to the prolonged impact of Russia Ukraine conflict.

Inflation increased from 5.6% in FY2021 to 6.2% in FY2022 due to post-COVID-19 strong recovery of domestic demand, higher global commodity prices. Amid the Russian invasion of Ukraine, devaluation of Taka against the US dollar, and impact of floods, it is expected that inflation will further rise in FY2023. While both revenue collection and expenditure fell short of target, while

public spending significantly increased in FY2022 due to the costs of increased subsidies due to the impact of Russian invasion of Ukraine. As a result, the budget deficit increased to 5.5% of GDP in FY2022 from 3.7% in FY2021. Fiscal pressure will further rise in FY2023 with the increased spending for economic recovery, social protection, and reconstruction of the damaged infrastructure from the 2022 floods. As a result, the budget deficit is estimated to further increase to 7.1% of GDP in FY2023.[22] The current account deficit significantly widened to 4.1% of GDP in FY2022 with higher import payments and decline in remittances and is expected to remain high in FY2023.

**Table 1: Key macroeconomic indicators FY2018-FY2022 (annual growth, %)**

| | FY2018 | FY2019 | FY2020 | FY2021 | FY2022 |
|---|---|---|---|---|---|
| Real GDP Growth(%) | 7.32 | 7.88 | 3.448 | 6.94 | 7.24 |
| a. Agriculture | 3.54 | 3.26 | 3.42 | 3.17 | 2.2 |
| b. Industry | 10.2 | 11.63 | 3.61 | 10.29 | 10.44 |
| c. Services | 6.55 | 6.88 | 3.93 | 5.73 | 6.31 |
| GDP Growth (at market price) | 13.55 | 11.83 | 7.42 | 11.35 | 12.64 |
| Private Consumption Growth (%) | 9.41 | 4.86 | 3.00 | 8.02 | 13.18 |
| Government Consumption Growth (%) | 5.28 | 13.40 | 1.95 | 6.88 | 5.79 |
| Public Investment (% of GDP) | 6.88 | 6.96 | 7.29 | 7.32 | 7.62 |
| Private Investment (% of GDP) | 24.94 | 25.25 | 24.02 | 23.7 | 24.06 |
| Exportsof Goods Growth (%) | 6.66 | 9.15 | -17.10 | 12.40 | 33.45 |
| Imports of Goods (%) | 25.23 | 1.79 | -8.57 | 19.71 | 35.95 |
| Consumer Price Index (CPI) Inflation (%) | 5.78 | 5.48 | 5.65 | 5.55 | 6.15 |
| Current Account Balance (% of GDP) | -3.00 | -1.30 | -1.30 | -1.10 | -4.10 |
| Fiscal Balance (% of GDP) | -3.99 | -4.74 | -4.87 | -3.72 | -5.14 |
| Public Debt(%ofGDP) | 29.50 | 31.10 | 34.12 | 35.52 | 36.30 |

**Source:** Source: Bangladesh Bureau of Statistics, Bangladesh Bank, and Finance Division, Ministry of Finance

## B. Economic impact of the 2022 floods

There is long-standing evidence of the negative economic impacts of disasters, especially in lower-income countries that do not have the same level of resources to invest on disaster prevention and mitigation as higher-income economies.[23] It is estimated that Bangladesh suffers a loss of around 2% of GDP every year on average due to climate-induced disasters, with monsoon and flash floods being the most economically damaging disasters. By 2050, the economic losses from severe flooding can be as high as 9% of GDP if the proper mitigation actions are not taken.[24] The 2022 floods caused loss of lives, severely damaged infrastructure and other assets and disrupted the economic activities inflicting heavy losses to agriculture and aquaculture.

Due to limited time and personnel resources available during preparation of the PDNA, it was not possible to conduct a full assessment of the macroeconomic impacts of 2022 floods. The impact of the disaster in relation to national GDP is significant. It had a negative macroeconomic effect at the national level. To overcome this, a recovery program consisting of the restoration of damaged rural roads and water resources management infrastructure; relief, and rehabilitation programs for affected farming communities to recover damaged assets and resume their farming activities; and social programs to help communities rebuild damaged housing are essential.

[22] Finance Division, Government of Bangladesh. *2022. Monthly Report of Fiscal Position: July 2022 (Fiscal Year 2022-23)*. Dhaka.
[23] Klomp, J., and Valckx, K. 2014. Natural disasters and economic growth: A meta-analysis. *Global Environmental Change*, 26, 183–195.
[24] World Bank. 2022. Bangladesh Country Climate and Development Report. Washington DC.

Bangladesh remains at a low risk of debt distress; however, due to the significant current account deficit and the need for government to borrow to replenish foreign exchange reserve as well to carry out development projects, necessary reforms will be carried out to facilitate economic efficiency and sustainable development. The current economic reform measures include ADB, IMF and WB budget support for strengthening the public financial management, increasing financial access, strengthening trade facilitation, and expanding social protection. Further reforms will be carried out to help the country towards climate resilient development and smooth graduation from least developed country status in 2026.

**Impact on trade:**

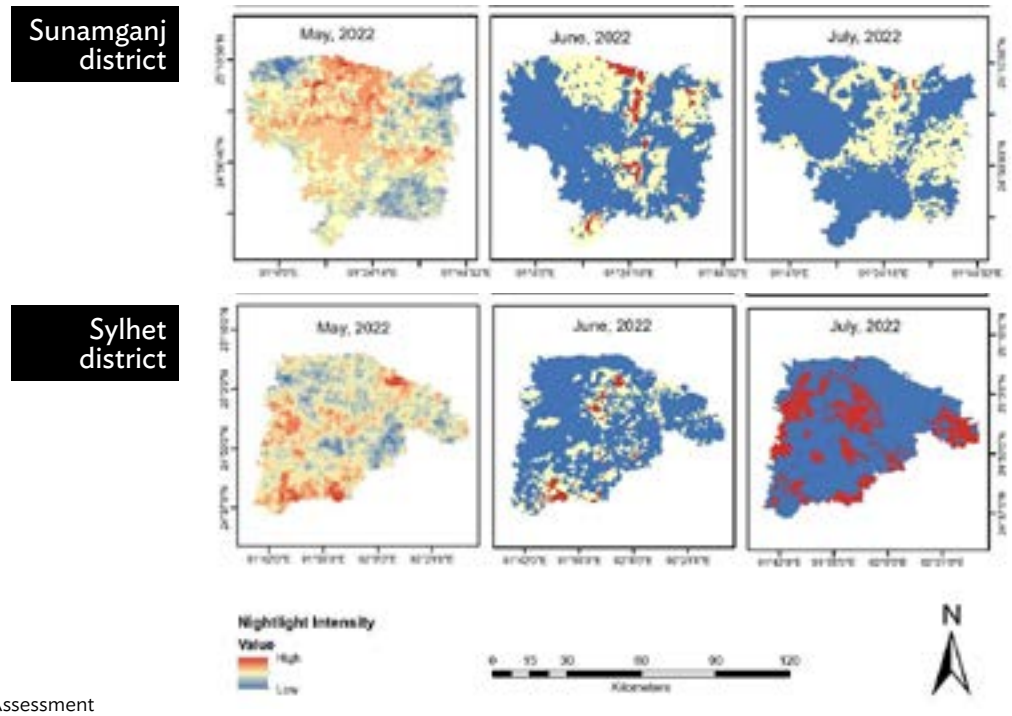
The combination of the flood in the first half of the year and the lack of rain in the second half of the year has resulted in shortfall in production of all three rice crops: boro, aus, and aman. The north-eastern haor region, which is a key production area for the boro crop, has produced 1.3 million tons less than target level. Likewise, the production of aus crop was missed by 0.65 million tons. This loss was partially offset by the aman crop exceeding targets by at least 1 million tons. The actual production of aman is yet to be published, but it is likely that it will reduce the quantity demanded of imported rice from its planned 1.6 million tons to a lower level. In addition, to contain retail prices of rice from further escalation the government has reduced import duty on rice from 62.5% to 25% in June 2022 and then to 5% in August 2022.

**Impact on local economic activity:**

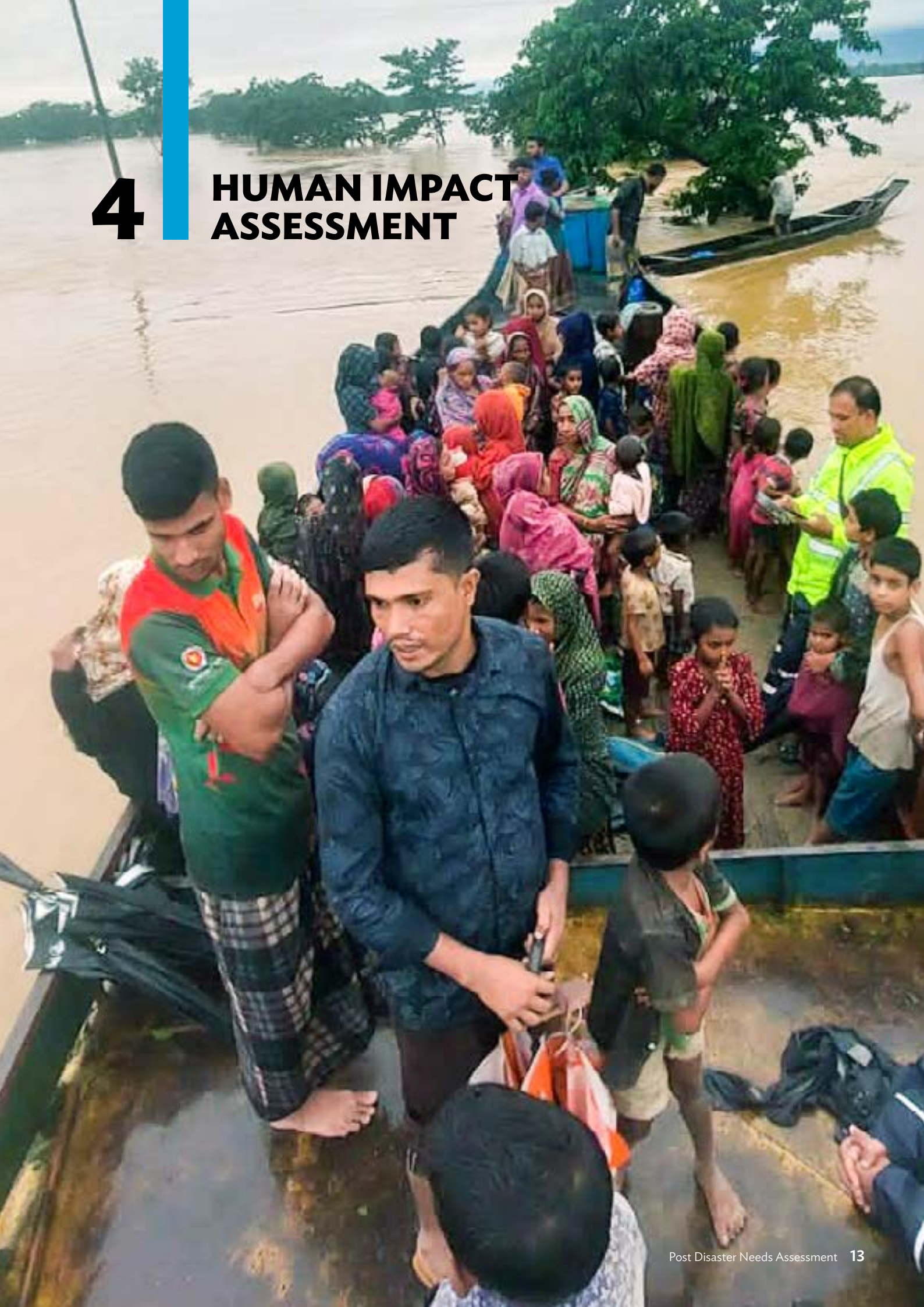
In recent years, researchers have made novel use of satellite nightlight data as a proxy for local economic activity. The primary reason for using remote sensed nightlight data is that in many developing countries, GDP data are published annually, while information about the economic welfare of households comes at even longer intervals. For example, the Household Income and Expenditure Survey (HIES) data is available in a 5–6-year interval, while the census is conducted every 10 years. Satellite nightlight data provide a picture of a local area and is available at a monthly frequency, and at very low cost. Nightlight intensity for Sunamganj and Sylhet districts of the north-eastern region of Bangladesh is presented covering the period from May-July 2022 (Figure 4). June and July were the worst affected months, with nightlight intensity dropping dramatically (the blue shaded area). The decline in nightlight intensity was highest in June 2022. Although, during normal time the nightlight intensity is slightly higher in Sylhet than Sunamganj, which is consistent with the former being more economically better off than the latter, both districts were equally affected in terms of the loss of economic activity reflected on lower nightlight intensity.

Figure 4

Nightlight intensity, May-July 2022



# 4 HUMAN IMPACT ASSESSMENT



The 2022 floods are expected to have a significant impact on lives and livelihoods, with the disaster's impact on household welfare experienced through four primary pathways: (i) loss of household income and employment/livelihoods due to destroyed crops, livestock death, or inactivity of businesses; (ii) loss of assets, including homes, livestock, productive equipment, and household durables; and (iii) rising food prices due to food shortages resulting from lost food stocks.

The severity of flooding in a given area, the speed with which the water recedes, the socioeconomic standing of residents before the flood, and the efficiency of the relief and reconstruction effort all play a role in determining the scope and duration of the disaster. Reversing the negative effects on household welfare will take time and involve losses, such as those to human capital and land productivity, that may set in motion long-lasting declines in welfare, necessitating individualized, focused attention even in the best-case scenario.

## A. Poverty

Prior to the floods, many of the disaster-affected districts already suffered from higher monetary and non-monetary poverty, especially among households in rural areas. District-level data reveal a varied poverty situation across the flood-affected districts. There is evidence that haor area communities experience a markedly higher level of poverty than the average district rates of poverty making them more vulnerable to the impacts of disasters. Non-monetary measures of poverty suggest that during the pre-flood period, households in calamity-hit districts also experienced worse living standards and gaps in access to utilities. These households were likelier to live in katcha or semi-pucca homes (made entirely or partially of mud and unbaked bricks), which heightens vulnerability to disasters. Households are also more likely to lack access to basic sanitation facilities and clean water. Some flood-affected areas showed high child stunting rates given their location in rural areas, poverty status, and lack adequate water and sanitation facilities. Food insecurity, especially in the haor areas is also a major challenge.

Deficiencies in human capital endowment and constraints in access to opportunities in labor markets contribute to higher poverty rates in disaster-affected districts, which in turn reflect lower productivity and more limited resilience. These overlapping deprivations increased people's susceptibility to natural disasters before the 2022 floods and left them even more at risk of falling further behind or staying there afterward. The high concentration of poor people in flood-prone areas makes them especially susceptible to the devastation that a sudden flood can cause. The loss of farmland and associated income, as well as the subsequent increase in food scarcity, are the most direct and immediate effects. Analysis of the impact of previous floods in the north-eastern area found that as a response to income loss, people are forced to take up loans with high interest rates and later sell assets such as cattle or property to pay off the loans.[25]

## B. Employment and livelihoods

To better understand the impact of the disaster at the household level, a household survey was carried out in December 2022 for the two districts of Sylhet and Sunamgunj. A total of 840 households were surveyed in the two districts, of which 540 households were directly affected by the 2022 floods. The average monthly household income was approximately Tk17,000 for all Sylhet respondents and Tk15,500 in Sunamganj. For the affected households in Sylhet, average monthly income during the flooding declined by 61 percent (an income loss of about Tk11,500). The total affected population were 3,91,633 with an average household size of 4.8.[26] In Sunamganj, the monthly income for unaffected households remained almost same during and after the flood compared to their initial income before the flood. However, for affected households income during the 2022 floods declined by 71 percent (an income loss of about Tk11,700 on average). The total affected population was 6,66,529 with an average household size of 5.08.

On average, affected households from both Sylhet and Sunamganj reported a higher number of household members to have stopped working due to the floods than unaffected households. There were 223 households from affected regions of Sylhet having at least one household member to have stopped work due to flood. These households reported 52 work-days lost on average. Households that had their members involved as masons reported 52 work-days lost, and 42 work-days lost was reported by households who had their members involved with the agricultural sector. These households suffered average income loss of Tk23,000 due to flooding. For households in unaffected areas of Sylhet, there were 123 households that reported at least one household member stopping work. Among these 123 households, on average 29 work-days were lost (household aggregate, there could be multiple members who faced work-day lost). Household members involved with the service sector (35 days) and masons (33 days) reported higher number of work-days lost than other sectors. On average, these households in unaffected areas of Sylhet suffered income loss of Tk10,000 due to the flooding. Households that had members working as masons and in the business sector reported higher income losses due to flooding compared to other sectors. In Sunamganj, 276 households from the affected areas reported at least one member losing on average 50 work-days due to the flooding, while only one household from the unaffected area reported work-days lost. Households with members working in the tailoring (48 days), service sector (46 days), and as agricultural labour (45 days) reported higher number of work-days lost compared to other sectors. On average, these households lost Tk22,000 as income due to the flood.

About 74% of the households from the affected areas of Sylhet reported at least one member suffering from illness during the floods, while 17% of households from unaffected areas reported illness. In affected areas of Sunamganj, 67% of households reported that at least one household member suffered from illness due to flood, either during or after flood, while none of the households from unaffected areas reported illness of their members. The most common disease among the members were fever and cough, and diarrhoea. On average, the cost of treatment was higher for households from the affected regions of Sylhet, where households spent on average Tk2,200 on

[25] Kamal, A.S.M.M. et al. 2018. Resilience to flash floods in wetland communities of north-eastern Bangladesh. *International Journal of Disaster Risk Reduction 31*, 478-488.
[26] From FREAP household survey (2022).

their members to recover from illness, equivalent to about 30% of monthly household income during flood time, compared to Tk766 spent in unaffected households. Household from affected regions of Sunamganj spent about Tk1,800 as treatment cost on their members, which is equivalent to about 40% of monthly household income during flood time.

In Sunamganj, over 80% of households from affected areas reported that their water source for cooking as well as washing and cleaning were affected due to the flood. None of the households from unaffected areas reported about their sources from cooking and washing and cleaning being affected. About 63% of the households from the affected areas of Sylhet reported of their water source for cooking and washing and cleaning being affected by flood. Affected households reported that an additional 20 minutes was required for collecting water. Additional cost per household was around Tk500 and Tk200 in Sylhet and Sunamganj respectively.

Households from affected areas in Sylhet needed an additional 30 minutes on average to travel going to the market, workplace, and crop land. For similar households from Sunamganj, a household needed additional 33 minutes for travelling to market, 27 minutes to travel to workplace, and 41 minutes when travelling for social purposes. On average, households from the affected Sunamganj areas spent Tk46 more than similar households from Sylhet area for travelling for different purposes. In general, households from Sunamganj affected areas incurred more cost for travelling to the market and workplace than households from the affected areas of Sylhet.

## C. Disruption to services and loss of infrastructure and assets

The floods disrupted maternal and reproductive healthcare, food and medical supplies, and child food. Other vital infrastructure was damaged, such as latrines, tube-wells, water networks, and transport networks like village access roads and railway connectivity were damaged. Floods damaged river embankments, irrigation infrastructures, agricultural equipment, and crops/food stock were damaged. Floods damaged many access roads and railway tracks, cutting off transport to hospitals, bazaars, and schools. Transport disruption  limited women's mobility, reproductive health services, and child development. Transporting food and lifesaving goods became more difficult. Households that once relied on boat transport during monsoons were now paying double due to low road connectivity in the area. Transporting patients to hospitals was difficult. Damaged health infrastructure and facilities remain unrepaired, which compromises women, children, and elderly people's privacy, safety, sanitation, and hygiene, causing them suffering and inconvenience. Clothes, cooking utensils, cooking stoves, food stock, personal belongings like medicines, sanitary pads, books, and educational materials were commonly damaged during floods besides cattle and crops.

Housing and human settlements were severely damaged by the 2022 floods. A total of 186,703 homes suffered full or partial damage due to the floods. Many communities have been uprooted from their homes in Sylhet and Sunamganj, where most of the areas were inundated. Rural homes, many of which are katcha, made of only bamboo or of bamboo and tin, have suffered severe damage.[27]

[27] For further details see United Nations Development Programme. 2022. *Community-led housing recovery needs assessment—North and northeastern floods 2022*. Dhaka.

## D. Human development

The floods harmed human development, deepened existing inequities between households and individuals, and caused substantial loss to human capital (education and health), including stunting, and learning losses, which will affect productivity and physical resilience if not addressed during rehabilitation. Lack of access to clean water and sanitation will place greater pressure on overstretched healthcare services, perpetuating a vicious cycle of disease and poverty.

The impact of the floods on education in the affected area is likely to be pronounced. More than 3,000 primary and secondary schools in Sylhet and Sunamganj districts have been affected and remained closed for about a month, resulting in learning loss for over 1.5 million learners. The impact of the floods on health in Sylhet and Sunamganj districts was significant with 349 community clinics out of 505 affected. As of 29 July 2022, 19,918 cases of waterborne diseases and other ailments were reported, and 74 people died, including 33 children in Sylhet division. Nutrition services were disrupted as well.[28]

Findings from previous floods in the north-eastern part of Bangladesh suggest that people with lower education levels are more vulnerable to floods. This is because less educated people generally work in the primary sector such as agriculture or fishing, while people with a higher educational level prefer to work in the service sector, which is less directly impacted by flooding.[29] According to BBS (2022), the main source of household income in the disaster-prone areas of Bangladesh is agriculture (35.43%), followed by day laborers (31.43%), business (17.62%), and service (12.60%).[30] Furthermore, nearly 58% of people in the disaster-prone areas are either not educated or completed at most the primary education.

[28] UNICEF Bangladesh Office. 2022. *Humanitarian Situation Report No. 8 – North-eastern Flood*. Dhaka.
[29] Dey, N.C., Parvez, M. and Islam, M.R. 2021. A study on the impact of the 2017 early monsoon flash flood: Potential measures to safeguard livelihoods from extreme climate events in the haor area of Bangladesh. *International Journal of Disaster Risk Reduction* 59.
[30] Bangladesh Bureau of Statistics. 2022. *National Accounts Statistics (Provisional Estimates of GDP, 2021-22 and Final Estimates of GDP, 2020-21*. Dhaka.

## E. Land use and ownership

During the rainy season, the locals make extensive use of the water for fishing, duck breeding, and travel; however, during the dry season, paddy and other crops are grown. Most roadside properties are privately owned, but given the need for urgent rehabilitation, the community is willing to set aside land for development and reconstruction of connecting roads. Both during the flood season and the dry season, some areas have a severe need for water and sanitation.

People residing in flood-affected areas nearly all have agriculture-based livelihoods, with many being sharecroppers who do not own land. Some people are on- and off-farm agricultural and livestock workers, and home-based workers connected to agriculture. Many lost their livelihoods due to inundation of crop lands pre- or post-harvest and prolonged water stagnation compared to flash floods in previous years. Only in some roadside high land people can grow crops twice in a year. Paddy and vegetables are grown in these areas. People consulted during community meetings expressed their concern as they lost income earning sources and are having difficulty coping. They have about five to nine family members depended on the earning of one member. Other than loss of crops, vegetables and fruits, people's livelihood also largely impacted by damage to livestock fisheries and poultry due to the flood. Local people expressed their demand for financial assistance, seed, cattle, agriculture instruments, water pump, low-rate interest loan and fertilizer from government to restore their livelihood.

## F. Women, girls, and other vulnerable groups

Given their circumstances and restricted access to social protection and coping mechanisms, vulnerable groups like women, children, and people with disabilities were disproportionately affected by the floods. Flood damage highlighted stark differences in safety, education, decision-making, and employment that already exist between men and women. The recovery effort runs the risk of leaving behind people with disabilities because they are frequently marginalized, economically disempowered, and subject to discrimination in housing, employment, education, and other social services.

The effect of the floods on women, and girls was more severe, complex, and unique than for other groups. Due to infrastructure damage, the floods not only resulted in financial losses but also significantly hampered women's and girls' right to privacy and security. The effects of catastrophic events range from the deterioration of poor households' living conditions to significant effects on livelihoods and income-generating activities, particularly agriculture and livestock; difficulty gaining access to drinking water and sanitary latrines and maintaining menstrual hygiene; and problematic daily commuting and goods transportation due to damaged roads.

Women and girls were more negatively impacted than men by damaged sanitary facilities. In times of flooding, it has been particularly difficult for women without access to sanitary products to maintain their menstrual hygiene, especially when floodwater washed away their clothing, kitchenware, and other valuables. Flood shelters were also overcrowded and lacking gender-sensitive and disability inclusive design features. Even after the flood waters subsided, there was still a problem with the lack of clean drinking water due to damaged and non-operational tube-wells. Defecating in a bucket and polyethene was the only practical option in the absence of latrines. Feces were then dumped into the water. Most homes were forced to drink water that was already contaminated with feces from the latrines because they had no other choice. Women who were interviewed stated that many households continue to consume contaminated river and canal water.

Rapidly enhancing access to health services in impacted communities requires the provision of emergency health services, with a focus on children and women. Increased risks from waterborne illnesses like cholera, malaria, and dengue as well as the breakdown of proper sanitation and insufficient access to nutrition could have long-term effects on inclusive growth (including a rise of stunting rates). Pregnant women, lactating mothers, new mothers, children under five, immunocompromised individuals, and patients with chronic diseases, including those with disabilities and the elderly, will receive special attention because their pre-existing conditions are made worse by the lack of access to medications and medical services due to the floods.

Household priorities to support immediate recovery needs may result in girls' education being deprioritized, disrupting learning for school-aged children. School closures affect children's mental health, nutrition, and abuse risk in addition to learning. This increases young girls' vulnerability to unintended pregnancy, early, and forced marriages.

There have been negative effects on women's economic independence and well-being due to the destruction of their means of subsistence, particularly in the areas of agriculture and livestock. Women are more susceptible to the effects of flooding than men are because of cultural and social barriers that make it difficult for women to work or be employed outside the home or communities.

Women are more likely to be victims of gender-based violence (GBV) after the floods because of the stress caused by displacement and the breakdown of social order that results from a lack of safety measures. Many cases of child marriage and marriage under duress spike after a crisis or when people feel more financially unsecure.


CNG

# 5 DAMAGE, LOSS, AND NEEDS ASSESSMENT

## A. Summary of damage, loss, and needs

Immediately following the floods in June, DDM activated the provisions of the SOD and all government agencies with the assistance of local officials at the ward, union, and upazila level worked during July, using the D-Form data template, to compile estimates of sectoral damage, the number of communities and households affected, including loss of life, and the severity of the disaster's impact. Indicators reported in the D-Form data have been mapped to sectors used in PDNAs for consistency.

Based on collated D-Form data, damage information from 18 districts and 11 sectors has been summarized. The estimated cost of the damage across all sectors from the D-Forms totaled Tk564,984 lac ($547.6 million) (Table 2)

## B. Damage, loss, and needs by sector

The PDNA assessed the impact of the 2022 floods on 4 major sectors that accounted for 62% of total damage and have substantial public recovery needs—transport (rural roads and railways); water resources management; WASH; and agriculture and livestock—with a geographic focus on 9 contiguous north-eastern districts, which together accounted for approximately 68% of total damage. The 9 districts are: Sylhet, Sunamganj, Moulvibazar, Habiganj, Mymensingh, Netrokona, Sherpur, Kishoreganj, and Brahmanbaria.

**Table 2: MoDMR estimates of damage**

| District | Infrastructure sectors | | | | Productive sectors | | Social sectors | | | | Cross-cutting | Total (Tk lac) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Transport and communications (Tk lac) | WASH (Tk lac) | Water resources management (Tk lac) | Energy (Tk lac) | Agriculture, livestock, and fisheries (Tk lac) | Commerce and industry (Tk lac) | Housing (Tk lac) | Education (Tk lac) | Health (Tk lac) | Culture and heritage (Tk lac) | Environment (Tk lac) | |
| Bogra | 3,936 | 128 | - | - | 1,751 | - | 4,322 | 55 | 9 | - | 5 | 10,206 |
| Brahmanbaria | 2,035 | 6 | 8 | 80 | 9,682 | - | 13,296 | 32 | 1 | 1 | 199 | 25,340 |
| Feni | 0 | - | - | - | - | - | - | - | - | - | - | 0 |
| Gaibandha | 100 | 32 | 450 | - | 581 | - | 40,147 | 353 | - | 9 | - | 41,672 |
| Habiganj | 4,869 | 2,298 | 243 | 55 | 34,344 | - | 5,914 | 93 | 11 | 83 | 763 | 48,672 |
| Jamalpur | 644 | 13 | 0 | - | 34,546 | - | 3,244 | 17 | - | 3 | 32 | 38,500 |
| Kishoreganj | 4,555 | 507 | - | - | 4,568 | - | 2,706 | 45 | - | - | 997 | 13,378 |
| Kurigram | 1,306 | 693 | 225 | 39 | 22,411 | - | 2,627 | 353 | 68 | 74 | 252 | 28,048 |
| Lalmonirhat | 18 | 18 | - | - | 59 | - | 10 | 13 | - | - | 85 | 203 |
| Moulvibazar | 4,012 | 4,378 | 219 | 571 | 6,877 | 375 | 6,396 | 375 | 21 | 177 | 479 | 23,880 |
| Mymensingh | 358 | 58 | 16 | - | 327 | - | 3,409 | 3 | - | - | 235 | 4,404 |
| Netrokona | 16,523 | 595 | 495 | 10 | 7,823 | - | 7,513 | 862 | 49 | 33 | 2,618 | 36,521 |
| Nilphamari | 0 | - | - | - | 4 | - | 24 | - | - | - | 45 | 73 |
| Rangpur | 0 | 11 | - | - | 23 | - | 150 | - | - | - | 1,400 | 1,584 |
| Sherpur | 593 | 15 | 69 | - | 243 | - | 239 | 5 | - | - | 165 | 1,329 |
| Sirajganj | 1,305 | 199 | 5 | 31 | 30,884 | 5 | 27,768 | 589 | 13 | 13 | 971 | 61,781 |
| Sunamganj | 38,311 | 20,879 | 7,059 | 358 | 15,741 | - | 29,775 | 1,953 | 162 | 444 | 5,992 | 120,674 |
| Sylhet | 40,003 | 5,533 | 17,884 | 304 | 17,286 | 109 | 21,559 | 825 | 194 | 465 | 4,559 | 108,720 |
| Total | 118,566 | 35,362 | 26,673 | 1,448 | 187,149 | 489 | 169,098 | 5,573 | 526 | 1,301 | 18,798 | 564,984 |

**Source:** D-Form data from MoDMR

## Infrastructure sectors

### Transport—Rural roads, bridges, culverts, and railways

**Damage and loss:**

A vibrant transport sector is essential for both economic growth and poverty reduction. Inundation of the land adjacent to roads and bridges damaged by the 2022 floods threatens vulnerable villagers. Some of the damage caused by the disaster to national roads and bridges, which are managed by the Department of Roads and Highways, has already been repaired or is under repair as a matter of urgency to maintain primary roads. However, damage caused to rural roads, that are widely distributed in the haor areas affected by the floods, will require longer to repair and in some cases require reconstruction.

Almost all rural roads were inundated by flood water to a depth of 1-2 meters. The current of water was so intense that segments of the roads, vulnerable bridge/culverts were damaged and slope failure was common. Roads that had an orientation perpendicular to the direction of flood waters were severely damaged. Shaded portions of road sections covered by trees and portions with inadequate earthen shoulders and less vegetation cover and the downstream sides of roads and side slopes were also badly damaged. Existing openings of bridges and culverts could not cope with the incoming influx of flood water resulting in the widespread failure of many bridges and culverts. Because of the persistent inundation for several days under water the structural integrity of the roads was badly affected resulting in damage of pavement along bituminous roads.

Transportation of passengers and goods was stopped in some cases but resumed after emergency restoration works were done by the Government. Nevertheless currently, vehicles cannot travel on damaged roads in many areas though battery-operated three-wheelers can travel in some areas. In some cases, traffic has to follow long diversions. The speed of vehicles has reduced considerably resulting in longer travel times for vehicle users. As a result, the number of trips taken has fallen

from pre-disaster levels causing economic loss for vehicle operators. Moreover, while operating on damaged roads, frequent breakdown of vehicles coupled with more wear and tear of the tires has resulted in increased vehicle operating costs (VOC) of approximately 20-30%. Disaster-related damage has increased the transportation cost of commodities and passengers which has slowed down economic activities in flood-affected areas.

Data for the damage assessment during the PDNA were collected on the length of total road, length of the affected segments of pavement, number and length of damaged bridge/culverts, segments of damaged roadside slope, treatment options for rehabilitation, cost of damage, number of people affected. Traffic data plying on the road before the flood were collected through LGED's road database. Traffic data after the disaster were collected through LGED upazila-level officials. Data related to vehicle operating cost (VOC) of pre- and post-disaster were collected through LGED upazila-level officials. Loss was calculated based on the category of road, traffic volume, socio-economic connectivity, and other parameters of transport. Each road has been evaluated, which will help LGED to prioritize the affected roads for optimizing resources for rehabilitation and phasing of rehabilitation works. To collect data correctly in a consistent manner, all relevant district and upazila-level officials were given training virtually on the data collection process.

As can be seen in the initial D-Form data (Table 2), rural roads in the adjacent districts of Kurigram and Jamalpur were also affected by the floods. Estimates of the damage and loss in these two additional districts have been included in the PDNA as part of the sector assessment for rural roads.

Rural roads in 87 out of 104 upazilas in the 11 districts were affected by the floods. Of the total length of damaged paved and semi-paved roads of 23,331 km in the 11 districts, 4,456 km were located in affected upazilas, of which 2,210 km road sections comprising 1,044 rural roads were fully or partially damaged. Of the 87 affected upazilas, roads in 41, 30, and 16 upazilas had damage that was assessed as high, medium, and low respectively. Among the affected districts, rural roads in Sunamganj, Sylhet, and Jamalpur districts experienced the highest severity of damage. The overall damage and loss in the rural roads sector for the 11 districts was estimated at the cost of damage regarding the pavement, bridge/culverts and slide slopes was estimated at Tk295,345 lac ($284.5 million) in the 11 districts, with damage estimated at Tk235,981 lac ($227.3 million) and loss at Tk59,364 lac ($57.2 million) (Table 3).

The branch line railway from Sylhet to Chhatak was damaged in many places along its length during the disaster making the entire line non-functional. Damage totaling Tk14,533 lac ($14.0 million) was caused to the railway track and sleepers. Small culverts in key locations were fully or completely washed away. There were also economic losses associated with the damaged rail line estimated to be around Tk3,408 lac per year.[31] The economic losses were associated with increased road transport vehicle operating costs and road pavement wear, increased travel times and accidents as well as lost revenue by Bangladesh Railway.

**Recovery and reconstruction needs:**

Rehabilitation and reconstruction needs for the sector are estimated at Tk306,775 lac ($336.8 million) (Table 3). Recovery and reconstruction needs are calculated in terms of replacement costs according to current prices plus an estimated premium of 30% to take account of the increased investment cost needed to incorporate BBB principles and climate resilient design intended to reduce future costs associated with natural hazards. Given the scope and intent to incorporate BBB principles and other climate resilient design features it will also be necessary to further develop LGED's design and implementation capacity.

[31] IIFC. 2022. Feasibility Study of Railway Track and Bridge Rehabilitation in Sylhet to Chhatak section. Infrastructure Investment Facilitation Company, Dhaka, Bangladesh.

The guiding principles for strategic recovery in the rural roads sub-sector consist of four approaches: (i) build back better; (ii) recovery and reconstruction of critical rural road assets; (iii) developing systemic resilience against flood and other climate change impacts; (iv) strengthening governance and capacity development of LGED and BR to complete the recovery and reconstruction works as quickly as possible.

The phasing of recovery and reconstruction is important for optimal use of resources. The priority score given against each rural road will help LGED prioritize critical rural roads for phasing the rehabilitation work. Prioritized rural roads involving damaged pavements with small, damaged culverts and possible completion within a year are recommended to include under short term basis in the recovery plan. Since, the rehabilitation of long bridges is time-consuming, the rural roads involving bridges are recommended to be undertaken in the medium term.

**Building resilience:**

LGED with the assistance of Bangladesh University of Engineering and Technology (BUET) already developed a new climate-resilient rural road design standard in 2019, which may be followed for the proposed reconstruction works. In addition, LGED has established a Climate Resilient Local Infrastructure Centre (CReLIC) to mainstream climate resilient and climate induced disaster risk reduction issues into planning, design, construction and maintenance of roads and other local infrastructures. CReLIC can play a role in supporting the recovery and reconstruction plans.

For the railway line, more than 20 km of replacement track and associated sleepers, one major bridge and 8 minor bridges/ culverts designed to a BBB standard to better withstand future floods will need to be constructed as part of the recovery program.

**Table 3: Damage, loss and needs for rural roads, bridges, culverts, and slope protection**

| | District | No of upazilas | No. of affected rural roads | Total length of roads (km) | Damage to road pavement | | | Damage to bridges/culverts | | | Damage to slope protection | | Total damage (Tk lac) | Total loss (Tk lac) | Total damage and loss (Tk lac) | Recovery and reconstruction needs (Tk lac) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total affected length (km) | Costof Damage (Tk lac) | % of road length affected | Total affected no. of bridges and culverts | Total affected length of bridges (M) | Cost of Damage (Tk lac) | Total affected area of slope protection (sqm) | Cost of damage (Tk lac) | | | | |
| 1 | Sylhet | 13 | 368 | 1,187 | 653 | 36,120 | 55 | 328 | 1,149 | 8,345 | 39,395 | 2,686 | 46,747 | 14,492 | 61,239 | 60,772 |
| 2 | Sunamganj | 11 | 135 | 793 | 415 | 54,012 | 52 | 235 | 2,014 | 16,168 | 317,189 | 10,491 | 80,906 | 25,272 | 106,178 | 105,178 |
| 3 | Moulvibazar | 7 | 109 | 427 | 220 | 12,173 | 51 | 127 | 415 | 2,297 | 29,029 | 1,057 | 15,434 | 2,392 | 17,827 | 20,065 |
| 4 | Habiganj | 6 | 98 | 405 | 178 | 11,612 | 44 | 219 | 581 | 4,039 | 181,534 | 2,671 | 18,268 | 2,959 | 21,228 | 23,749 |
| 5 | Mymensingh | 11 | 32 | 198 | 88 | 4,176 | 45 | 86 | 264 | 2,151 | 40,218 | 467 | 6,919 | 761 | 7,680 | 8,994 |
| 6 | Netrokona | 10 | 73 | 439 | 167 | 10,006 | 38 | 127 | 530 | 4,713 | 38,874 | 2,324 | 17,043 | 2,420 | 19,463 | 22,155 |
| 7 | Sherpur | 5 | 70 | 267 | 137 | 7,161 | 51 | 122 | 485 | 2,904 | 92,079 | 4,392 | 13,998 | 2,800 | 16,798 | 18,198 |
| 8 | Kishoreganj | 5 | 31 | 146 | 14 | 1,184 | 10 | 27 | 343 | 946 | 122,502 | 1,156 | 3,286 | 427 | 3,713 | 4,271 |
| 8 | Brahmanbaria | 4 | 30 | 134 | 47 | 3,306 | 36 | 44 | 228 | 3,972 | 32,829 | 450 | 7,728 | 1,700 | 9,429 | 10,047 |
| 10 | Kurigram | 8 | 45 | 210 | 104 | 6,092 | 49 | 85 | 288 | 2,082 | 10,200 | 553 | 8,727 | 1,859 | 10,586 | 11,345 |
| 11 | Jamalpur | 7 | 54 | 252 | 186 | 10,848 | 74 | 110 | 1,376 | 4,391 | 77,085 | 1,685 | 16,924 | 4,282 | 21,206 | 22,002 |
| Total | | 87 | 1,045 | 4,456 | 2,209 | 156,690 | 505 | 1,510 | 7,673 | 52,008 | 980,934 | 27,932 | 235,981 | 59,364 | 295,347 | 306,776 |

**Source:** PDNA team estimates based on data from LGED.

## Water resources management

**Damage:**

The Bangladesh Water Development Board (BWDB) has constructed many flood control, drainage, and irrigation structures to create safe living and carry out economic activities, especially related to crop agriculture and fisheries. A total of 1,718 km of submersible embankments along the periphery of 43 haors in Sunamganj district and 200 km of submersible embankments along the periphery of 39 haors in Sylhet district have been constructed to protect the boro rice crop from early monsoon flooding. Following harvesting of boro paddy, embankments remain submerged during the entire monsoon. The submersible embankments in Sunamganj district provide pre-monsoon flood protection to a cultivable area 145,384 ha out of a cumulative gross area of 234,327 ha with annual paddy production potential of 843,226 metric tonnes (MT).

Submersible embankment systems have also been built in other haor regions. In Netrokona, 443 km submersible constructed along the periphery of 45 haors. About 200 km of submersible embankments have been constructed along the periphery of 23 haors in Kishoreganj. The embankments in this district provide early pre-monsoon flood protection to 36,589 hectares of haor lands. About 250 km of full flood protection embankment has been constructed along the banks of the main Surma and Kushiyara rivers that provide full flood protection to a gross area of about 50,000 ha. Both submersible and flood control embankment systems comprise appurtenant structures, i.e., regulators and sluices.

BWDB has constructed erosion protection revetments along the banks of Surma and Kushiyara rivers. The constructed erosion protection revetments have proved effective in checking erosion at the places where they are provided. However, the many unprotected reaches have eroded over time. Some of the immediate adjacent reaches of existing revetments have also eroded, causing collapse of existing work.

The mid-May flood caused some damage to the submergible embankments system; however, no submergence of any haor occurred. The June flood was unprecedented in extent, flow force, depth, and duration. The sudden flood-level rise and high velocity of flow caused substantial damage to submersible embankments through a combination of seepage, overflow, and wave thrusting. Along the banks of Surma and Kushiyara in the Sylhet area, flood control embankments were previously constructed to provide protection from all types of flooding. However, these embankments have deteriorated over time to a condition below design standard with inadequate maintenance. As a result, the embankments were not able to withstand the unprecedented high flood, and embankments were overtopped, breached, and eroded in many places.

BWDB prepared initial assessments of damages through inspection at accessible places, and through drone surveys in remote inaccessible haor sites. Physical measurements were not possible as the site remained under water until November. BWDB is currently carrying out instrument-based on-site surveys.

The damage sustained by embankments varies in severity at locations depending on local conditions, i.e., orientation of embankment in respect of flow direction, flow force, and proximity to riverbank. Damages were classified in three categories: (i) severely damaged (embankment has been breached or washed away or almost flattened to the ground), (ii) substantially damaged (sections that are seriously reduced and de-shaped through loss of body material), and (iii) marginally damaged (embankment height is retained though some material eroded from side slopes).

Almost all the sluices and regulators are in dilapidated condition. Damage includes breakage of gate leaves, non-functional hoisting devices, jammed gates, cracks in concrete, corrosion of other metallic parts, clogged intake/outlet channels. However, proper functioning of the sluices/regulators is essential for performing proper water management within the protected areas.

The banks of Surma and Kishiyara rivers are subject to active erosion at many locations along their course. BWDB has identified 32 sites where the 2022 floods have accelerated erosion. Homestead areas, bazaar areas, and in some locations flood embankment or roads, have become vulnerable to progressive riverbank erosion. In most of the identified sites, bank protection works exist to some length. The existing works are threatened by progressive erosion along adjacent unprotected banks.

Based on a review of the various assessments presented by BWDB field officials, field visits to selected sites to review flood damage assessments, an updated, rationalized damage assessment for the water resources sector has been prepared (Table 4). Damages have been valued based on reconstruction costs to design standards that existed before the 2022 floods. Total damage was estimated at Tk42,252 lac ($40.7 million).

**Recovery and reconstruction needs:**

Damaged embankments need to be repaired/ reconstructed as soon as possible to ensure protection of the forthcoming boro rice season. If embankment systems are not quickly restored to pre-flood condition, the livelihood of millions of people in the region will be at considerable risk. Given the importance of the haor region's production of rice and its role in ensuring the nation's food security, immediate repair/reconstruction of damaged embankments is important to safeguard the region and nation's food security and to ensure that livelihoods and growth are sustained.

In the haor region, homesteads are clustered along the riverbanks. Growth centers and bazaars are also located mostly along the riverbanks. River erosion causes destruction of homesteads and rural growth centers. Communities need safer places to live and conduct livelihood activities by protecting the riverbank in their vicinity from river erosion.

The 2022 floods caused disruption of normal life in the haor districts inundating roads, flood control structures like embankment, drainage sluices and riverbank protection works, and inflicted heavy losses to properties such as dwelling houses, and community and government buildings. During the receding flood, riverbank erosion at different locations along the Surma and Kushiyara rivers had aggravated leading to destruction of dwelling houses, shops, and other public and community properties at several locations.

Restoration of the flood defense systems through repair and reconstruction of damaged embankments, sluices, and regulators is urgently needed. River erosion needs to be checked by putting bank protection works along the affected riverbanks.

The needs for recovery and reconstruction of damage in the water resources sector are estimated at Tk149,554 lac ($144.1 million). This amount includes an additional allocation to consider the deterioration of some structures for which restoration to the pre-disaster situation will not achieve the minimum standard for ensuring its protection. A premium for incorporating build back better for affected structure is also included (Table 5).

**Table 4: Damage in the water resources sector**

| | District | Flood control embankment | | | | | | Submersible embankment | | | | | | Sluices/ regulators | | Riverbank protection Works | | Total damage (Tk lac) | Total damage ($ million) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Severely damaged | | Substantially damaged | | Marginally damaged | | Severely damaged | | Substantially damaged | | Marginally damaged | | | | | | | |
| | | Length (km) | Value (Tk lac) | Length (km) | Value (Tk lac) | Length (km) | Value (Tk lac) | Length (km) | Value (Tk lac) | Length (km) | Value (Tk lac) | Length (km) | Value (Tk lac) | No. | Value (Tk lac) | Qnty (km) | Value (Tk lac) | | |
| 1 | Sylhet | 10.0 | 1,500 | 75.0 | 7,500 | - | - | - | - | - | - | - | - | 13 | 425 | 4.0 | 6,000 | 15,425 | 14.9 |
| 2 | Sunamganj | - | - | - | - | - | - | 22.3 | 5,585 | 16.7 | 2,087 | 193.5 | 12,095 | 20 | 198 | 1.0 | 1,500 | 21,464 | 20.7 |
| 3 | Moulvibazar | - | - | 3.6 | 895 | - | - | - | - | - | - | - | - | - | - | | | 895 | 0.9 |
| 4 | Habiganj | - | - | 2.9 | 730 | - | - | - | - | - | - | - | - | 2 | 20 | | | 750 | 0.7 |
| 5 | Mymensingh | - | - | 6.1 | 230 | - | - | - | - | - | - | - | - | - | - | | | 230 | 0.2 |
| 6 | Netrokona | - | - | | | - | - | 7.7 | 1,925 | - | - | - | - | 22 | 387 | | | 2,312 | 2.2 |
| 7 | Sherpur | 2.0 | 210 | 8.5 | 340 | - | - | - | - | - | - | - | - | - | - | | | 550 | 0.5 |
| 8 | Kishoreganj | - | - | - | - | - | - | | | 10.4 | 625 | - | - | - | - | | | 625 | 0.6 |
| 9 | Brahmanbaria | - | - | - | - | - | - | - | - | - | - | - | - | | | | | | - |
| Total 9 districts | | 12.0 | 1,710 | 96.0 | 9,695 | 0 | 0 | 30.0 | 7,510 | 27.1 | 2,712 | 193.5 | 12,095 | 57 | 1,030 | 5.0 | 7,500 | 42,252 | 40.7 |

**Source:** PDNA team estimates based on data from BWDB.

**Table 5: Recovery needs for the water resources sector**

| Item | Damage repair (Tk lac) | Improvement (Tk lac) | Total recovery and reconstruction needs | |
|---|---|---|---|---|
| | | | (Tk lac) | ($ million) |
| Damaged flood control embankment | 14,827 | | 14,827 | 14.3 |
| (a) Submergible embankment (restoring to pre-flood design) | 29,012 | | 29,012 | 27.9 |
| (b) CC block armoring (in Sunamganj only) | | 24,813 | 24,813 | 23.9 |
| Flood fuses | | 9,635 | 9,635 | 9.3 |
| Riverbank erosion works | 9,750 | 49,914 | 59,664 | 57.5 |
| Damaged regulator/sluice | 1,339 | | 1,339 | 1.3 |
| New regulator/sluice construction | | 4,254 | 4,254 | 4.1 |
| Village platform | | 6,000 | 6,000 | 5.8 |
| **Total** | **54,928** | **94,616** | **149,544** | **144.1** |

**Source:** PDNA team estimates based on data from BWDB.

**Building resilience:**

Beyond the immediate recovery and reconstruction needs required to meet recovery standards of flood protection, BWDB plans to undertake initiatives to strengthen longer-term climate resilience. BWBD plans to integrate improved performance and sustainability features in the embankment systems through the provision of "flood fuses". The submersible embankment systems have been put in place to provide protection of the boro rice crop from early flash floods, but haors are also an important open water fish habitat. Both rice cultivation and fish production are equally important for haor areas as haors are important sources of fish nationwide besides meeting local consumption needs. The growing of fish in haors requires early entry of water and migration of fish stock from rivers to haors. For this purpose, submersible embankments are cut by local people at places after harvest of boro crops. These cuts facilitate plying of country boats during full monsoon inundation, and after that early drainage of water from the haors to become suitable water for boro rice plantation. The cuts need to be closed again before the early flash flood season. Cuts that are not closed properly get widened in an uncontrolled manner and require additional resources to close every year. Moreover, borrowing of earth from low-lying areas is difficult. An innovative solution to uncontrolled cut and closing has been developed under JICA financed Haor Flood Management and Livelihood Improvement Project which provides managed cuts at selected locations. The cuts will be closed with earth at the beginning of the dry season and then opened after the boro harvest season by removing the filling. It is hoped that providing such managed cuts at selected locations will facilitate more controlled management of floods, water, and fish stock entry into the haors, post-flood drainage and plying boats in and out of haor polders during monsoon floods.

Another sustainability and performance improvement that BWDB is considering involves armoring embankment surfaces with concrete blocks. Submersible embankments are designed to be submerged during the full monsoon flood. During the submergence process and during draining out process, the embankments are damaged to some extent. However, some locations are more

vulnerable and to a greater degree due to their location, orientation in relation to the main flow direction and proximity to river. These are the locations where embankments have been severely damaged during the unprecedented 2022 flood. BWDB plans to reconstruct the embankment reaches at these locations to design standard and armor the embankment surface with concrete blocks for greater sustainability. However, the concrete block armoring requires huge expenditure, to the tune of 10 to 12 times extra over the cost earthen construction. So BWDB needs to be selective in choosing reaches for concrete block armoring to ensure reconstruction remains economically viable.

In addition to repairing the damaged sluices/regulators, BWDB plans to construct 6 new sluices and regulators to improve drainage of the flood control systems. BWDB also plans to construct 19 village platforms in different haors located in Sylhet and Sunamganj districts, though locations of the planned platforms have not yet been definitely identified. BWDB intends to construct the platforms on khas land (government owned land). Possible locations will need to be finalized through consultation with the communities living within individual haor areas.

The construction of flood fuses, concrete block armoring and new regulators need specific design and approval. BWDB design office in Dhaka usually prepares the design of new works. The proposed riverbank protection works will also require site-specific design.

## Water supply, sanitation, and hygiene

**Damage and loss:**

There was widespread damage to deep and shallow tube-wells that provide the primary source of drinking water supply for households, as well as damage to latrines. An estimated 4.2 million people suffered disruption to WASH services across the 9 north-eastern districts. Facilities were completely inundated with water rendering many of them inoperable. The DPHE reported that 106,727 water points and 283,355 latrines were damaged. Sylhet and Sunamganj districts were the worst affected districts, accounting for 86% of damage in the WASH sector (Table 6).

Overall damage and loss in the WASH sector is estimated at Tk 57,850 lac ($55.7 million) (Table 7). Damage was estimated at Tk52,591 lac ($50.7 million). There were also losses experienced due to the disruption to WASH services. People, especially women and children who bear the greatest burden in fetching and carrying water, have to travel longer distances to access

**Table 6: No. of tube-wells and sanitation facilities damaged**

| | | No. of deep tubewells affected | | No. of shallow tube-wells affected | | No. of sanitation facilities affected | |
|---|---|---|---|---|---|---|---|
| | District | Fully damaged | Partially damaged | Fully damaged | Partially damaged | Fully damaged | Partially damaged |
| 1 | Sylhet | 532 | 7,232 | 1,742 | 12,674 | 46,750 | 100,949 |
| 2 | Sunamganj | 3,408 | 26,208 | 4,076 | 18,149 | 33,368 | 48,207 |
| 3 | Moulvibazar | 505 | 962 | 452 | 1,400 | 12,833 | 6,022 |
| 4 | Habiganj | 204 | 318 | 397 | 1,120 | 4,061 | 7,032 |
| 5 | Mymensingh | 0 | 0 | 0 | 0 | 0 | 1,000 |
| 6 | Netrokona | 233 | 2,470 | 690 | 2,650 | 0 | 6,110 |
| 7 | Sherpur | 0 | 0 | 0 | 45 | 0 | 260 |
| 8 | Kishoreganj | 80 | 650 | 90 | 300 | 400 | 2,850 |
| 9 | Brahmanbaria | 0 | 0 | 0 | 0 | 0 | 100 |
| | Total | 4,962 | 37,840 | 7,447 | 36,338 | 97,412 | 172,530 |

**Source:** PDNA team estimates based on data from DPHE.

water, which reduces the time available for other purposes. It is also likely that with reduced water quality waterborne diseases will increase with the associated loss of productivity and increased health costs. Livelihoods have been impacted through disruption to water supply, including rearing of livestock and poultry, and cultivation of cash crops. The women are trudging hours to collect water from alternate sources. Water collection often has a time, energy and childcare cost attached. In addition, the disruption to water supply and loss of sanitation facilities has compromised personal hygiene, including a menstrual hygiene management. The impact to women's dignity from the loss of access to sanitation is difficult to measure, nor is feasible to quantify the impacts on children, the elderly and disabled population from the disruption to water supply and sanitation services. It has not been possible to directly estimate a value for loss in the WASH sector currently; however, based on other similar disasters, a loss value of 10% of the damage has been used equivalent to Tk5,259 lac ($5.1 million)

**Recovery and reconstruction needs:**

There is concern that overtopped tube-wells will result in contamination of groundwater. Without an urgent effort to repair and reconstruct damaged WASH facilities, people will likely have to obtain water from unsafe sources, mostly rivers, and that a reduction in access to sanitation facilities will leave people with no option but to defecate in open spaces, which will in turn increase the likelihood of contaminating water courses in adjacent rivers and streams.

Recent experience has also highlighted the declining productivity of shallow tube-wells due to a decline in the water table, especially in the dry season, when many installations become non-functional. New tube-well installations will need to include a submersible pump design, which is more costly but will provide more sustainable access to clean water supply for communities.

Recovery and reconstruction needs in the WASH sector are estimated to be Tk78,887 lac ($76.0 million). It will take time, additional resources, and the adoption of more effective tube-well and latrine designs to improve access to clean water and sanitation across the haor region. Substantially more resources will need to be invested to achieve longer-term resilience in the WASH sector above and beyond the immediate recovery program for the 2022 floods.

**Table 7: Damage, loss, and needs in the WASH sector**

| | | Damage to deep tubewells (Tk lac) | | Damage to shallow tubewells (Tk lac) | | Damage to sanitation (Tk lac) | | Total damage (Tk lac) | Estimated loss (Tk lac) [10% of damage] | Total damage and loss (Tk lac) | Total damage and loss ($ million) | Recovery and reconstruction needs (Tk lac) | Recovery and reconstruction needs ($ million) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | District | Fully damaged | Partially damaged | Fully damaged | Partially damaged | Fully damaged | Partially damaged | | | | | | |
| 1 | Sylhet | 426 | 723 | 1,045 | 1,267 | 9,350 | 10,095 | 22,906 | 2,291 | 25,197 | 27.7 | 17,638 | 17.0 |
| 2 | Sunamganj | 2,726 | 2,621 | 2,446 | 1,815 | 6,674 | 4,821 | 21,102 | 2,110 | 23,212 | 25.5 | 16,249 | 15.7 |
| 3 | Moulvibazar | 404 | 96 | 271 | 140 | 2,567 | 602 | 4,080 | 408 | 4,488 | 4.9 | 3,142 | 3.0 |
| 4 | Habiganj | 163 | 32 | 238 | 112 | 812 | 703 | 2,061 | 206 | 2,267 | 2.5 | 1,587 | 1.5 |
| 5 | Mymensingh | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 10 | 110 | 0.1 | 77 | 0.1 |
| 6 | Netrokona | 186 | 247 | 414 | 265 | 0 | 611 | 1,723 | 172 | 1,895 | 2.1 | 1,327 | 1.3 |
| 7 | Sherpur | 0 | 0 | 0 | 5 | 0 | 26 | 31 | 3 | 34 | 0.0 | 23 | 0.0 |
| 8 | Kishoreganj | 64 | 65 | 54 | 30 | 80 | 285 | 578 | 58 | 636 | 0.7 | 445 | 0.4 |
| 9 | Brahmanbaria | 0 | 0 | 0 | 0 | 0 | 10 | 10 | 1 | 11 | 0.0 | 8 | 0.0 |
| | **Total** | **3,969** | **3,784** | **4,468** | **3,634** | **19,483** | **17,253** | **52,591** | **5,259** | **57,850** | **64** | **40,495** | **39.0** |

**Source:** PDNA team estimates based on data from DPHE.

**Productive sectors**

## Agriculture and livestock

**Damage and loss:**

Due to the flooding and drainage pattern in north-eastern districts, cropping in the haor area is only possible within a short window from mid-December–mid-May. Boro rice, transplanted in December/January, and harvested in April/May is the single crop of the haors. Aman rice is cultivated in peripheral highlands which is transplanted in July/August and is harvested in November/December. The dominant cropping patterns in the region are: (i) boro-fallow-fallow, (ii) boro-fallow-aman, (iii) fallow-fallow-aman, (iv) fallow-aus-aman, (v) boro-aman, (vi) boro-aus-aman, and (vii) fallow-aman. The overwhelming majority of cropping patterns consist only of rice. The 9 north-eastern districts account for 26% of the boro rice crop.

Two seasonal rice plantings accounts for 90% of all crops; boro and aman acreages are 61% and 46% of net cropped area respectively, with the area under non-rice-based cropping patterns being much lower. Other minor cropping patterns comprise vegetables, spices, pulses, wheat, potatoes etc., that are cultivated on a small proportion of the region's highlands. Livestock—cows, goats, buffalo, ducks, and chicken—are also farmed.

The 2022 floods caused widespread damage to agricultural machinery, e.g., tube-wells for irrigation, reapers, threshers, and tractors; inputs, e.g., fertilizers and pesticides; seedbeds established for the subsequent rice crop; and many fatalities among different livestock. Total damage was estimated at Tk75,587 lac ($72.8 million) (Table 8).

Although the 2022 floods did not affect the standing boro crop it washed away rice that had already been harvested but was being stored in people's houses and other storage areas. In Sylhet and Habiganj almost half of the total annual production of boro rice was lost. In other districts levels of loss were lower.

**Table 8: Damage, loss, and needs in the agriculture and livestock sector**

| | District | Damage (Tk lac) | | | | Total Damage (Tk lac) | Land Damage (Ha) | Yield (MT/Ha) | Loss of Production (MT) | Total loss (Tk lac) | Total damage and loss | | Recovery and reconstruction needs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agricultural machinery | Inputs | Livestock | Seedbeds | | | | | | (Tk lac) | ($ million) | (Tk lac) | ($ million) |
| 1 | Sylhet | 2,862 | 6,747 | 304 | 91 | 10,004 | 27,317 | 5.3 | 144,780 | 39,091 | 49,095 | 47.3 | 16,729 | 16.1 |
| 2 | Sunamganj | 4,502 | 21,980 | 1,033 | 119 | 27,634 | 7,379 | 4.9 | 93,767 | 25,317 | 52,951 | 51.0 | 21,412 | 20.6 |
| 3 | Moulvibazar | 660 | 1,825 | 166 | 102 | 2,753 | 7,388 | 3.3 | 24,380 | 6,583 | 9,335 | 9.0 | 3,351 | 3.2 |
| 4 | Habiganj | 3,268 | 7,524 | 8 | 46 | 10,845 | 30,460 | 6.6 | 201,036 | 54,280 | 65,124 | 62.7 | 21,706 | 20.9 |
| 5 | Mymensingh | 1,446 | 427 | 42 | 25 | 1,940 | 1,727 | 6.6 | 11,398 | 3,078 | 5,017 | 4.8 | 1,893 | 1.8 |
| 6 | Netrokona | 3,965 | 941 | 319 | 13 | 5,238 | 3,809 | 6.4 | 24,378 | 6,582 | 11,819 | 11.4 | 4,593 | 4.4 |
| 7 | Sherpur | 485 | 62 | 16 | 6 | 569 | 250 | 6.6 | 1,650 | 446 | 1,014 | 1.0 | 418 | 0.4 |
| 8 | Kishoreganj | 2,935 | 7,568 | 160 | 35 | 10,698 | 1,441 | 6.6 | 9,511 | 6,820 | 17,158 | 16.9 | 7,395 | 7.1 |
| 9 | Brahmanbaria | 1,727 | 3,380 | 800 | 1 | 5,908 | 13,685 | 5.9 | 80,742 | 21,800 | 27,708 | 26.7 | 9,494 | 9.1 |
| | **Total** | **21,850** | **50,453** | **2,848** | **436** | **75,587** | **93,456** | **5.7** | **534,032** | **163,995** | **239,582** | **230.8** | **86,992** | **83.8** |

**Source:** PDNA team estimates based on data from DAE.

Production losses occurred especially in the agricultural crop and livestock subsectors, livestock, poultry, fish and fingerlings, cash crops, stock for seed and animal feed, egg, and stored food grains. The production losses include value of the lost crops, increased cost of production and estimated production losses in subsequent seasons. The Ministry of Livestock and Fisheries reported that 663,534 cattle were affected, and the Ministry of Agriculture reported that 254,251 hectares of croplands were damaged. Total loss was estimated at Tk163,995 lac ($158.30 million) (Table 9).

**Recovery and reconstruction needs:**

**Table 9: Loss in the agriculture sector**

| District | Crop area damaged (Ha) | MT/ Ha | Total rice production (MT) | Total rice production lost (MT) | % of production lost | Value of loss (Tk lac) |
|---|---|---|---|---|---|---|
| 1 Sylhet | 27,317 | 5.3 | 250,496 | 144,780 | 57.8 | 39,091 |
| 2 Sunamganj | 19,136 | 4.9 | 819,988 | 93,767 | 11.4 | 25,317 |
| 3 Moulvibazar | 7,388 | 3.3 | 181,159 | 24,380 | 13.5 | 6,583 |
| 4 Habiganj | 30,460 | 6.6 | 437,550 | 201,036 | 45.9 | 54,280 |
| 5 Mymensingh | 1,727 | 6.6 | 1,077,242 | 11,398 | 1.1 | 3,078 |
| 6 Netrokona | 3,809 | 6.4 | 749,905 | 24,378 | 3.3 | 6,582 |
| 7 Sherpur | 250 | 6.6 | 377,149 | 1,650 | 0.4 | 446 |
| 8 Kishoreganj | 3,827 | 6.6 | 694,537 | 25,259 | 3.6 | 2,568 |
| 9 Brahmanbaria | 13,685 | 5.9 | 516,316 | 80,742 | 15.6 | 21,800 |
| **Total** | **93,456** | **6.5** | **5,104,342** | **607,390** | **11.9** | **163,995** |

**Source:** PDNA team estimates based on data from DAE.

The overall recovery and reconstruction needs for the agriculture sector are estimated at Tk86,992 lac ($83.8 million). The immediate needs for recovery are to provide assistance to farmers to ensure that the subsequent cropping seasons for rice can go ahead. Clearing of fields can be undertaken through cash-for-work schemes. Seeds and fertilizers need to be procured and other agricultural machinery provided for, as well as fertilizer and other inputs (Table 10).

Considering that households that operate micro-enterprises and farms have lost regular sources of incomes and have defaulted on loans from informal and formal lenders; financing of operating capital for farms and enterprises can help farmers recover.

**Table 10: Recovery programs in the agriculture sector**

| Recovery category | Recovery item | Estimated Cost (Tk lac) |
|---|---|---|
| Agri-mechanization | Need based, site specific & crop specific (reaper-200, power thresher 200, maize thresher-50, tractor-75, power tiller-75, combined harvester-50), and other need based small equipment | 7,873 |
| Irrigation pump and other machinery | LLP-2000, Drip irrigation system-500, sprinkler irrigation-500 in fruit orchard, solar pump system-75 & grain dryer (BARI/BAU model)-20 | 8,745 |
| Capacity development for the farmers | Farmers, Entrepreneurs, Experts, extension workers (Training, workshops, seminar, exposures, award, motivation, fair, field trip) | 1,740 |
| Adaptation and mitigation | Adaptation to climate change (Technology transfer & demonstration) | 10,000 |
| Strategic partnership | Strategic Partnership & Adaptive Research with BRRI, BARI & DAM | 7,500 |
| Infrastructure, renovation, installation | Multipurpose Training center (renovation, reconstruction, installation, office equipment, utilities) & compost (vermicomposting, cow dung) | 5,958 |
| Services and hiring | Services & hiring (consultant, monitoring & short, mid-term evaluation, vat, tax & other cost) | 7,500 |
| Miscellaneous | Utilities, logistics, maintenance, operations, utilities, equipment etc. | 1,060 |
| **Total** | | **50,375** |

**Source:** PDNA team estimates based on information from DAE.

## Cross-cutting

### Disaster risk reduction:

Bangladesh's system for disaster management has undergone transformation from reactive (relief-centric) to proactive (risk-informed). Over the last two decades, the country has invested in developing institutional arrangements, policies, plans, and a legislative regime that are conducive to risk-based approach and practice of disaster management. Since 2004, DRM has been mainstreamed across government line ministries, promoting DRM as a "whole-of-government" approach. In recent years, efforts to make national planning process disaster risk-informed are on-going.

For early warning, the Flood Forecasting & Warning Centre (FFWC) of BWDB is responsible for forecasting and disseminating flash flood, monsoon flood, cyclone and other disaster forecasts. Through a partnership with Google, FFWC is able to disseminate flood warning data in real time. BWDB has 357 water level gauge stations, 136 river water discharge measuring stations and 274 rain gauge stations. BWDB also collaborates with the Indian Government to get rainfall and water level data from upper riparian catchments.

Within the haor area, there are about 36 water level monitoring stations of which around 15 stations near Sunamganj were offline during 18-19 June 2022 as they were completely under water. About 8 manual gauges were washed out in the river and later reinstalled. Under the Bangladesh Weather and Climate Services Regional Project, BWDB has been installing automatic weather stations across the country including in the haor region. Recovery initiatives to strengthen DRR monitoring include the installation of permanent concrete gauges; safety gear and boat support for gauge readers so they can continue collecting data in adverse conditions; automation of water level gauge stations in the haor areas; interactive voice response (IVR) service upgrades and system capacity enhancements, including flash flood messaging in the IVR system; network-connected, pole-fitted siren/alert system installation; and voice messaging down to the community level.

The third five-year national plan on disaster management currently under implementation defines four inter-related thematic areas for building resilience[32]:

- Disaster risk reduction related to mainstreaming DRR into national and local plans, e.g., hazard analysis and risk profiling, early warning
- Disaster preparedness related to ensuring people are prepared and response will be carried out efficiently and effectively
- Humanitarian/emergency response activities that help restore lives and livelihoods, basic infrastructure, and early recovery
- Rehabilitation, reconstruction and recovery related to long-term recovery through build back better.

The 2022 floods highlighted the types of impacts that can be expected from increased disaster risk associated with more intense and frequent flooding. Damage caused to physical infrastructure has undermined development gains by disrupting access to health, education, and other social services, impeding human capital development; reduced employment and income earning opportunities, putting the near-poor at risk of falling back into poverty; threatening food security due to a loss of agricultural output; and exacerbated social risks, such as gender-based violence leading to an overall reduction in the quality of life for affected communities. Given the regularity of repeated flood events, a timely response to address disaster risks and avoid the potential negative social and economic consequences is essential to avoid the possibility of a compounding disaster should further floods afflict the country in the near future. Anticipatory measures, such as shock-response social protection, prepositioning of goods, application of resilient design standards for government infrastructure considering increased climate risks can accelerate early recovery efforts.

Some community members consulted following the floods raised concerns about the access to, sufficiency of, and conditions within disaster shelters.[33] As recognized in the NPDM, Bangladesh has taken strides to significantly improve disaster preparedness—through improved early warning systems, volunteer mobilization for assistance, and community-based disaster management that have substantially reduced the number of human fatalities following a disaster. However, there is still room to further improve the mechanisms, structures, and processes for disaster response and recovery which represent the next frontier in building the country's resilience to the effects of disasters and climate change.

A key priority of the current NPDM is on building back better in recovery, rehabilitation, and reconstruction. Activities planned include updating disaster preparedness and contingency policies, plans and programmes; investment in people-centred multi-hazard, multisectoral forecasting and early warning systems; increased resilience of new and existing critical infrastructure; capacity development, especially for local authorities; recovery schemes to provide psychosocial support and mental health services; training the existing workforce and voluntary workers in disaster response; ensuring the continuity of operations and planning, including social and economic recovery, and the provision of basic services in the post-disaster phase; and the development of guidance for preparedness for disaster reconstruction, such as on land-use planning and improved structural standards.

The response and recovery to the 2022 floods presents an opportunity put into practice priorities identified in the NPDM, as well as advancing implementation of BDP 2100 that includes the management of water resources in the haor area as one of its strategic objectives. Short-, medium-, and long-term plans for the haor region include flood risk protection, river management, achieving water security, integrated water/land resources management, sustainability of haor wetland and biodiversity, and institutional development.

[32] Government of Bangladesh. National Plan for Disaster Management 2021-2025. Dhaka.
[33] See on gender for further details of the challenges faced, especially by women, in gaining access to disaster facilities safe, sanitary, and secure.

## Environment

Environmental and economic factors are closely inter-connected in the north-eastern region of Bangladesh, which is characterized by the presence of large wetland areas (haors) that deliver a range of ecosystem services that providing food, fresh water, flood control, and erosion protection. Agricultural practices in the haor area include rice cultivation, fisheries, farming of various animals including cattle, ducks, chicken, goats. PDNA survey reports that surface waterbodies used for water supply, agriculture, and fisheries in the haor ecosystem were polluted by fully or partially damaged 283,355 toilets. The agrochemicals used in the crop fields contaminated the wetlands by spreading out to the nearby waterbody which in turn affected the fisheries resources including endangered fish species. Overtopping of tube-wells by polluted flood water resulted in contamination of groundwater. Agricultural intensification through increased use of agro-chemicals in the area has led to increases in boro rice production and other agricultural output putting pressure on the ecological balance.

The 2022 floods exposed these risks and highlight the importance of establishing a balance between the ecological and economic priorities. A total of 61,045 ponds and other types of water bodies were damaged due to the 2022 floods, undermining the potential for fisheries and integrity of the wetlands. While embankments are a critical part of maintaining the integrity of the haors, incorrectly located physical infrastructure can exacerbate disaster risks. There has also been a significant increase in tourism-related activities in the haor area. Sustainable tourism can be an important source of diversified income for rural communities; however, unplanned, excessive, and inappropriate use of wetland resources for tourism can degrade habitats and undermine ecosystem services. The haor area also has some forested areas including freshwater swamp forest that experienced some damage due to the floods.

The recovery plan on environment for the 2022 floods will include a combination of physical, behavioral, and governance related activities which will also improve the local environment. Community toilets or sanitation services to be provided by DPHE will substantially improve the surface water quality while supply of treated surface water will reduce pressure on the groundwater. Improving irrigation systems by adopting 500 drip irrigation systems and 500 sprinklers will reduce water loss which in turn ensure more water for fisheries and wildlife in the haor region. Critical embankments will be rehabilitated and reconstructed with due regard to ecological considerations and future disaster risks. The patches of plantation program along the embankment by BWDB will strengthen regulating services of the ecosystem through erosion control and carbon sequestration. Recognizing the importance of including local people in plans for the region, the recovery plan will incorporate activities to raise public awareness about the risks and threats to the wetlands posed by their inappropriate use. Effort will also be made to strengthen the regulatory framework governing access and use of the wetland area and the capacity of local authorities to effectively manage the haor districts.

## Gender[34]

The impact of the 2022 floods on the poor, women and girls was more severe, multi-faceted and different in nature than for any other groups. The floods not only caused economic loss, but also significantly hindered privacy, safety, and security of women and girls due to infrastructure damage. The aftermath of the disaster ranged from deteriorated living conditions of poor households to serious loss of livelihoods and income generating activities especially agriculture and livestock; difficulty availing access to drinking water and sanitary latrines; problem maintaining menstrual hygiene; troublesome daily commute and goods transportation due to damaged roads. Unsanitary defecation practices, and poor quality of water use caused by damaged latrines and tube-wells possess significant health risk among the poor especially women and girls.

[34] See Section 4 on Human Impact Assessment for further details of the impact of the 2022 floods on women and other vulnerable groups.

**Post-disaster impact on women, girls, children, and vulnerable groups**. There is a shortage of adequate flood shelters in affected districts especially in the periphery of Sylhet. Existing shelters are not properly equipped with WASH facilities and gender equality and social inclusion (GESI) features. Users reported that shelters were overcrowded, lacked adequate lighting and sufficient safe spaces for women and children. Water supplies, latrines and other sanitation facilities were inadequate for the sheltering population. Menstruating women, and new mothers suffered the most due to inaccessible toilets.[35]

The floods severely damaged access roads totally cutting off transport connectivity to vital facilities such as hospitals, bazars, and schools. It caused suffering to commuters, the sick, pregnant women, and school going children. Disrupted roads and transport services limited women's mobility and access to critical reproductive health services. Food and lifesaving goods transportation has become more difficult. Most villagers could not take their belongings with them due to two reasons- unaware of early flood warning and lack of safe space for livestock in the shelters, resulting to loss.

The Sylhet-Chattak railway track was critically damaged at different points along with its three stations namely Kajanchi, Gobindaganj, and Chattak. Due to interrupted railway service, low-income people especially daily laborers and farmers have suffered the most. As many as 200 students who travel to attend classes in Sylhet from Chattak are facing difficulty to continue their study. The proposed railway station for reconstruction is not equipped with GESI friendly features. It does not have a ramp for the elderly and differently abled individuals, nor has access to drinking water to passengers. Waiting room and toilets are also out of order. The low-laying railway platform is not suitable for women and elderly people to board train. The railway hospital stopped its operation since the closure of the Chattak station depriving communities of access to health services.

Affected rural farming households lost their only source of income due to flood damage to thousands of hectares of paddy, different varieties of crops, loss of livestock and aquatic resources. A large group of women are among them who are overwhelmed by the loss of livelihoods overnight. They need livelihood restoration support to start all over again. Most farmers in the periphery of Sylhet especially Kanaighat and Goainghat were found to be leaseholders who do not own lands. Crops and livestock loss during flood further burdened them with large amount of debt.

Women are generally involved in vegetable cultivation, rice drying, and livestock rearing. Among women, only female-headed households cultivate rice. They need both financial and training support. DAE runs farmers field school (FFS) for the rural farmers, of which 30% were found to be women. Most farmers in the haor region cultivate one crop (boro) all year round. They remain unemployed rest of the year. Only creating alternative livelihoods opportunity can assist them overcoming the situation.

Women who support their families and children by rearing livestock lost their only source of income. Many households bought their livestock by taking loan from local lenders at high interest rate. Many flood affected families claimed that they are now heavily burdened by debt. On the other hand, the flood also damaged their food stock, clothes, furniture, and educational material of children. Their debt is furter aggravated by food crisis, of which the children and women are suffering the most.

Latrines and tube-wells were the most heavily affected infrastructures during flash flood. Damaged sanitation facilities affected the women and girls more than men. In the absence of latrines, the only way practicable was defecating in polyethene and bucket. Afterwards, feces were thrown away into water. Maintaining menstrual hygiene has been particularly challenging for women with no access to sanitary pad amidst flood especially when flood water washed away their cloths, cooking utensils, and valuable belongings.

[35] See also USAID. 2022. *2022 flash flood – Evacuation centre assessment: Findings from Sylhet and Sunamganj districts, Bangladesh*. Dhaka.

Scarcity of safe drinking water was another challenge even after flood water receded. Tube-wells were damaged and non-functional. Most households had no options but to drink water from nearby waterbodies that was already contaminated by fecal waste from the latrines. Interviewed women reported that many households still drink unsafe water from the rivers and canals.

Damaged access roads were found to have no streetlight at all for commuting at night. It restricts women from carrying out important activities after dusk due to safety concerns. Absence of adequate lighting is potentially detrimental for safety and security of women as well as prevention of GBV, harassment and other criminal activities.

**Recovery needs and recommendations**. More multi-storey flood shelters need to be constructed to accommodate displaced populations during floods. The new shelters should be equipped with GESI features including ramp, lactating room, gender segregated toilets and WASH facilities. The shelters should also be equipped with emergency power supply for lighting and access to water during disaster as well as space for livestock.

To avoid adverse effects of damage of flood embankments in the areas where only one crop is cultivated all year round, livelihood trainings would facilitate the poor creating alternative source of income and navigate through difficult times. However, at least 30% of livelihood trainings should be poor women, single mothers, or divorced women.

Tube-wells that suffered different degrees of damage during flood need immediate repairing. Considering the vulnerability of flood prone Sylhet division, climate resilient tube-wells with raised platform shall be explored as a design option for DPHE. Installation of mini-piped water system with public tap stands would a practical answer to provide water in mass scale for low-income rural communities. Improved access to water will minimize both time poverty and physical stress for women. Unsanitary makeshift toilets in affected areas need an immediate upgrade to improved toilets preferably with raised platform and septic tank; because otherwise the structures will be easily damaged during flood and leak fecal sludge into environment.

To overcome the seasonal employment crisis, livelihood training for farmers in haor region may facilitate the poor households. Similar to FFS, the target trainees must include at least 30% women. Farmers need support for irrigation modernization and cheaper agricultural equipment. One option is to form farmers group/association and distribute machineries among them at subsidized rate. 20-30% female farmers must be included into the group so that they can avail the services at cheaper price. To avoid adverse effects of flood and reduce extreme dependency on rice cultivation, DAE officials suggested crop diversification and promoting rabi crop including mustard, sunflower and corn. To do so, seeds and fertilizers need to be distributed among the farmers. At least 30% recipients of those should be women.

To eradicate unsanitary defecation practices, a large-scale awareness program on hygiene, sanitation, climate adoptive practices and menstrual hygiene and techniques of rain-water harvesting is necessary for rural communities. The affected population should be trained on rainwater harvesting and mobile toilet use as an adoptive strategy for future disastrous events.

Among other recommendations to avoid future impacts of disasters on agriculture DAE officials proposed controlling water level through sluice gates; building threshing floors in the haor region for paddy drying and storing; thunder arrester in the paddy fields. These facilities should be given under the management of cooperative society. They should include at least 20-30% women into the groups. All other trainings such as organic farming, vermin compost use should include 20-30% women participants.

During reconstructing of railway stations, adding GESI friendly features including sex segregated toilet, separate waiting room, and access to drinking water in the station would make the trains equally usable for all age and sex groups. Railway stations should include safe ticketing, waiting, commuting, toilet and breastfeeding facilities at the stations. Low laying station platform should be

raised to make train boarding comfortable for women, elderly, children, and persons with disability. Separate ticket counter for men and women will reduce unnecessary competition for tickets.

The current SOD also includes guidelines on gender-responsive DRR include detailed instructions that cover the entire disaster management cycle from pre-disaster preparedness; assessing post-disaster damage and needs; post-disaster humanitarian response planning, strategies and resource mobilization; implementation and monitoring; through to evaluation and lessons learned. Many of the provisions of the SOD on gender-responsive DRR have yet to be fully implemented. The 2022 floods offers an opportunity to significantly advance the integration gender-responsive DRR into the response and recovery framework and agency plans.

**Governance**

At national level, MoDMR has overall responsibility for coordinating national disaster management efforts and serves as secretariat to National Disaster Management Council (NDMC), the highest-level body for providing direction, functional and hazard-specific planning and execution responsibilities that are assigned to sectoral ministries and agencies. The SOD provide direction to sectoral ministries and other agencies on their roles and responsibilities on risk reduction, disaster preparedness, response, recovery and related activities. MoDMR provides technical support for capacity development of sectoral ministries and other agencies required for the implementation of the NPDM.

In 2015, a National Emergency Operations Center (NEOC) was established at the secretariat of the MoDMR as a coordination mechanism to respond effectively to the severe disastrous situations of the unanticipated event. Emergency operations centers can also be activated at the district level to manage and coordinate disaster response through strategic deployment of staff to the field as well as coordination with various clusters and working groups. The Ministry of Foreign Affairs (MoFA) leads the coordination of external humanitarian assistance. It coordinates requests for international assistance as directed by the government and NDMC.

At the sub-national level (union, sub-district, and district) disaster management committees (DMCs) are established and capacitated to conduct vital disaster management functions prior, during, and after any disaster events. DMCs are comprised of locally elected public representatives, local administrators, as well as representatives such as women, teachers, and community leaders. During disasters, DMCs provide local-level coordination. Following a bottom-up approach, findings, and recommendation of DMCs are transmitted from union (lowest administrative level) to district level via sub-district DMCs. District DMCs collect, collate, and transmit findings to DDM and MoDMR.

In relation to the 2022 floods, local DMCs were activated to collect information on the effects of the floods shortly after the disaster struck using the D-form templates starting down at the ward level and up the district level. Local DMCs helped coordinate the conduct of various rapid assessments conducted by UN agencies and INGOs through the cluster structures on gender[36], food security[37], and shelter.[38] They were also involved in coordinating with organizations involved in the immediate response, especially in the context of initiatives supported by members of NAWG as well as the government's own

**Humanitarian coordination**. To enhance the coordination of the post-disaster humanitarian response, a Local Consultative Group for Disaster and Emergency Response (LCG DER), co-chaired by the UN and the MoDMR was established. The Humanitarian Coordination Task Team (HCTT) along with its nine humanitarian clusters and various working groups, operates under the auspicious of LCG-DER. In addition to its coordination function the HCTT plays a vital role in formalizing and strengthening the relationship between the government of Bangladesh and national and international humanitarian organizations.

[36] UN WOMEN. 2022. Rapid gender analysis of flood situation in north and north-eastern Bangladesh. Dhaka.
[37] Bangladesh Food Security Cluster. 2022. Rapid food security, livelihood and market assessment. Dhaka.
[38] Shelter Cluster Bangladesh. 2022. Flash Flood 2022 in Bangladesh: Shelter Damage and Needs Assessment. Dhaka.

**DAMAGE, LOSS, AND NEEDS ASSESSMENT**

The HCTT has advocated for the inclusion of the cluster system and the HCTT platform in the current revision of the SODs. To reinforce humanitarian engagement in support of key national authorities, the need to organize high-level quarterly strategic meetings between NDMC members, including UNRC, was also highlighted. The HCTT has also advocated for strengthening of humanitarian civil-military coordination. The prime ministers' office has recently established a consultative group on civil-military coordination to be led by MoDMR and the armed forces division to facilitate the interaction between humanitarian and military actors for disaster response, and to guide the development of policy and strategic advice.

# 6 BUILDING BACK BETTER FOR A GREEN, INCLUSIVE, RESILIENT BANGLADESH

## BUILDING BACK BETTER FOR A GREEN, INCLUSIVE, RESILIENT BANGLADESH

Disaster recovery presents an opportunity to build resilience to future disasters, increase adaptation to climate change, and advance economic and environmental sustainability. A recovery framework (RF)[33] for the 2022 floods has therefore been prepared to complement the findings of the damage, loss, and needs assessment. The RF sets out a vision and defines guiding principles for medium-term recovery over the next three years (from mid-2023–mid-2025). In recognition of the long-term nature of recovery and reconstruction, recovery efforts beyond three years will be integrated into the national development planning process. Though the programs and financing presented in the RF are based on the sectoral needs and recovery programs identified in the PDNA, they are only a subset of the overall recovery needs identified.

The RF, which follows a sector based and programmatic approach, specifies rehabilitation priorities and illustrative recovery projects to be undertaken in affected areas from mid-2023–mid-2026. The Government's recovery efforts will center on restoring public assets and services, providing assistance and support to affected individuals, households, and communities to recover from the disaster and restore livelihoods and economic activities, and bolstering resilience against future disasters. Some projects related to recovery are currently underway; others have been started by the Government, development partners, and civil society organizations. Despite the intended allocation of resources to the recovery effort, it is uncertain that existing resources will be sufficient to recover completely from the tragedy. As a result, there will be a funding shortfall for which the Government will seek assistance from development partners.

Implementation of the recovery programs will require regular and on-going coordination and monitoring to ensure that constraints and bottlenecks are quickly overcome. The Government has assigned overall responsibility for the recovery framework to MoDMR. Coordination and monitoring will be undertaken by Department of Disaster Management (DDM) drawing on existing mechanisms wherever possible.

[33] A recovery framework (RF) brings focus to the recovery effort, guides coordination across institutions, enables deeper participation of affected communities, leverages partnership, and helps to mobilize resources.

## A. Current Government policies and plans

The Government has issued a range of policies and plans that are relevant for designing and implementing the recovery plan for the 2022 floods.[34] Reducing future disaster risk of flood-damaged infrastructure requires a medium to long-term investment in climate adaptation beyond the short-term recovery and reconstruction that will be well aligned with the Government's National Adaptation Plan (NAP) approved in November 2022.[35] The NAP documents Bangladesh's successful adaptation initiatives in water, flood, and erosion management as well as for disaster risk reconstruction and climate resilience livelihood. It identifies the haor area as one of the 11 climate-stressed regions with flood risk management being a top priority. The climate resilient infrastructure can be developed innovatively that can serve as a benchmark for infrastructure in other climate hotspots.[36]

The post disaster recovery framework will be aligned with the Government's haor area masterplan—a framework plan for developing the haor areas through optimal utilization of natural and human resources for the next 20 years (up to FY 2031-32).[37] The plan has been formulated following the principles of integrated water resources management of social equity, economic efficiency, and environmental sustainability. In addition, the recovery framework will also be aligned with Bangladesh Delta Plan 2100 (BDP2100) for integrated water resources management in a holistic way by addressing climate change and environmental challenges.[38] BDP2100 recognizes the haor area as one of 6 hotspots for water resource management through the integration of water, land use, and climate change. BDP 2100 highlights the need to effectively reduce vulnerability to floods and build resilience to climate change and other delta challenges.

**Climate Adaptation**:

NAP's areas of emphasis includes building climate-resilient housing facilities; managing disruptions of livelihoods due to disasters, such as occupational changes and shifts in work hours; expanding social safety nets and security; reducing early marriage, domestic violence and abuse; improving the disaster resilience of child education facilities; improving rural WASH infrastructure; ensuring social inclusion in disaster management; and establishing risk and recovery mechanisms for climate vulnerable people and migrants with a World Bank study estimating that Bangladesh could have 13.3 million internal climate migrants by 2050.[39]

## B. Bangladesh's vision for a green, inclusive, resilient recovery

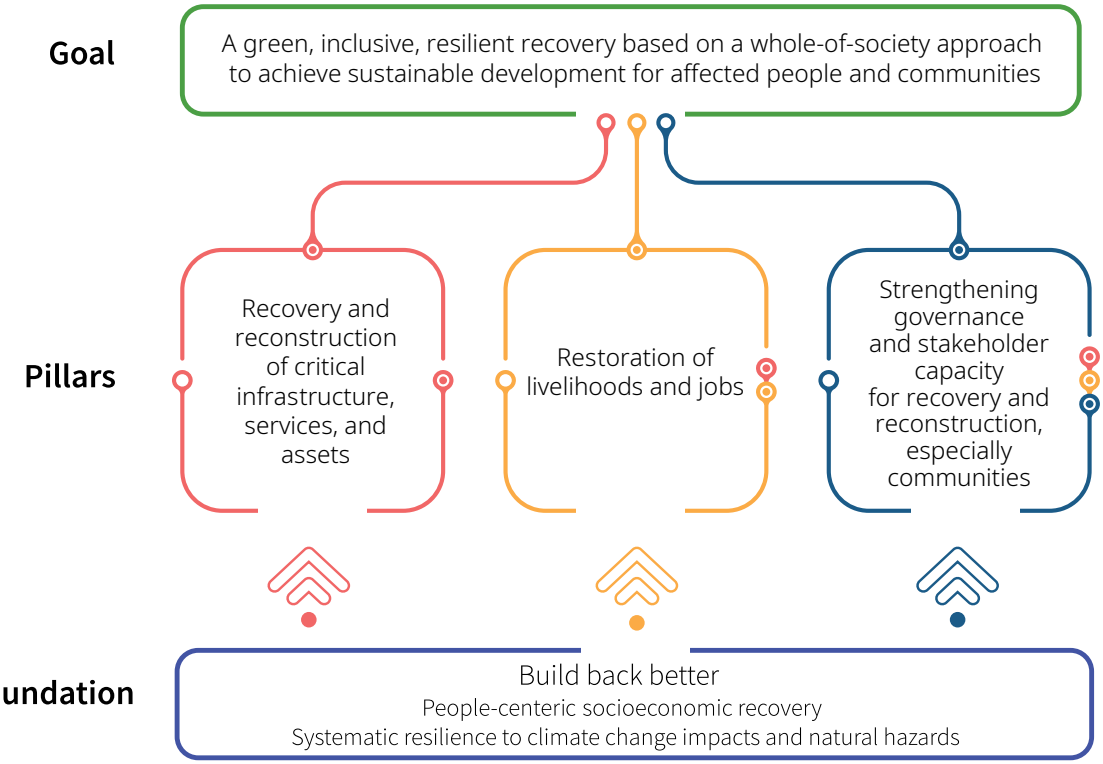
The 2022 floods reflect the increasing risk faced by the north-eastern districts of Bangladesh from disasters and the effects of climate change. The 2022 floods call for systemic changes to respond to disasters and their intersection with other shocks. Actions are needed to speed-up efforts to mainstream resilience to disaster and climate change in development planning and asset management. This requires a participatory and inclusive approach that brings together civil society, government, the private sector, academia, think tanks, and the international community. The recovery strategy for recovering from the 2022 floods includes extensive stakeholder engagement to inform the scope, design, institutional arrangements, monitoring, and accountability framework for recovery. Building on global recovery good practice, within the context of Bangladesh's socioeconomic, cultural, and institutional circumstances, the recovery program will prioritize the

[34] Annex 2 presents a summary of national plans, policies, strategies, legislation, and programs related to disaster risk management and climate adaptation.
[35] Ministry of Environment, Forest, and Climate Change, 2022. National Adaptation Plan of Bangladesh, Dhaka. The NAP proposes 113 interventions, including 90 high-priority projects aimed at a total investment of BDT20,037 billion (approximately $230 billion) to be implemented over 27 years (2023–2050) until the 13th Five Year Planning period. The NAP will be mainstreamed by the sector ministries in their respective annual development plans.
[36] Annex 3 provides an outline of activities highlighted for the haor region in the NAP.
[37] Government of Bangladesh. 2012. Master Plan of *Haor Area.* Dhaka.
[38] Government of Bangladesh, Ministry of Planning, 2018. Bangladesh Delta Plan 2100, Dhaka.
[39] World Bank. 2022. Resilient Infrastructure for Adaptation and Vulnerability Reduction Project. Washington DC (P173312).

needs of affected populations while delivering results efficiently, equitably, and transparently. Bangladesh's vision for a green, inclusive, resilient recovery from the 2022 floods rests on three key pillars grounded in an underlying foundation (Figure 5).

Figure 5

Framework for a green, inclusive, resilient recovery




The RF is based on the need to restore lost livelihoods and assets and improve lives, strengthen communities, and upgrade assets to make Bangladesh more resilient to future disaster and climate change impacts—supporting the country's on-going transition from disaster response to disaster risk management. In working towards the vision of a stronger and more resilient Bangladesh, a set of principles has been developed to guide recovery efforts that will be reflected in the specific recovery plans of ministries and departments:

- **Build back better:**

Recovery includes reconstruction, rehabilitation, and enhancement—not simply re-establishing the pre-disaster status. To reduce future vulnerability and improve living conditions, while promoting more effective reconstruction taking account of the risk from natural hazards (climate-related and hydrological), a BBB approach will be employed to enhance the resilience of key infrastructure. By applying BBB principles, roads, bridges, and public buildings will be reconstructed to a better, climate resilient, and more durable construction level. Opportunities to build back better must be considered when they clearly contribute to an improvement in resilience and/or functioning, are cost-effective based on life-cycle analysis, and do not come at the expense of repairing or replacing important infrastructure and services elsewhere. The BBB foundation in the RF will also support implementation of action plan 4 of the Government's National Plan for Disaster Management.

- **Climate smart:**

Given the dominant role of agriculture as a means of livelihood for families in the north-east, there is a considerable opportunity to support and expand efforts to implement climate-smart agriculture practices In the context of the haor area these may include floating farming, weather-based insurance schemes to reduce farmer risk, increasing the use of renewable energy in agriculture, crop suitability zoning, localized weather forecasting, stress-tolerant rice varieties.

- **Inclusion:**

Being inclusive implies integrating civil society, the private sector, communities, gender issues, and social inclusion into the recovery effort with a strong focus on developing community capacity for adaptation and resilience. Providing voice to vulnerable groups, including women and girls, persons with disability, and youth is essential for strengthening local resilience. To better prepare the poor and vulnerable to deal with the effects of future hazards and shocks, recovery programs will respond to the needs of the most socioeconomically vulnerable households and communities, such as enhancing poor people's access to financial services through microfinance and microinsurance.

- **Resilience:**

To build a stronger and more resilient Bangladesh, the recovery program will support continuing efforts to move forward from integrating resilience prominently into public policy and planning frameworks and institutions—a task that Bangladesh has made recognized progress on—to action through the implementation of programs and projects for which substantial resources will be made available.

- **Collaboration and coordination:**

To accomplish the quickest and most successful recovery, central and local government, development partners, civil society, the private sector, communities, and individuals will need to work together under the overarching supervision of the national government. The Government will provide periodic reports on the status of the recovery plan to maintain a steady flow of information. Development Partners will be invited to provide updates based on their individual recovery efforts.

## C. Programmatic approach

**The RF will adopt a sector-based programmatic approach that seeks to:**

- Promote synergy across activities where beneficial
- Incorporate risk mitigation and improvement opportunities to bolster resilience
- Use social impact assessment methodologies and tools to assure appropriate program design with people's participation
- Identify program objectives, targets and indicators based on pre-disaster baselines and expectations for the recovery, which can subsequently be used to measure the overall performance of recovery programs.

Priorities for recovery from the 2022 floods will be determined by the needs identified during the humanitarian response, early recovery activities, and the PDNA process. The RF covers medium-term recovery and reconstruction activities over a three-year period from mid-2023 –mid-2026, in addition to coordinated short-term ongoing humanitarian assistance.

Recovery initiatives will be launched in a variety of ways, including new initiatives and reprioritization of existing programs. Collaboration is essential for connecting those involved in recovery, including those in government, business, culture, and other non-governmental sectors. It is difficult for a single agency or group to achieve recovery on its own, and agencies will need to collaborate. Agencies will be able to take coordinated, timely, and long-lasting initiatives if they establish and maintain constructive relationships.

**Recovery programs are being, or will be, implemented under three recovery priority areas:**

### Recovery priority 1: Repairing and improving critical infrastructure

BBB principles will be used to restore and improve the functioning of public infrastructure and services to increase resilience to climate change. Repair, reconstruction, and rehabilitation of critical infrastructure such as rural roads and bridges will allow for the delivery of services to affected communities as well as greater movement of people, goods, and services, acting as a catalyst for recovery. Repair and reconstruction of tube-wells for water supply, as well as assistance with the installation of new latrines, will improve WASH outcomes. Design options for elevated emergency service delivery hubs will also be investigated.

### Recovery priority 2: Restoring livelihoods

By providing short-term employment opportunities such as cash-for-work, social protection services, and access to microfinance services, the livelihoods of those affected will be improved, particularly for vulnerable people and those living in poverty. This includes assistance for more productive, climate-smart agriculture, fisheries, and livestock to ensure the north-eastern districts' economy recovers in a sustainable manner. Food security will be improved in affected areas as agricultural production is restored through the selection of climate-resilient crops and infrastructure.

### Recovery priority 3: Strengthening governance and capacity

The Government will support efforts to improve disaster risk management and adaptation to climate change enable Bangladesh to become more resilient through the reconstruction, replacement and repair of priority infrastructure; strengthening governance and institutional arrangements, strengthening community understanding of risk and resilience; development of a comprehensive disaster risk management (DRM) communications strategy; development of a framework for monitoring the progress and evaluating the impact of the overall recovery program; and exploring options for investing in catastrophe risk insurance.

## D. Coordination, monitoring, and communication

Existing legislation provides for MoDMR to take a leadership role in overseeing the coordination, monitoring, and reporting of progress on the recovery program for the 2022 floods. Individual line agencies will be responsible for developing and implementing their own specific investment programs and will report progress to DDM who will provide regular updates of the status of implementation.

For the recovery program, a results-oriented monitoring framework, will be developed, including measures to unblock bottlenecks. Effective monitoring necessitates program refinement in terms of expected outcomes, indicators, and targets. Government spending on recovery activities will be tracked using existing financial systems by tagging recovery activities as part of the recovery program. Development partners will be asked to prepare reports on financial expenditures and achieved results. Reports will cover the status of implementation and highlight any challenges that must be overcome.

MoDMR will develop and implement a communication strategy to keep all stakeholders up to date on progress. A quarterly progress report on the recovery program will be prepared to allow stakeholders to monitor recovery progress, including through popular media channels. The RF will be reviewed on a regular basis to ensure that it remains current and relevant. A review may be required if another significant event forces changes to the longer-term approach to recovery; monitoring reveals the need to revise the approach to recovery or address an ongoing market failure; and/or other influences or risks materialize that have a significant impact on recovery activities, such as changes in the availability of finance or changes in global conditions that have a direct impact on the recovery program.

## E. Development partner support for recovery and resilience

The Government has requested ADB to support an emergency assistance loan (EAL) to help finance the recovery program that includes improving access roads and infrastructure, rehabilitating irrigation infrastructure and embankments, constructing WASH facilities, restoring railway infrastructure for improved livelihood, and improving rural livelihoods through agricultural transformation. The Government will seek additional support to meet remaining financing gaps.

In addition to financing recovery needs associated with the 2022 floods, development partners have already committed to provide support for longer-term resilience.

The World Bank is providing $500 million for the Resilient Infrastructure for Adaptation and Vulnerability Reduction (RIVER) project that was approved in May 2022.[40] The project will directly support areas damaged by the floods through construction of climate-resilient flood shelters and community infrastructure, and the conduct of capacity development initiatives for disaster preparedness and response in the most flood-prone districts, including the flood-affected districts of north-east Bangladesh. The RIVER project will be implemented over 6 years (2022–2026).

JICA has an ongoing JYP15.27 billion (approximately $108 million) Haor Flood Management and Livelihood Improvement Project covering flood management infrastructure, rural infrastructure and agriculture and fishery in the five Haor region districts of Brahmanbaria, Habiganj, Kishoreganj, Netrokona and Sunamganj.[41]

[40] World Bank. 2022. *Bangladesh: Resilient Infrastructure for Adaptation and Vulnerability Reduction Project - Project Appraisal Document*. Washington D.C.
[41] JICA, 2014. *Haor Flood Management and Livelihood Improvement Project (HFM&LIP) – BD-P80 | Countries & Regions*. Tokyo.

**BUILDING BACK BETTER FOR A GREEN, INCLUSIVE, RESILIENT BANGLADESH**

IFAD has also an ongoing (2011–2023) Haor Infrastructure and Livelihood Improvement Project – Climate Adaptation and Livelihood Protection ($133.3 million) covering the five Haor region districts of Netrokona, Sunamganj, Kishoreganj, Habiganj and Brahmanbaria.[40] IFAD's project aims to reduce poverty in these five districts by improving road infrastructure, building local capacity, and expanding access to natural resources, technology, and markets.

UNDP Bangladesh has conducted a community-led housing recovery need focusing on private housing and community infrastructure in the worst impacted upazilas (subdistricts) of Sylhet, Sunamganj and Netrokona. Based on the UNDP assessment, the housing recovery and reconstruction with build back better principals is estimated to cost Tk27,687 million ($296 million).

# 7 CONCLUSIONS

**Bangladesh is exposed to a high level of disaster risk.** It is ranked as the 7th most disaster-affected country in the world, one of the 10 most climate-affected countries, and is ranked as the 28th most vulnerable and 35th least ready to respond to climate change. The country faces numerous disasters including floods, cyclones, tidal surges, riverbank erosion, earthquakes, and landslides on a regular basis. The high level of disaster risk is being further compounded by the effects of climate change. IPCC estimates predict that "wetter rainy seasons and drier dry seasons" with more violent monsoon floods will affect the South Asia region in future.

**The unprecedented floods that struck during May–June 2022 inundated a vast area across 18 affected districts in the north and north-eastern part of Bangladesh.** The compounding effect of twin flood events during May followed by record-breaking rainfall in Meghalaya state in India during June caused widespread damage, destruction, and disruption to public infrastructure, services, and livelihoods. The more than 1-in-100-year floods of 2022 dramatically reduced agricultural output in the worst affected districts, washed out thousands of tube-wells on which people depend for their drinking water supplies, caused extensive damage to embankments and culverts that help manage the flow of water, and seriously affected the rural road network that people rely on for their livelihoods and access to services. An estimated 7.2 million people were affected by the floods and 141 people lost their lives between May–August 2022.

**An immediate post-disaster damage assessment conducted by MoDMR estimated the total cost of damage in 13 sectors in 18 districts affected by the floods at Tk564,984 ($547.6 million).** The 7 haor wetland area districts of Sylhet, Sunamganj, Moulvibazar, Habiganj, Netrokona, Kishoreganj, and Brahmanbaria, and 2 adjacent districts of Mymensingh and Sherpur bore the brunt of the disaster, accounting for more than 68% of the total damage estimated by MoDMR. Among the 13 sectors, 4 sectors accounted for 62% of total damage—rural roads, bridges, culverts, and railways; water resources management; WASH; and agriculture and livestock. The housing sector accounted for a further 30% of the damage.

**The 2022 floods compounded the macroeconomic challenge confronting Bangladesh.** The economy was still recovering from the negative economic impact of the COVID-19 outbreak and the global economic downturn experienced during 2022, which have been reflected in a lowering of the country's growth prospects for 2023. The average economic impact of disasters has been estimated at $2.2 billion annually, equivalent of 1.5% of current GDP.

**People living in districts affected by the floods experienced extreme hardship.** Damage to rural infrastructure disrupted access to services, such as schools, clinics, and hospitals, and economic connectivity was hampered by interruption to market access and loss of agricultural output. Employment and livelihood opportunities were severely impacted with reduced demand for day-laborers and difficulty for farmers to undertake agricultural activities. A household survey carried out after the disaster found that monthly income in the two worst affected districts of Sylhet and Sunamganj declined by 61% and 71% respectively. Impacts on health and education are also likely to be significant. More than 3,000 primary and secondary schools in Sylhet and Sunamganj districts were affected and remained closed for about a month, resulting in learning loss for over 1.5 million learners, and 349 community clinics out of 505 were affected. Cases of waterborne diseases and other ailments were reported up to the end of July 2022, affecting 19,918 people.

**Women and other vulnerable groups were disproportionately impacted by the floods.** Flood shelters were overcrowded and lacked gender-sensitive and disability-inclusive design features. A lack of clean drinking water due to damaged and non-operational tube-wells and destroyed latrines caused multiple problems, including open defecation that contaminated scarce drinking water supplies. Women who were interviewed stated that many households continue to consume contaminated river and canal water. School closures, which affect children's mental health, nutrition, and abuse risk, in addition to lost learning, can increase young girls' vulnerability to unintended pregnancy, early, and forced marriage.

**The assessment carried out for the PDNA estimated the cost of damage and loss at Tk652,970 lac ($629.0 million) and needs at Tk602,709 lac ($580.6 million).** The damage, loss, and needs assessment focused on the 9 heavily affected north-eastern districts and 4 priority sectors linked to the Government's priorities for recovery and reconstruction of public infrastructure and economic recovery, (Table 11).

**Table 11: Damage, loss, and needs by sector**

| Sector | Damage | | Loss | | Total damage and loss | | Recovery and reconstruction needs | |
|---|---|---|---|---|---|---|---|---|
| | (Tk lac) | ($ million) | (Tk lac) | ($ million) | (Tk lac) | ($ million) | (Tk lac) | ($ million) |
| Rural roads, bridges, culverts, and railways | 250,514 | 241.3 | 62,772 | 60.5 | 313,286 | 301.8 | 325,668 | 313.7 |
| Water resources management | 42,252 | 40.7 | - | - | 42,252 | 40.7 | 149,554 | 144.1 |
| Water supply, sanitation, and hygiene | 52,591 | 50.7 | 5,259 | 5.1 | 57,850 | 55.7 | 40,495 | 39.0 |
| Agriculture and livestock | 75,587 | 72.8 | 163,995 | 158.0 | 239,582 | 230.8 | 86,992 | 83.8 |
| **Total** | **420,944** | **405.5** | **232,026** | **223.5** | **652,970** | **629.0** | **602,709** | **580.6** |

In terms of geographic breakdown, the two worst affected districts of Sunamganj and Sylhet together accounted for 57% and 63% of total damage and loss, and recovery and reconstruction needs, respectively (Table12).

**Table 12: Damage, loss, and needs by district**

| | Damage | | Loss | | Total damage and loss | | Recovery and reconstruction needs | |
|---|---|---|---|---|---|---|---|---|
| | (Tk lac) | ($ million) | (Tk lac) | ($ million) | (Tk lac) | ($ million) | (Tk lac) | ($ million) |
| Sylhet | 95,083 | 91.6 | 55,873 | 53.8 | 150,956 | 145.4 | 138,258 | 133.2 |
| Sunamganj | 165,640 | 159.6 | 56,107 | 54.0 | 221,747 | 213.6 | 240,218 | 231.4 |
| Moulvibazar | 23,162 | 22.3 | 9,383 | 9.0 | 32,545 | 31.4 | 35,423 | 34.1 |
| Habiganj | 31,923 | 30.8 | 57,445 | 55.3 | 89,369 | 86.1 | 54,016 | 52.0 |
| Mymensingh | 9,188 | 8.9 | 3,849 | 3.7 | 13,037 | 12.6 | 11,713 | 11.3 |
| Netrokona | 26,316 | 25.3 | 9,174 | 8.8 | 35,490 | 34.2 | 33,556 | 32.3 |
| Sherpur | 15,148 | 14.6 | 3,248 | 3.1 | 18,396 | 17.7 | 19,354 | 18.6 |
| Kishoreganj | 15,187 | 14.6 | 7,305 | 7.0 | 22,492 | 21.7 | 17,274 | 16.6 |
| Brahmanbaria | 13,646 | 13.1 | 23,501 | 22.6 | 37,148 | 35.8 | 19,549 | 18.8 |
| Kurigram | 8,727 | 8.4 | 1,859 | 1.8 | 10,586 | 10.2 | 11,345 | 10.9 |
| Jamalpur | 16,924 | 16.3 | 4,282 | 4.1 | 21,206 | 20.4 | 22,002 | 21.2 |
| **Total** | **420,944** | **405.5** | **232,026** | **223.5** | **652,970** | **629.0** | **602,709** | **580.6** |

**The RF prepared for the PDNA emphasizes the importance of building back better as a key foundation for achieving longer-term resilience to the increased risks predicted due to climate change.** Implementing BBB in practice requires a people-centric approach to socioeconomic recovery and establishing systematic resilience to the impact of climate change and natural hazards. Government agencies responsible for undertaking recovery and reconstruction activities in the four priority sectors for recovery and reconstruction of public infrastructure and economic recovery will adopt approaches designed to strengthen longer-term resilience. For example, the design of rural roads will be enhanced to a higher level of resilience, concrete armoring will be selectively applied to strengthen embankments, elevated platforms and submersible pumps for deep tube-wells will be implemented to increase the sustainability of water supply, and climate-smart agricultural practices will be adopted.

**Significant financial resources are needed to establish longer-term resilience in the north-eastern districts.** The planned EAL from the Asian Development Bank will make an important contribution to enable and accelerate implementation of activities that support the recovery and reconstruction effort for the 2022 floods in the 9 target districts and 4 focus sectors. However further resources will be needed to cover other areas and other key sectors, such as housing. External funding for longer-term resilience already includes the World Bank's RIVER project, and support from JICA and IFAD in the haor area. Beyond the existing and planned external support and to leverage scarce public resources, the Government is also engaged in mobilizing additional financing from global climate funds for building resilience.

# ANNEXES

## ANNEX 1: STAKEHOLDER ENGAGEMENT

A broad range of stakeholders participated in the PDNA process, including but not limited to Government ministries and departments, sectoral experts, academics, elected representative, local official, and civil society organizations. The kick-off meeting of the PDNA was held on 10 November 2022 with representatives from BWDB, LGED, DPHE, DAE, and BR. Representative officers of ADB and sector experts also attended meeting.

Extensive field visit was conducted in the second half of November. The PDNA focused on five sectoral agencies: BR, BWDB, DPHE, DAE, and LGED. Field officers of government administration and selected sectors were met in the field. Sector offices were visited by sector specialists but the TL and DTL visited all other agencies. Sector based recommendations were expressed by the agencies and also by local people.

BWDB emphasized on restoring the effectiveness of the flood defense systems through repair and reconstruction of damaged embankments, sluices, and regulators. Guarding riverbank erosion is very important to protect the bank protection works along the affected riverbanks. Field offices of BWDB and local people emphasized on submergible embankments. Additional suggestions were the armoring of the embankments, culvert construction, flood fuses, and causeways.

For the construction or reconstruction of rural roads at Upazila level, the key agency is the LGED. The PDNA team consulted the LGED at headquarters, division, district, and upazila level. The recovery packages preferred by LGED have been planned under three packages: road rehabilitation; bridge and culvert rehabilitation or reconstruction; and slope protection of the roads.

DAE was consulted through the focal point of headquarters, divisional and district offices, as well as farmers at the field level. From a recovery point of view, DAE emphasized agricultural mechanization by using combine harvest and rice transplanter with a view to reduce the risk of crop damage; high value crops cultivation (tomato, bean, etc.); irrigation facilities development to bring cultivation of non-cultivated field; efficient water management like drip irrigation, sprinkler irrigation, etc.; ensure quality seed for increasing productivity; soil health improvement (vermicompost/compost etc.); fruit gardening (guava, citrus fruits, etc.); capacity building of farmers and extension officials; demonstration activities to disseminate technologies; institutional development to adapt climate adverse condition; and development of training infrastructure facilities.

DPHE was consulted for their recovery plan for drinking water and sanitary toilets. The agency prefers the installation of new DTWs with pump facilities over STWs in Sunamganj district. Because ground water level falls beyond the reach of STW, especially in winter season. There is little scope for repairing affected latrines. Therefore, the agency plans to construct new latrines.

The PDNA team consulted BR for the assessment of loss, damage, and needs in the rail segment connecting Chhatak from Sylhet. The agency indicated to fix the broken line with an addition of some rail bridges where the line has been totally washed out by flood water.
In addition, the key agencies identified 5 sectors, other important agencies, including but not limited to district and Upazila administration, DDM, and ERD.

Additionally, UNDP, JICA, and Needs Assessment Working Group (NAWG) were also consulted for a better understanding of needs and required response.

## ANNEX 2:

## NATIONAL PLANS, POLICIES, STRATEGIES, LEGISLATION, AND PROGRAMS RELATED TO DISASTER RISK MANAGEMENT AND CLIMATE CHANGE ADAPTATION

| Year | National plans, policies, strategies, and programs | Remarks related to disaster risk reduction and anticipatory action |
|---|---|---|
| 1973 | Cyclone Preparedness Program (CPP) | Dissemination of early warning and information of the cyclone, giving primary aid during cyclone, searching, rescuing, and transferring people to the safe shelter |
| 1988 | Flood Action Plan | A long-term program for obtaining a permanent and inclusive solution to the flood problem of Bangladesh |
| 1993 | Disaster Management Council | Provide policy guidance towards disaster risk reduction and emergency response management |
| 1997 | Standing Order on Disaster | Disaster risk reduction and strengthening emergency response system |
| 2001 | National Water Management Plan | Implement an information network; Management of water and land resources during disaster like flood, erosion, river morphology changes |
| 2005 | Coastal Zone Policy | Intensifying the coverage of safe drinking water facilities during disaster; Sustainable livelihoods for vulnerable communities |
| 2008 | National Disaster Management Policy | Emphasizes on strategic policy framework, national principles, broad national objectives, and strategies of disaster management |
| 2009 | Bangladesh Climate Change Strategy and Action Plan (BCCSAP) | Climate change strategy management to eradicate poverty and reduce disaster risk reduction while prioritizing adaptation |
| 2012 | Disaster Management Act | Disaster zone declaration, disaster management fund relief, helps in coordination of disaster management activities, strengthen and formulate rules, regulates the mandatory rules and responsibilities of Ministries, committees, and appointments, and build infrastructure for effective disaster management |
| 2013 | National Water Act | Protect any water bodies (pond, lake) used for safe drinking water supply, more urgently in the disaster-stricken area. |
| 2013 | The Climate Change and Gender Action Plan (CCGAP: Bangladesh) | Gender inclusive comprehensive disaster risk management |
| 2015 | National Plan for Disaster Management | Shift towards a comprehensive disaster risk reduction culture, from just disaster relief and response |
| 2018 | Bangladesh Delta Plan 2100 | Long-term plan to ensure water and flood security economic growth and environmental sustainability while reducing vulnerability to natural disasters and building resilience to climate change |
| 2019 | Standing Orders on Disasters, and Guidelines for Government at all levels | Established the essential actions that are required in implementing Bangladesh's Disaster Management Model |
| 2020 | National Plan for Disaster Management 2021-25 | Updated earlier plan with focus on build back better |
| 2021 | Mujib Climate Proserity Plan | Highlight need to improve adaptation capacity of communities through capacity building and infrastructure |
| 2022 | National Adaptation Plan (NAP) | Identify specific adaptation needs; develop and implement strategies, adaptation investment to undertake actions for protecting vulnerable communities. |

**Source:** Zaman T, Tahsin KT, Rousseau Rozario S, Kamal AB, Khan MR, Huq S and Bodrud-Doza M. 2022. An overview of disaster risk reduction and anticipatory action in Bangladesh. Front. Clim. 4:944736.

**ANNEX 3:**

**SUMMARY OF NATIONAL ADAPTATION PLAN STRATEGIES AND INVESTMENTS FOR THE HAOR AREA**

The NAP has identified some adaptation options, with a focus on the haor and Sylhet-Mymensingh region. Improved water resource management includes the conservation of ecosystems, wetlands, and biodiversity, with a focus on supporting sustainable development through adaptation. Nature-based solutions (NbS) will be promoted as an umbrella term for ecosystem-based solutions to protect, sustainably manage, and restore natural or modified ecosystems, as well as to address societal challenges effectively and adaptively. Dredging of all major and medium rivers would be done to accommodate and smooth flood drainage during climate-induced extreme events. Furthermore, the NAP recommends participatory conservation of wetlands ecosystems by promoting submersible embankments and elevated roads with adequate cross-drainage; construction of guide walls for protection from wave action or flash floods in haor areas; operationalization of M&E system for polder/ embankment management; and regular cleaning of khals (canals) inside the haor.

To improve connectivity, the NAP emphasizes the construction of farm-level roads, particularly in haor and low-lying areas; regular and timely maintenance of water management and drainage structures, embankments, and submersible embankments; and maintaining connectivity of rivers or khals with perennial beels and seasonal wetlands in haor areas. Connecting emergency response services via boat ambulances, boat schools, potable drinking water, medication and sanitation facilities; repairing, rehabilitating, or building access roads to gender and disability-responsive flood shelters; and conservation of urban wetlands or khals; developing walkways and recreational facilities along the banks of khals or wetlands.

The NAP-guided WASH interventions for the Haor areas are as follows: research and piloting for climate-resilient infrastructures, improved public health, and WASH technologies; development of haor, wetland, and char-specific WASH technologies focusing on serving the needs of people living on Aati (in haor) and char; excavation or re-excavation of dighi, pond, reservoir, or construction relevant infrastructure for freshwater harvesting; maintenance of adequate freshwater With the participation of relevant stakeholders, create and support a climate change vulnerability and early warning dissemination network.

Extension of climate-smart technologies for increasing irrigation water use efficiency; augmentation of surface water for irrigation and multipurpose use; extension of stress tolerant, pest and disease resistant rice and non-rice crops; introduction and up-scaling of innovative and indigenous agriculture; crop diversification/intensification for natural resource optimization and climate vulnerability Increase fertilizer use efficiency to reduce climate stress; farm modernization/ mechanization to reduce production; strengthening and development of impact-based Early Warning System and Data Management for Agriculture; improvement of storage or post-harvest facilities, transportation, communication, and e-commerce-based market facilities for agricultural products; extension of climate resilient technology to combat climate-related stresses in Aquaculture; development of climate-ready open water fisheries management; expansion of climate-stress tolerant livestock and poultry breeds, farm, feed, and fodder; development of climate-resilient infrastructure for the safety of livestock and poultry during a disaster; provision of causeways in haor areas to facilitate agricultural and fisheries production; extension of community seedbeds in haor, beel, and floodplain areas; introduction of mechanical grain dryer for haor, chalan, and floodplain areas.

# Post Disaster Needs Assessment

*BANGLADESH: FLOODS 2022*

The Post-Disaster Needs Assessment (PDNA) for the 2022 floods has been prepared under the leadership of the Ministry of Disaster Management and Relief, supported by the Asian Development Bank. The report has been guided and informed by government agencies and departments including the Economic Relations Division of the Ministry of Finance, Local Government Division, Ministry of Water Resources, Ministry of Agriculture, and Ministry of Railways.

**Ministry of Disaster Management and Relief**
Government of the People's Republic of Bangladesh