Government of the People's Republic of Bangladesh

Ministry of Water Resources

Bangladesh Haor and Wetland Development Board

Master Plan of Haor Area

Volume II

Main Report

April 2012

CEGIS Center for Environmental and Geographic Information Services
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Master Plan of Haor Area

Volumes

1 Volume I: Summary Report

2 Volume II: Main Report

3 Volume III: Project Portfolio

4 Annexes

Annex 1: Water Resources

Annex 2: Agriculture

Annex 3: Fisheries

Annex 4: Pearl Culture

Annex 5: Livestock

Annex 6: Forestry

Annex 7: Biodiversity and Wetland

Annex 8: Transportation

Annex 9: Mineral Resources

Annex 10: Health and Nutrition

Annex 11: Industry

Annex 12: Education

Annex 13: Water Supply and Sanitation

Annex 14: Social Services and Facilities

Annex 15: Power and Energy

Annex 16: Housing and Settlement

Annex 17: Tourism

Annex 18: Transboundary River Systems

Annex 19: Climate Change Scenario

Annex 20: Morphology

Annex 21: Social Life and Livelihood

Table of Contents

List of Figures

List of Tables

Chapter 1 Introduction

1.1 Background

Haor with their unique hydro-ecological characteristics are large bowl shaped floodplain depressions located in the north-eastern region of Bangladesh covering about 1.99 million ha (19,998 sq. km.) of area and accommodating about 19.37 million people. There are 373 haor/wetlands located in the districts of Sunamganj, Habiganj, Netrakona, Kishoreganj, Sylhet, Maulvibazar and Brahmanbaria. These 373 haor cover an area of about 858,000 ha which is about 43% of the total area of the haor region. It is a mosaic of wetland habitats including rivers, streams, canals, large areas of seasonally flooded cultivated plains and beels. Number of haor and their areas in haor districts are given below in the Table 1.1. The haor of the North East region and district-wise locations are shown in Figure 1.1 to Figure 1.8.

Table 1.1: District wise number and area of haor

District	Total area in ha	Haor area in ha	No. of haor
Sunamganj	367,000	268,531	95
Habiganj	263,700	109,514	14
Netrakona	274,400	79,345	52
Kishoreganj	273,100	133,943	97
Sylhet	349,000	189,909	105
Maulvibazar	279,900	47,602	3
Brahmanbaria	192,700	29,616	7
Total	1,999,800	858,460	373

The physical setting and hydrology of the haor region produce a unique hydrological regime, which creates innumerable opportunities as well as constraints for the inhabitants. Annual rainfall ranges from 2200 mm along the western boundary to 5800 mm in its north east corner and is as high as 12000 mm in the headwaters of some catchments extending to India. The region receives water from the catchment slopes of the Shillong Plateau across the borders in India to the north and the Tripura Hills in India to the southeast. Flash flood is the main disaster here which engulfs the primary production sector (e.g., agriculture) and thus threatens the lives and livelihoods of the inhabitants of the haor region. Excess rainfall in the upstream hilly areas and subsequent runoff, river sedimentation, unplanned road and water management infrastructure, deforestation and hill cuts, landslide, improper drainage and the effect of climate change and variability can be viewed as the main reasons for the devastation caused by flash floods.

> The financial statement of the Government of Bangladesh as reflected in the Budget 2010-11 clearly recognised the fact that "*People of the haor areas of the country's north-eastern region are more poverty stricken than the other regions. Crops in this region are very often damaged by flash floods. "Evaluating the past and present status of haor and swamps, an integrated Master Plan incorporating sustainable and appropriate strategy and management is being formulated for comprehensive development of haor areas."*

The haor area is still under-developed due to its physical and hydrological settings, although it is one of the major economic production zones of the country. Agriculture and fisheries are the main bases of the diversified economic resources of the area. About 0.71 million ha of net cultivable land is available in this area, which produces more than 5.25 million tons of paddy each year. However, sudden intrusion of flash flood may destroy agricultural production of about 0.33 million ha, worth Tk. 3,486 million or 3% of the national agricultural contribution to theGross Domestic Product(GDP). Since Boro rice is the only crop produced annually in most of the haor areas, the current economic system for non-aquatic resources offers very limited potential in terms of poverty alleviation.

Despite the economic importance of the zone, people of the haor area are poorer than elsewhere in Bangladesh. More than 28% of the total haorpopulation lives below the Lower Poverty Line (LPL). Agriculture is the principal livelihood of the farmers who cultivate a single crop in the year whole. This single crop remains under the constant threat of partial to complete damage from the early onrush of flash floods. Increasing fisheries productivity, mainly open water fishery and the importance of fisheries in the economy should be given priority since the area has huge potential of various fish production.

Haors are rich in aquatic biodiversity, particularly in diverse fish species. There are 140 species of fish in the haor region, which is also home to thousands of migratory birds. The area is thus steadily becoming anarea of popular tourist attraction in Bangladesh. Fish culture is an important economic activity in the haor area. The fishermen face economic, social and technical constraints in pursuing their occupation. They are relatively poor and often cannot meet up their basic needs from existing fisheries management practices. Over the years, many species of fish have become rare or have decreased significantly due to overfishing and habitat destruction. Again, sedimentation in rivers, canals and waterbodies creates disturbance in the local ecology in terms of disruption of fish breeding cycles and migration routes. These all lead to reduction of fish population, productivity and production.

Water transportation is a very important and essential component of the economic activity of the region. However, navigation network is deteriorating due to sedimentation in the adjoining rivers and haor.

The haorregion has long been lagging behind mainstream national development although the economic development of Bangladesh is moving steadily at a moderate pace. The government has taken many initiatives including the preparation of national and regional strategies to steer economic growth and has accordingly prepared plans over the years to boost up the country's development. It is difficult to foresee the country's overall progress without the development of the haorregion as it covers a major part of the country and population which deserves special development initiatives. The future challenges in the context of climate change are also a major concern for the sustainable development of the region.

At present, sectoral development initiatives have been executed and/or are being executed by different agencies within respective sectoral considerations. However, no macro level studies have been conducted so far to review the impacts of such sectoral development to interact with the overall development of this ecologically critical zone of haor, Baors and Wetlands. The natural resources that contribute significantly in the socio-economic development of the country are also getting depleted and degraded rapidly. The present practice manifests that different agencies are involved in their sectoral objectives and targets, which sometimes lack coordination and an integrated approach to development.

Therefore, a Master Plan is required for the haor area to harness the development potential by addressing the issues as well as to gain comprehensive understanding on the present hydrological and hydro-morphological characteristics and conditions, land-use patterns, ecological sensitivity and water quality situation. The Bangladesh Haor and Wetland Development Board (BHWDB)has taken the timely initiative of developing a comprehensive Master Plan for integrated development of the haor area and to preserve, protect and restore the ecosystem as well as to protect the people of this

area from natural disasters and to improve the livelihood of poor people. The BHWDB engaged the Center for Environmental and Geographic Information Services (CEGIS), a Public Trust under the Ministry of Water Resources (MoWR), for preparing the Plan.

Policies, strategies and plans relevant to the haor have been extensively reviewed to identify the targeted goal and priorities and to establish linkage with the Plan. The Master Plan has been prepared to translate the directives of the national policies, strategies and plans. The Plan provides the future development options based on analysis of the problems, issues, opportunities, strengths and risks of each sector. It has been formulated in an integrated manner envisioning mainly flood management, environmental sustainability, production of crop, fisheries and livestock, expansion of education, settlement and health facilities, road communication, navigation, water supply & sanitation, industry, afforestation, tourism, use of mineral resources and generation of power and energy.

This Master Plan is a framework plan for developing the haor region through optimal utilisation of natural and human resources for the next 20 years (up to 2032). The Plan has been formulated following the principles of the Integrated Water Resource Management (IWRM). This is a definite framework plan for the integrated development of haor area thereby ensuring preservation of haor, wetlands and their ecosystem. It will be implemented on the short, medium and long term basis with provision for updating and incorporating rationale changes in demand and land use.

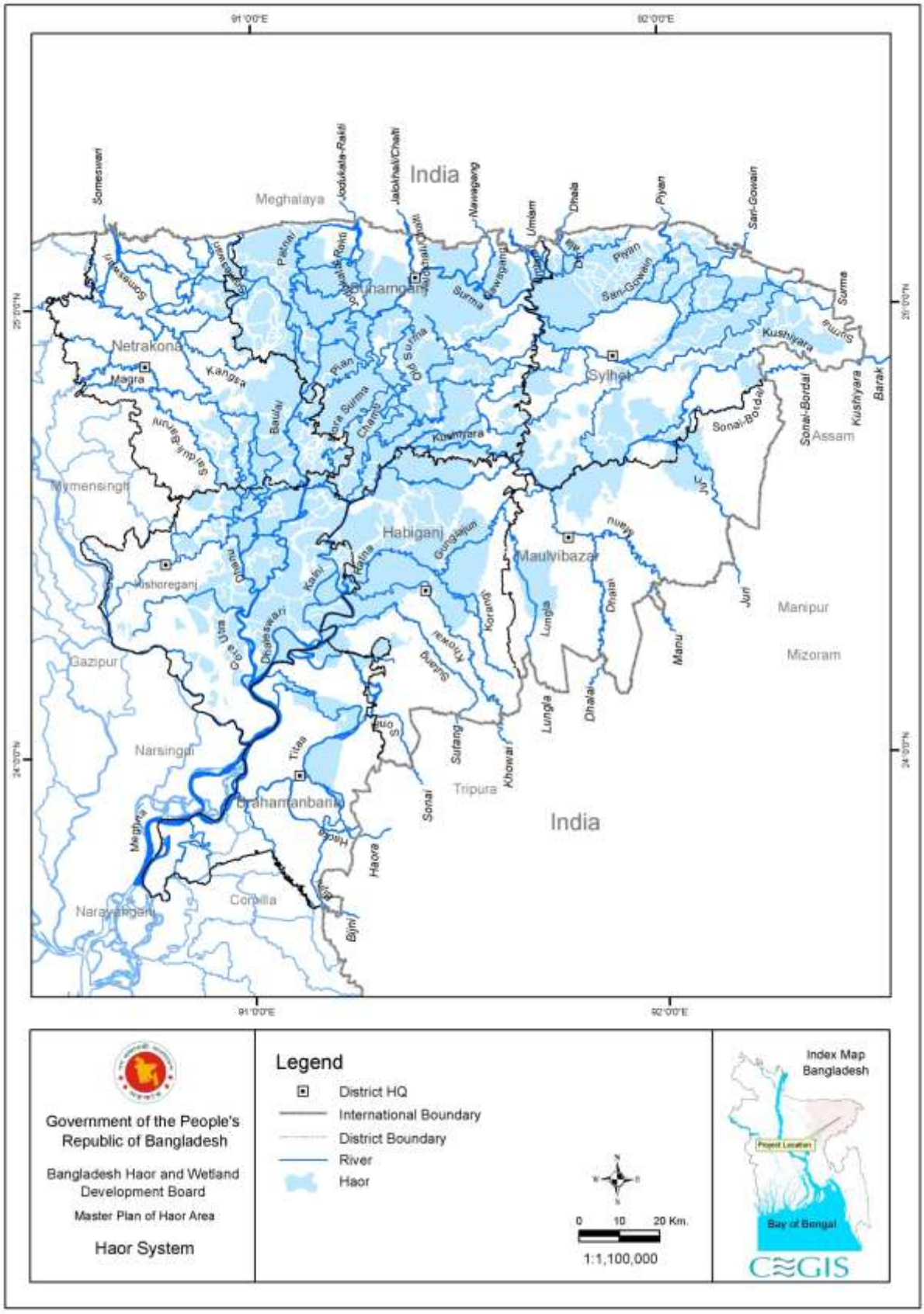


Figure 1.1: Haor of the North East region of Bangladesh

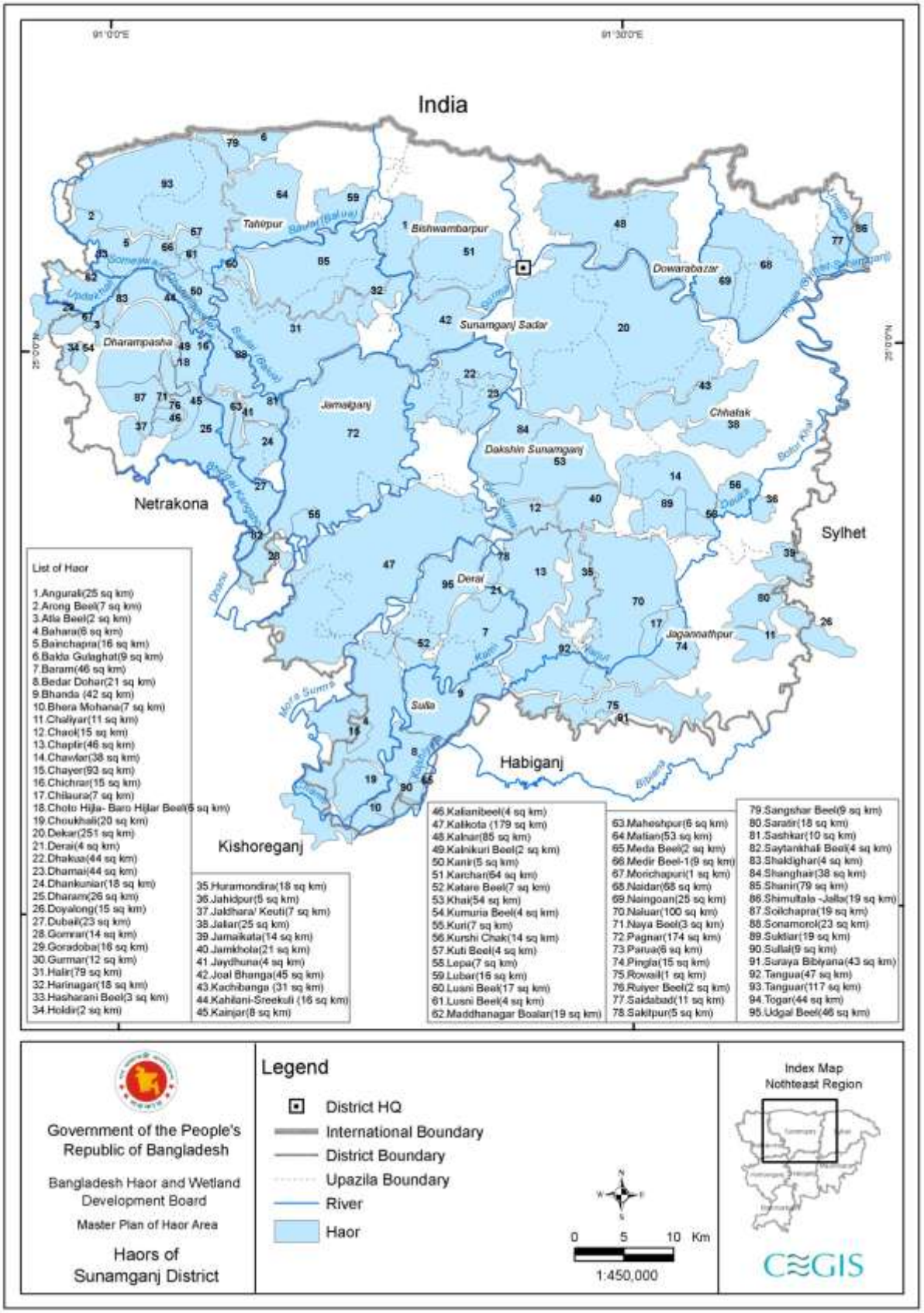


Figure 1.2: Haor of Sunamganj district

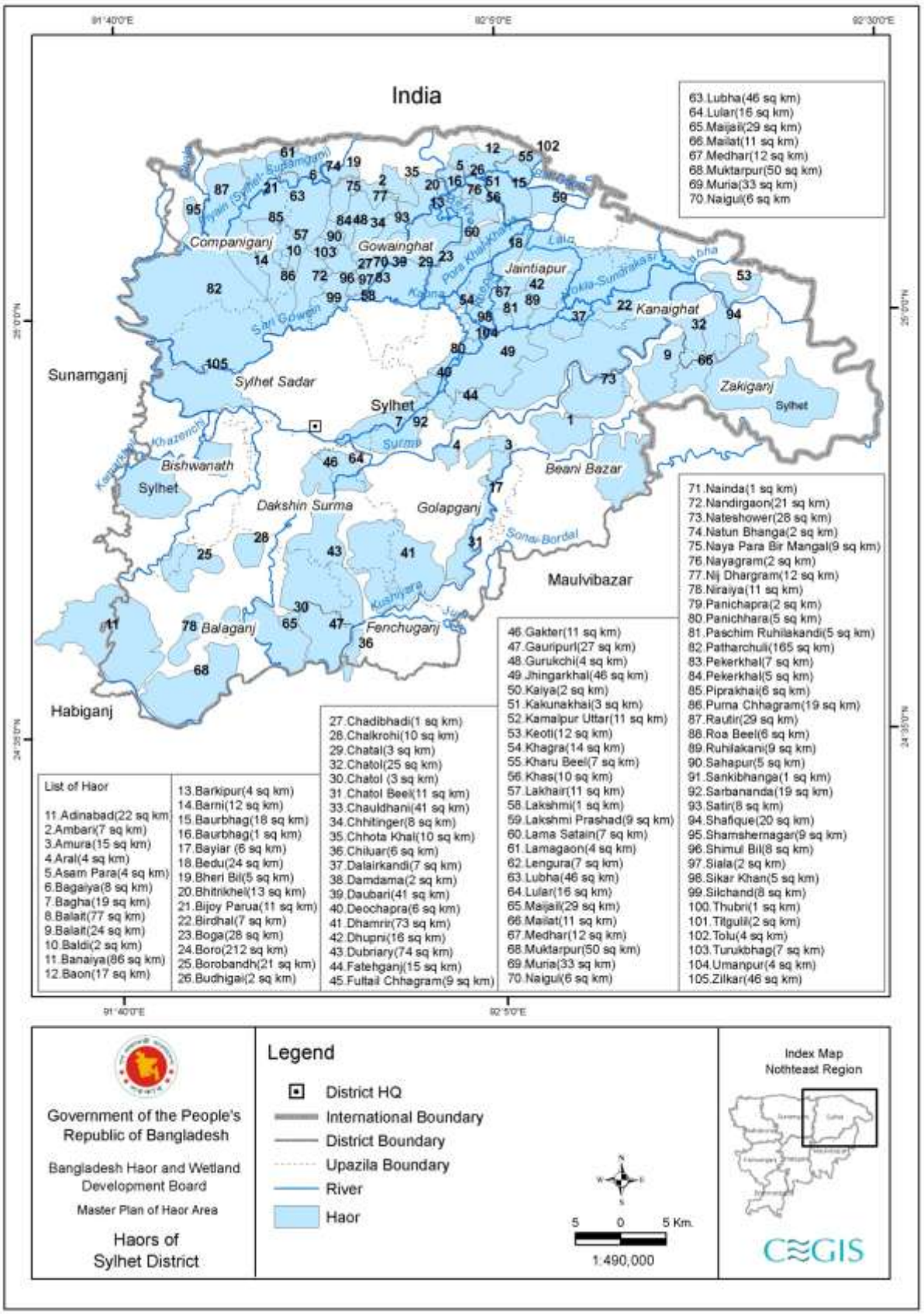


Figure 1.3: Haor of Sylhet district

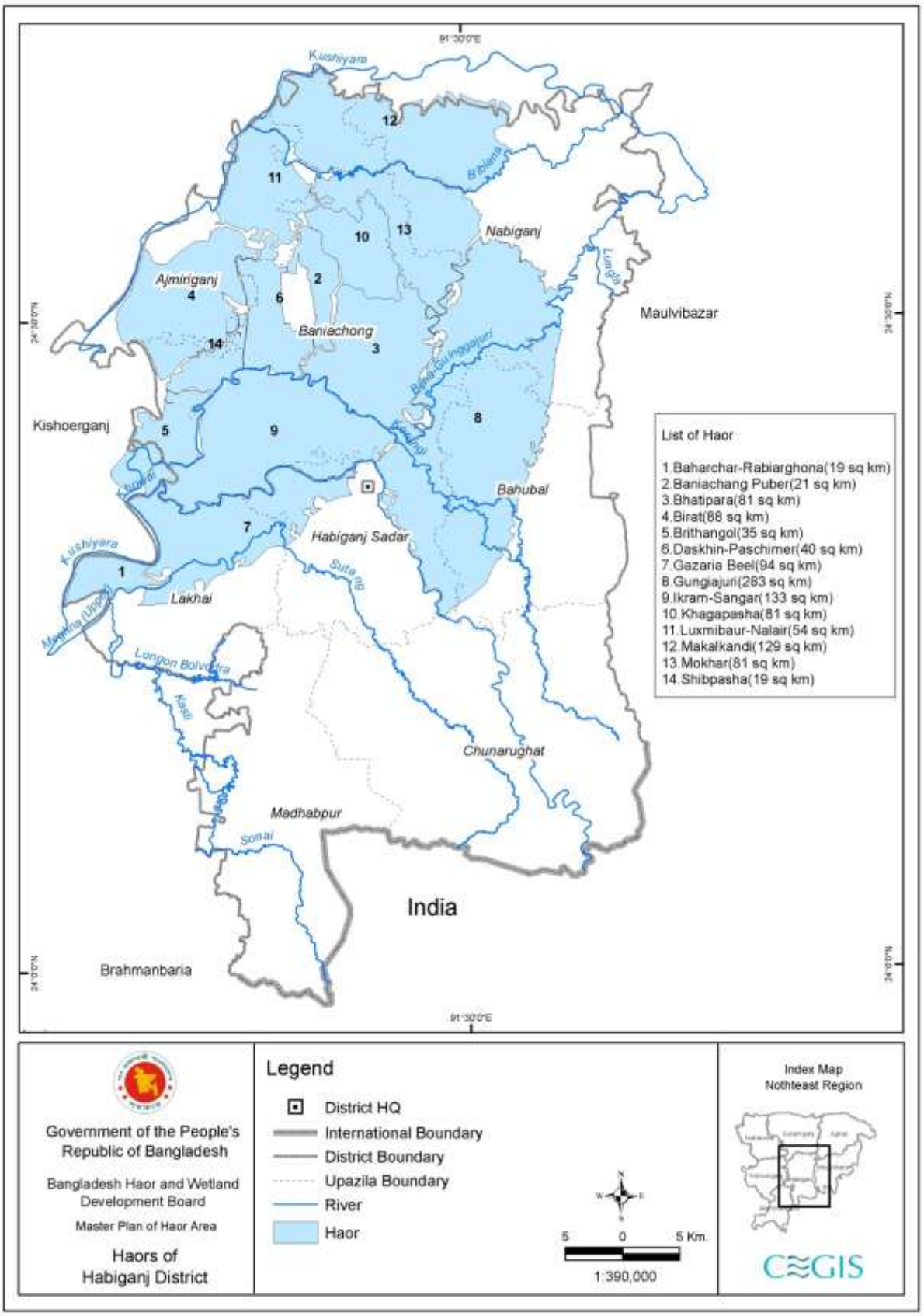


Figure 1.4: Haor of Habiganj district

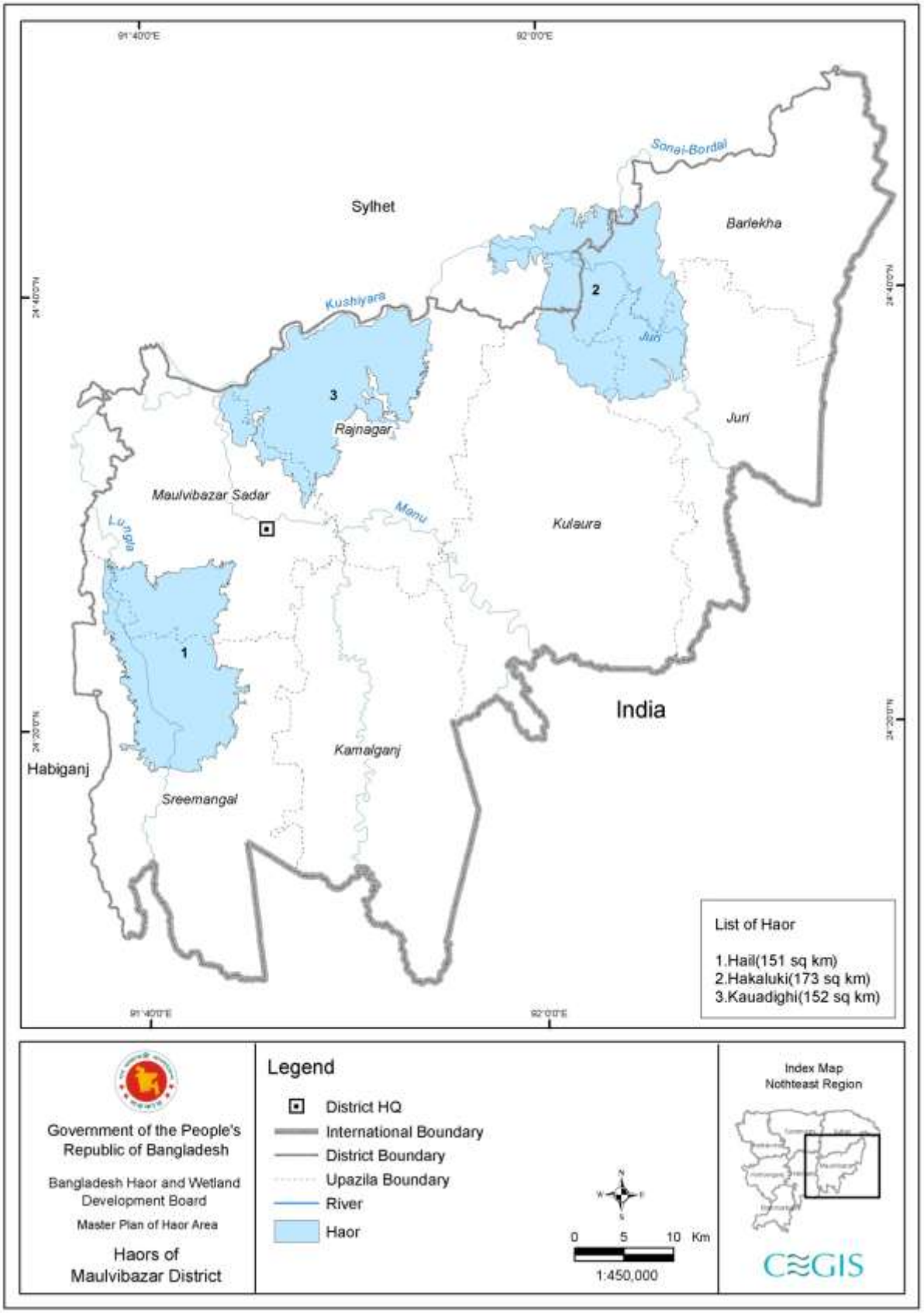


Figure 1.5: Haor of Maulvibazar district

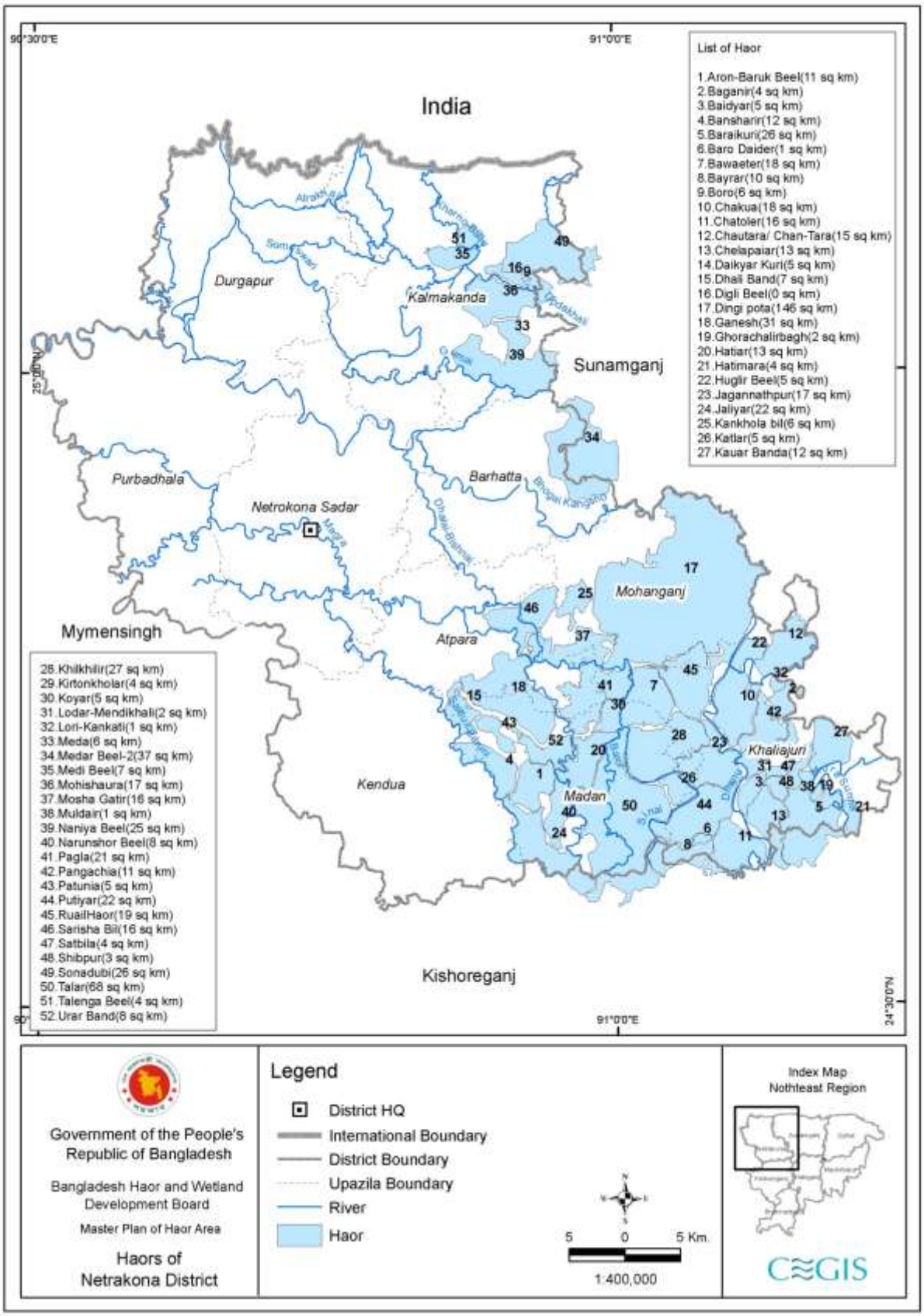


Figure 1.6: Haor of Netrakona district

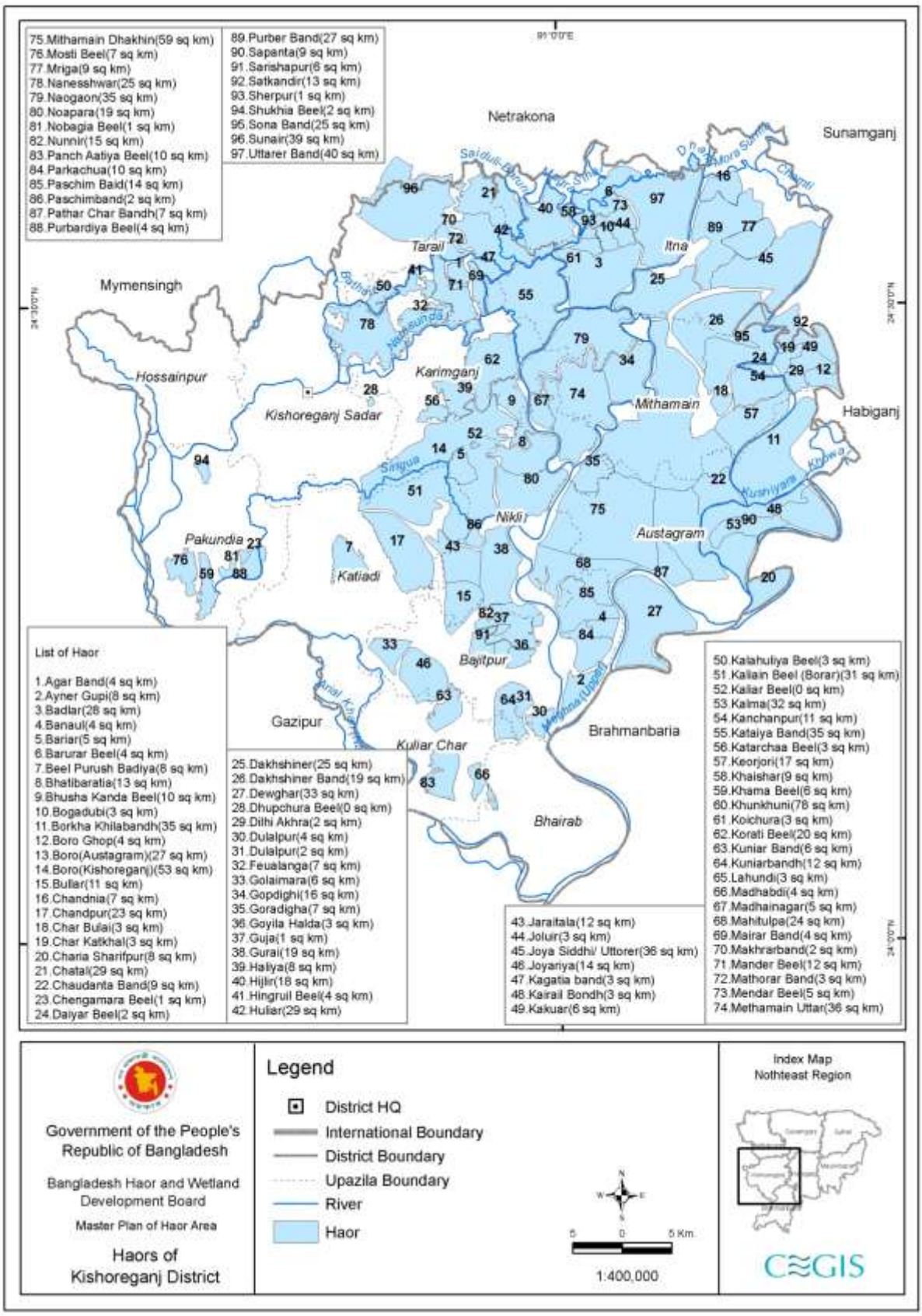


Figure 1.7: Haor of Kishoreganj district

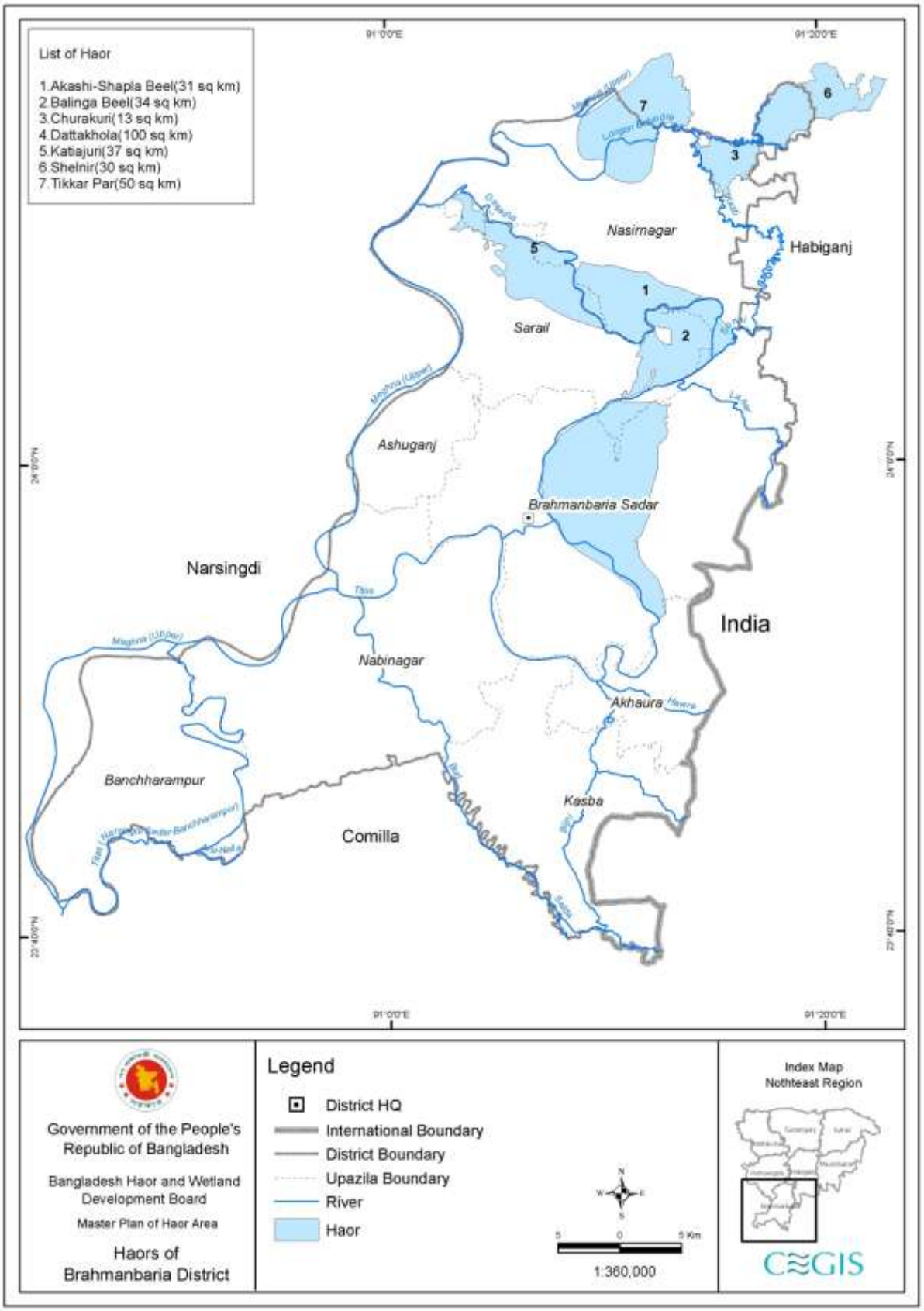


Figure 1.8: Haor of Brahmanbaria district

1.2 Goal and Objectives

1.2.1 Goal

The overall goal of the Master Plan is to achieve sustainable development of the area with integrated planning and implementation through multi-organizational involvement and community participation for optimum utilisation of resources and reduction of poverty. The target is to create conditions in which the development of sustainable livelihoods and integration of the area into the national development processes without hampering the unique haor ecosystem can take place. To achieve this goal, one of the major instruments is to develop a holistic Master Plan. The goal of this planning action is in line with the Vision 2021, the Sixth Five Year Plan and other relevant policies of the Government of Bangladesh (GoB).

1.2.2 Objectives

The objectives of the Master Plan are to develop the resources of the area as rapidly as possible so as to promote the welfare of the people, ensure adequate living standards, social services, opportunity and aim at the widest and most equitable distribution of income and property while maintaining and conserving the haor ecosystem. Implicitly in the plan is an increase in production and distribution of all kinds of goods which together generate and sustain healthy growth towards a modern economy. Accordingly, the specific objectives of the Master Plan are to:

- Maintain the aquatic environment, preserve natural water bodies such as haor and beels and facilitate drainage;
- Keep and maintain existing wetlands in and around natural canals for mitigation of flood risk and damage;
- Ensure crop and fish production, protection of homesteads and infrastructure and conservation of Biodiversity;
- Guide and control expansion of settlements and infrastructural development for wise management of wetlands;
- Develop integrated programmes to prevent degradation of resources and ensure sustainable management;
- Prepare and recommend integrated approach oriented interventions and future action programmes as well as department/agency-wise action plans; and
- Frame projects in line with stakeholder demands for the development of Haor area.

Chapter 2 Planning Process

2.1 Approach

The Master Plan for the haor area is an "integrated development plan" that optimises available resources for future development potentials, incorporating all relevant social and environmental considerations. The entire planning process is much more dynamic than the traditional sectoral Master Plans which mainly concentrate on the potential development of areas and landuse plans.

Concept of Integrated Water Resources Management (IWRM) approach has been followed in formulation of the Master Plan which has been defined by Global Water Partnership (GWP) as:

"A process which promotes the co-ordinated development and management of water, land and related resources, in order to minimize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem."

Spatial as well as non-spatial planning (i.e. social and economic planning) techniques have been adopted in preparation of the Plan. Space technology and GIS has been extensively used in the planning process for data extraction, interpretation and information management. The social techniques have included Public Consultation Meetings (PCMs) at upazila level and Focus Group Discussions (FGD) and Rapid Rural Appraisal (RRA) at union level for identification of problems, issues, people's needs and project interventions. Moreover, agency level and individual expert level consultations have been conducted to finalize the Plan.

Primary data have been collected through survey questionnaire carried out during PCMs. Remote Sensing images were processed and analyzed using GIS techniques. Secondary data were obtained from National Water Resources Database (NWRD), Bangladesh Bureau of Statistics (BBS) and published documents of different organizations.

The approach for developing the Master Plan was a blend of explorative, iterative and interactive processes. The explorative approach was adopted to draw the best available knowledge and information from the local level as well as secondary and other national sources. Public consultation meetings in all haor upazilas were conducted to take account of the issues, problems and development potentials of the region. The iterative approach helped in formulating different development scenarios and options on the basis of resource assessment and future projections. The interactive approach was taken to adopt participatory planning principles to ensure active participation of all stakeholders. This was achieved through interaction with local people, officials as well as think-tanks and knowledge-houses that had multiple links to development projects on haor, the environment and land and water resources. The interactive approach helped in making pragmatic selections to derive the best possible package of investment portfolios for the Master Plan.

2.2 Framework for Planning Process

A six-step methodology (Figure 2.1) has been adopted for the preparation of the Master Plan following the above-mentioned principles. Development of the Plan has been initiated through identification of development issues and problems of various development area sub-sectors such as water resources, agriculture, fisheries, health, education, communication, ecosystem, etc. In the second step, policy analysis for future directives has been carried out. The mandates of the BHWDB have been elaborated and an in-depth review has been made on existing policies, strategies and plans to correlate the mandates of the BHWDB with national policy directives. In the third step, the current profile (2010) of physical setting, human resources, natural resources and economic resources have been set followed by gap analysis between the base situation and development potential. In the fourth step, past and ongoing development initiatives have been thoroughly reviewed to learn from the past about the successes, achievements and failures.

Identifying Development Area wise strategies have been formulated in the fifth step. The demands of local stakeholders, considering individual and cross-cutting and technical issues as well as different strategies have been evaluated and risks assessed for prioritization of the Development Areas (DAs). In the final step, based on the development strategies set in the previous step, a detailed development plan has been formulated. In addition, upazila-wise priority investment portfolios have also been developed.

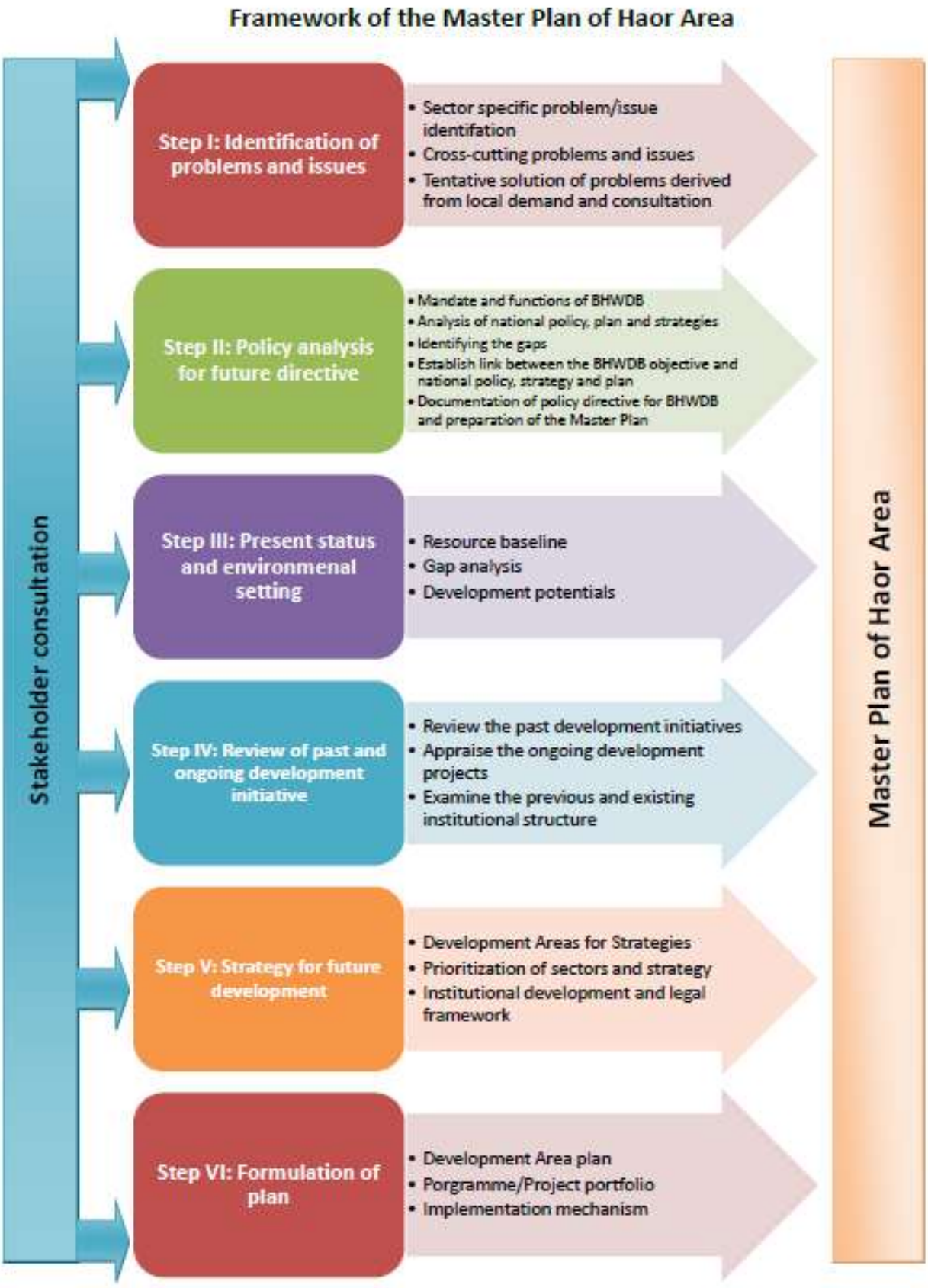


Figure 2.1: Framework for the planning process of the Master Plan

2.3 Participatory Approach in the Planning Process

Public consultations, an integral part of the participatory planning process, have been conducted in the context of the 'Master Plan of Haor Area Preparation' for integrated and sustainable development of the haor area. The major objectives of public consultations were to inform people about the Master Plan of Haor Area and to involve them in its preparation process. People were found to participate spontaneously in the consultation meetings. They discussed the present condition, problems, needs and aspirations and made meaningful choices and expressed preferences in the development context. The specific objectives of the consultations are presented below:

- Identification of problems and issues pertaining to the haor area and its people;
- Understanding people's expectations from the Master Plan for improving regional economic growth of the haor area;
- Involvement of people, stakeholders and agencies at the initial stage of project planning;
- Understanding the views of the people regarding possible interventions/projects to solve the identified problems;
- Determination of the possible impacts (both positive and negative) of the proposed interventions/projects;
- Understanding people's perception regarding mitigation/minimization of negative impacts.

2.4 Types of Consultation and Stakeholders

The consultations carried out at different stages with a wide range of stakeholders in line with policy requirements for participatory planning have included Public Consultation Meetings (PCM, FGD and RRA), Agency Consultations and Bi-lateral Discussions.

2.4.1 Public Consultations

Public Consultation Meetings (PCM)

PCMs have been carried out in 69 upazilas to identify upazila-wise problems, issues, opportunities and project interventions associated with the haor region for each of the 17DAs. PCMs conducted at upazila level covered DAs such as water resources, agriculture, fisheries, pearl culture, livestock, transportation, forestry, biodiversity, education, health, power and energy, tourism, settlements and public security, sanitation, industry, social services including market facility, religious institutions, graveyards and cremation grounds. Figure 2.2 shows the locations where the PCMs, FGDs and RRA have been carried out.

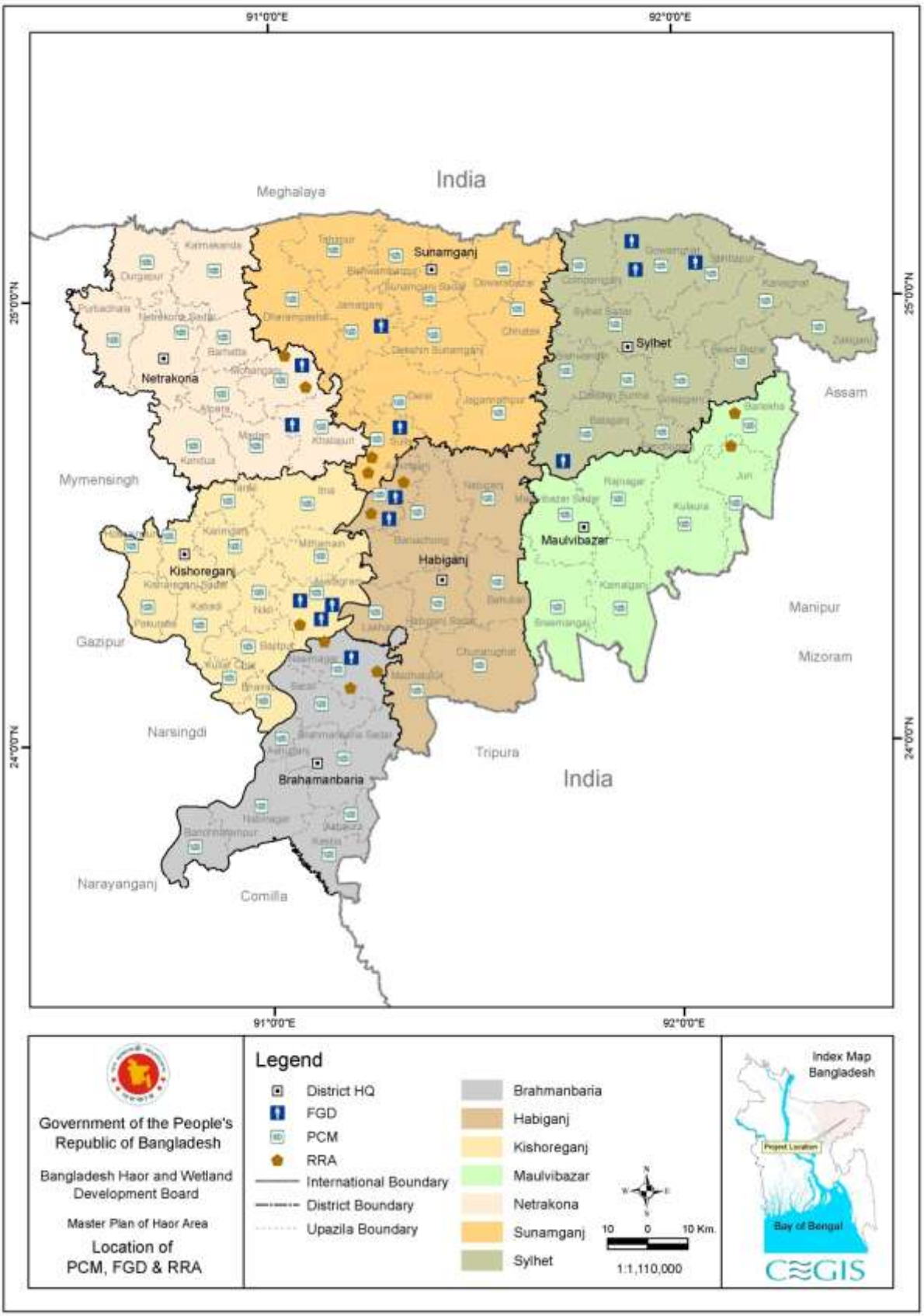


Figure 2.2: Locations of PCMs, FGDs and RRA

The participants of the PCMs were local government representatives at upazila level (Chairman and Vice-Chairmen), at village level (Chairmen and members), local elites and knowledgeable people from different professional groups from both union and upazila levels (teachers, lawyers, journalists, women, farmers, fishermen, etc.), government officials (UNO, BWDB, DAE, DoF, DLS, DPHE, LGED, BRDB, Department of Youth Welfare, Department of Health and Family Planning, Department of Social Services (DSS), Department of Women Affairs, Department of Forest (DoF), Department of Secondary and Primary Education), etc. and Non-Government Organization(NGO) representatives working in haor areas.

Focus Group Discussion (FGD)

Concurrent to the PCMs, a total of 30 FGDs were conducted in 10 unions of 10 upazilas with farmers, fishermen and women groups to address sector specific problems in detail.

Rapid Rural Appraisal (RRA)

RRAs were conducted one in each of the14 unions for collection and validation of socio-economic data, such as:

- employment opportunities by seasonal variation
- labour availability and wage and seasonality
- migration (seasonal/permanent)
- annual income and expenditure by income group
- self-assessed year-round poverty
- housing
- drinking water
- sanitation
- diseases
- treatment facilities
- households with different land ownership categories in the haor area
- households with different types of land tenure
- major disasters and damages that have occurred in the area
- markets and growth centers
- common property resources
- cultural heritage /archaeological sites

PCM in Mohanganj upazila, Netrakona

FGD with farmers in Nasirnagar upazila, Brahmanbaria

Agency consultation, DC office, Netrakona

Agency consultation, BIT office, DoF, Sylhet

2.4.2 Agency Consultations

All government agencies which have a stake in the haor areas have been identified and invited to nominate representatives as members of a Key Contact Group (KCG).

Thirty four government and non-government agencies located at upazila and district levels have been identified from where reports, documents and data were collected and collated. The data were spatial and non-spatial and in some cases, historical and time series. All the main sectoral reports covering each DA were discussed with the KCGs and meetings were held to discuss their views.

2.4.3 Bi-lateral discussions

Numerous meetings, both formal and informal, were arranged with different agencies, national experts and individuals to seek information and data on different perspectives. Formal meetings on draft DA reports with respective departments/agencies were held to get their views, opinions and comments. Other than this, formal meetings were also organised with the Technical Committee and Steering Committee of the BHWDB for their recommendation, feedback and approval.

2.5 Participatory Action Plan Development (PAPD) Process

The Participatory Action Plan Development (PAPD) process has been thoroughly followed while preparing the Master Plan of Haor Area. The process was followed in four steps as shown in Figure 2.3.

PAPD process during inception phase: During the inception phase, identification of the proponents' needs were done through Agency Consultation with the BHWDB. Based on an understanding of their needs a draft inception report was prepared which was sent to all members of the Technical Committee for their feedback. A dissemination workshop was organised after receiving feedbacks from the Technical Committee. The report was finalized incorporating feedbacks from national level stakeholders.

PAPD process during data collection: Upazila level data collection was facilitated through a total of 69 PCMs in 69 upazilas. At the PCM sessions, representatives from different professionals mix (farmers, fishers, day laborious etc.) as well as different implementing agencies (UNO, BWDB, LGED, DAE, DoF, DF, Health, DPHE etc.) and members from the social elites (teachers, journalists etc.) were consulted. Rapid Rural Appraisal (RRA) techniques were utilized for problem identification and also for developing the resource baseline. In this regard, a total of 30 RRA sessions were conducted in 30 unions. In addition to this, a total of 30 FGDs were carried out in 10 villages covering three different groups of farmers, fishers and women. Moreover, agency level consultation with the Key Informants also played a pivotal role in collection of information and evaluation of past, ongoing and future initiatives. The existing institutional structure and legal framework were also reviewed in the same process.

PAPD process during strategy formulation: Draft development strategies have been prepared for different DAs based on the above-mentioned baseline reports and by utilizing the outputs from the PCMs conducted in the previous steps. The development strategies were reviewed by Key National Experts engaged in each of the development sectors of the Master Plan. A number of bi-lateral meetings and a meeting with the Technical Committee were also held to disseminate the draft strategies.

PAPD process during plan preparation: DA plans were formulated on the basis of the development strategies. In this step, the sectoral development plans were transformed into a series of project portfolios in consultation with BHWDB officials and national sectoral experts. A team of economists and sectoral experts played an important role in developing the project portfolios. The investment portfolio was disseminated to the Technical Committee for their expert feedback, suggestions and approval.

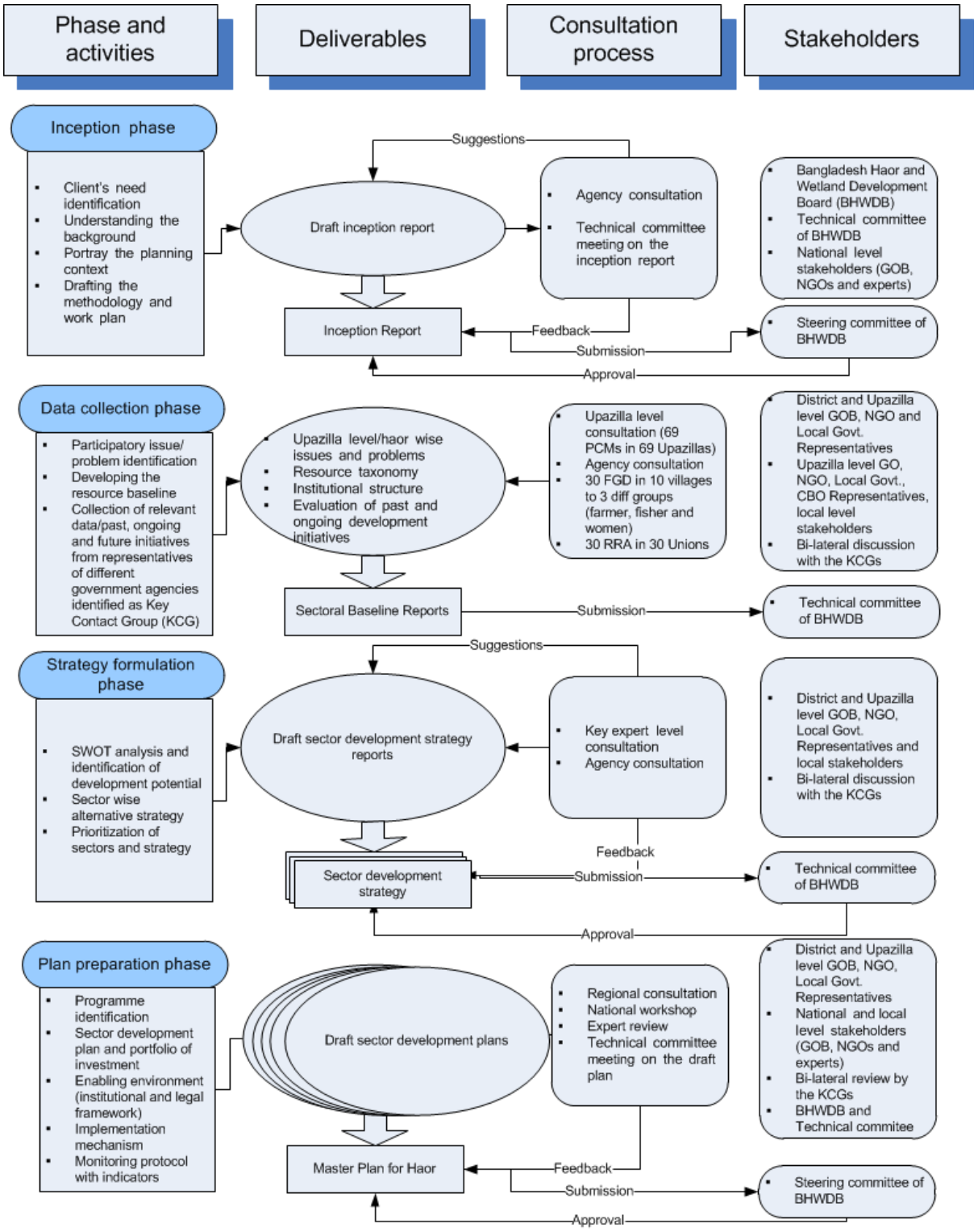


Figure 2.3: Overall development process of the participatory action plan

Chapter 3 Problems and Issues

3.1 Problem Identification

The haor region is bestowed with natural resources, which can be utilized to enhance the growth of economic resources for improving the quality of life. However, the natural settings of the area also pose a threat to its development potentials. There exist many problems and issues which need to be addressed.

As mentioned earlier, the PCMs arranged at upazila level have helped to identify the problems and issues for each sector and at the same time, the FGDs and RRAs helped in taking an in-depth look at the problems of some of the major livelihood groups working in the haor region. The PCMs have addressed a whole range of issues of haor and wetland such as:

- Water resources
- Water sharing
- Agriculture
- Fisheries
- Pearl culture
- Livestock
- Social forestry
- Biodiversity
- Livelihood
- Employment opportunity
- Transportation
- Education
- Health
- Market facility
- Religious institutions
- Graveyards and cremation grounds
- Food godowns and cold storage
- Mini hydropower
- Solar power and fuel
- Tourism, settlements and public security
- Usage of water
- Sanitation
- Industrial developments
- Sports and culture
- Social welfare
- Gender concerns
- Institutional infrastructure
- Natural disasters and climate change
- GO/NGO project interventions

The issues of consultation in the FGDs have been Environment, haor, Ecology& Biodiversity, Disasters, Livelihood, Gender, Transportation, Industrialisation, Livestock and Poultry, Public security, People's participation and Development projects. Discussions on livelihood, on the other hand has focused on agricultural practices, fishing and other income generation opportunities. Similarly, the topics on development projects have included possible projects to be implemented by the government and NGOs and their impacts on the haor region.

The major identified issues are:

- Flash flood
- Siltation and sedimentation of major rivers
- River bank erosion and wave erosion
- Reduction of navigability
- Lack of proper sanitation
- Scarcity of drinking water
- Fragile and inadequate road network
- Degradation of Eco-system
- Indiscriminate harvest of natural resources
- Over exploitation of fisheries resources and swamp forest
- Weakness in leasing system for fisheries
- Illiteracy
- Poverty
- Inadequate health facilities
- Inadequate O&M of existing infrastructure

The natural, physical and social environments in which people live influence in many ways the life style and their thinking process. The way that haor people perceive the problems of their region and its potentials for development has been reflected through the consultation meetings. These identified problems are summarised and presented in the following section and sub-sections.

3.2 Major Problems

3.2.1 Water Resources

The major water related problems of the haor area are flash flood, river bank and wave erosion, drainage congestion, poor navigability and sedimentation. Pre-monsoon flash floods are among the major disasters which engulf the primary production sector and thus threaten the lives and livelihoods of the haor inhabitants. The drainage problem here occurs mainly in December which is an important period since it is the time for planting Boro crop. The main reasons for the drainage problems are sedimentation in rivers and loss of connectivity between the haor and the rivers. Due to the sedimentation process, the rivers and canals get silted up and consequently there has been a loss of flow conveyance capacity. Sedimentation also plays a governing role in the morphology of the rivers in terms of change in course as well as floodplains. The existing villages of the haor are situated near rivers and are in the deeply flooded areas of the haor basin. These villages are normally raised for protection against floods. They are also threatened by erosion from wave action for around five months a year. Riverbank erosion is significant in some of the major rivers in the haor region.

3.2.2 Agriculture

The major agriculture related problems are:

- Crop loss due to floods
- Inadequate availability of seeds (improved and HYV)
- Inadequate distribution system for seeds

Flash floods have been a big threat to the livelihoods of the haor people, especially share-croppers and landless labourers. Although crops are also damaged by drainage congestion, hailstorms, cyclones and pests, flooding is the major cause of damage, mainly to rice crop. Based on available data on flood damage to crops from 1993 to 2010, it has been estimated that on average more than 4% of the total cropped area have been completely damaged. During that period about 1.02 million ha of rice, 7,300 ha of jute and 7,000 ha of other crop areas had been completely damaged by floods. From 1993 to 2007, major crop loss occurred in 1993, 1998, 2004 and 2010 with about 70% of cropped area damaged. From 1993 to 2010, about 2.44 million tons of rice, 64,000 tons of jute and 40,000 tons of other crops could not be harvested because of floods. The occurrence of flood varies widely from year to year. The devastating floods of 2004 inundated most of the haor region in mid-April and farmers lost Boro crop of about 0.6 million metric tons. The total amount of improved and HYV seeds distributed to farmers is less than the quantity required for most crops. The Bangladesh Agricultural Development Corporation (BADC) has an inadequate seed marketing network which includes 2 regional, 5 district level and 2 upazila level centers in the area. Due to insufficient capacity and poor distribution facilities, the BADC is unable to meet demands for improved and HYV seeds.

3.2.3 Fisheries

Loss of fisheries biodiversity is evident in the haor area which is directly linked to the loss of habitats and fishing practices. The physical habitat has been altered by channelisation, construction of embankments and diversions, siltation and degradation of wetlands. There have been not enough fish pass structures for protecting fisheries resources from the adverse effects of flood control

embankments and roads, etc. The nearly extinct enlisted species are nandina (*Labeonandina*), angrot (*Labeoangra*), pangus (*Pangasiuspangasius*), tor mohasol (*Tor tor*), baghayre (*Bagariusyarrelli*), etc. Some fish species which are at risk of extinction include chital (*Notopteruschitala*), raik/laso (*Cirrhinusreba*), ghonia (*Labeogonius*), rani (*Botiadario*), kanipabda (*Ompokbimaculatus*), madhupabda (*O. pabda*), kajuli/banshpata (*Ailychthyspunctata*), telotaki (*Channaorientalis*) and kuchia (*Monopteruskuchia*). The major causes of biodiversity loss or the major problems of the fisheries sub-sector have been identified as:

- Aggradation of habitats due to siltation
- Habitat alteration and fragmentation
- Over and indiscriminate fishing
- Disturbance to pre-monsoon spawning migration due to FCD/I projects
- over exploitation of swamp forests
- Unplanned road construction
- Water pollution
- Unavailability of quality fish seed
- Increasing use of agricultural inputs
- Inadequacy in fisheries management
- Reluctance in obeying fisheries laws and regulations as well as weak enforcement of such laws
- Climate change implications
- Inadequate extension services
- Short term lease/high lease value, etc.

3.2.4 Pearl Culture

The people of the haor region have been well aware of the economic value of pearls, but they do not know how to cultivate this valuable product. Lack of pearl culture training and extension work has been the main obstacles to pearl culture opportunities in this region. Another important problem is that pearl culture requires a high level of technical knowledge in the initial period of the muscles operation stage as well as highly experienced technicians during the laboratory stage. Unfortunately, such experts are not available in the country for conducting pearl culture activities efficiently. Since most pearl culture activities occur underwater, monitoring is also very difficult and requires a large number of trained people for the grafting activity. The cultivation period for pearls varies from 2 to 3 years to get marketable sized pearls. Due to the length of the pearl maturity period and long term financial involvement, farmers are not interested in pearl culture in most cases. Lack of well-established marketing channels and local level micro-entrepreneurs has been an important constraint to implementing pearl cultivation in the haor area.

3.2.5 Livestock

Traditional farming system is common in the area. The land is very low and subjected to floods and erosion which make it difficult to accommodate the existing livestock. The major obstacles/problems of rearing livestock have been shortage of grazing land, inadequate treatment facilities and shortage of feeds and fodder. Moreover, the farmers lack the know-how on modern rearing techniques and are not familiar with modern technologies. The health of animals in the haor region has been constrained due to infectious diseases, inadequate feed supply and low genetic potentialities.

Commercial livestock farming has not yet developed here due to poor communication and transport system. However, districts like Sunamganj, Netrakona and Kishoreganj have commercial livestock breeding farms which need to be adequately manned and funded.

Shortage of quality inputs, inadequate services and physical infrastructure, institutional weaknesses in terms of weak regulatory framework and enforcement, inadequate skilled manpower and resources and inadequate research and technological advancement have been the constraints to livestock development. Marketing channels are composed mainly of private marketing intermediaries, virtually without any government regulations.

3.2.6 Forest

The major issues for further development of forest resources in connection with forestry are richness of the ecosystem and ecosystem diversity; socio economy of the people especially the rural power structure, resource users, land tenure system, access and benefit sharing; inadequacy of scientific data and availability of information and GO, NGO involvement. The major problems of forestry are:

- Lack of community involvement
- Indiscriminate exploitation of natural resources
- No management plans for natural resources
- Land tenure problems
- Conflict of interest between the Ministry of Land and the Forest Department
- Very few NGOs working on natural resources and environment
- Widening gap of supply of and demand for forest products

3.2.7 Education

Some of the major issues of concern for the education sector have been lack of awareness, natural disasters, impoverishment, insufficient number of development interventions, weak infrastructure, scarce human resources, child labour, gender discrimination and malnutrition. The Gender Parity Index (GPI) in all the haor districts is more than 1, indicating that the percentage of girl students attending primary school (NAR) and secondary school (NAR) is more than that of boy students. Similarly, the NAR for girls is higher at secondary school than at primary school. One of the reasons for such high GPI is that girl students receive stipend in cash or kind and therefore are encouraged to attend school. At the same time, the boys by default are engaged in other income earning opportunities. In the haor area, the repetition rate is higher than the national average. The dropout rate in primary schools is 44% (boys 45%, girls 43%) on average which is higher compared to the national average of 40%. The districts of Kishoreganj (46%), Brahmanbaria (53%), Sunamganj (44%), Sylhet (42%) and Habiganj (50%) have a higher dropout rate than the national average. The dropout rate at the secondary level is higher than the primary stage by 3.4% (boys 3.36% and girls 3.51%). The problems related to infrastructure are: inadequate number of educational institutions, old buildings most of which are damaged, insufficient number of government institutions, infrastructures built on low land and insufficient allocation of resources. The problems related to human resources are insufficient number of teachers, the posts of teachers remaining vacant for a long time, lack of incentives for teachers working in the haor area and inadequate number of qualified teachers. Some of the other problems include students being the first generation at school,

illiterate guardians, migration tendency, inconsistency of school holidays in the haor area with the national holiday calendar etc.

3.2.8 Health

The health services in the haor area are poor. Shortage of health service centers, drugs and medicines, poor Transportation facilities, shortage of doctors/nurses and other staffs and lack of emergency services are the main pitfalls of health services in this area. A list of problems and issues has been drawn up at the PCMs e.g., most participants from 44 upazilas identified Transportation as the sectors having the most problems. Shortages of medicines and medical equipment have been also identified as major problems. Some of the other key problems and issues that have been highlighted included:

- impact of seasonal variation on disease and health services
- impact of economic impoverishment on people's access to health services
- undeveloped heath service facilities, specially at the grass root level
- dependency on informal/folk medicines
- accommodation problems for doctors/nurses and other staff
- natural disasters and health hazards compounding the existing problems of lack of hygienic sanitation facilities
- inaccessibility to safe drinking water
- lack of health awareness
- lack of doctors and nurses in most of the health institutions and apathy of doctors and staff to stay in their own working stations
- no haor-incentives for doctors and other staff
- unavailability of ambulances and transportation services during emergency situation

3.2.9 Water Supply and Sanitation

The haor region is mostly inhabited by poor and disadvantaged groups lacking access to basic water supply services. The situation is compounded by flash floods, which are a major threat to crop areas. Usually the haor area is flooded from May to October. Most of the tube wells are submerged during monsoon and flood periods, creating scarcity of drinking water and threatening the health of the haor community. Apart from the usual sources of water like deep/shallow tube wells/tara pumps, alternate sources of drinking water supply such as the Pond Sand Filter (PSF), ring wells, Rainwater Harvesting system (RWH) etc. have been still insufficiently available or used in the area, especially during flood periods.

Lack of appropriate sanitation facilities in flood-prone areas particularly during the flood period has been the main factor contributing to health problems and severe environmental degradation. Effluent dispersion from latrines into the groundwater is a significant pollution problem. The provision of physical sanitation facilities alone is not enough for the inhabitants of the area to be protected from diseases or for the environment from further degradation. Specific and specialised hygienic sanitation systems are essential for the people of the haor area.

3.2.10 Transportation

The Transportation system follows a special seasonal calendar. Although navigation is the main means of transportation, it is not possible during dry season due to the reduction of water in the rivers. On the other hand, during wet season road networks cannot be used as the low roads are inundated by flood water. At the beginning of autumn (mid-October) people can communicate neither by road nor by waterways as both roads and navigation routes remain unusable when the huge amount of water starts to decrease. During this period people has to travel mostly on foot.

Most of the haor upazilas are characterised by inadequate number of roads. There is a lack of necessary road networks from upazila level to union level. Moreover, other communication infrastructures such as bridges and culverts are also scarce in important locations of this area. There are very few modern vehicles for road network and navigation. Although boats are mainly used during monsoon, they are a risky means of transportation in bad weather.

The natural causes for the degradation of the transportation system are flash floods, *Afal* or wave erosion, annual inundation, water logging, siltation and sedimentation. Apart from this, Transportation facilities face problems such as lower land elevation, weak infrastructure, vulnerability due to seasonal variation, scarce facilities, unplanned development and lack of suitable modes of transportation.

A major portion of the haor area is low land. Every year the road network is inundated during the monsoon causing severe damage to the Transportation system. Siltation has caused poor navigability of major rivers and boat transportation is often hampered. Although, the road networks of most of the 69 upazila sadars are satisfactory, the union level road network is poor. Lack of communication with the upazila headquarters limits the scope of socio-economic development of haor dominated villages. Most of the existing paved (*pucca*) roads are not protected from floods. Submersible roads are narrow and are not properly maintained. Moreover, the poor condition of the roads and bridges hinder the passage of buses, trucks and other vehicles.

3.2.11 Housing and Settlement

The settlement area situated in low lying land is characterised by water logging. Wave erosion or *Afal* is one of the major threats to the haor settlements. In certain places, the settlements are protected with boundary walls, which are also subjected to damage from wave erosion. Due to scarcity of land, the people are forced to live in a crowded environment.

3.2.12 Industry

The problems related to industrialisation are: lack of public and private cooperative enterprise, scarcity of land and poor infrastructure facilities.

3.2.13 Energy and Power

The energy and power sector has not yet seen much development in the haor region. Mainly the natural characteristics of the region and its remoteness make it too costly to undertake expansion of grid lines over the watery areas. The water flow rate is not enough to setup plants for generating hydropower. Similarly, wind flow direction and speed are unsuitable for constructing windmills. Although solar electricity has been introduced in the area, very few such projects have been initiated so far. People have very poor knowledge about the use of solar electricity. Paucity of necessary

initiatives in the last few years has put this sector in the backseat of development initiatives. Inadequacy of necessary equipment and lack of adequate training facilities and capital have also been traced as major problems.

3.2.14 Mineral Resources

Various types of problems usually arise during the extraction of natural gas. For example, in the case of gas field explosion and fire, the local people lose crops and land and face environmental degradation. Similarly, exploitation of gravel and sand from quarries without proper environmental management creates adverse impacts which ultimately lead to environmentally degraded terrain. Sand stone, gravel and white clay are valuable resources that are gradually being exhausted. So, in order to reduce these types of problems, activities of development potential need to be implemented in a planned manner. Gravel exploitation in the area need to be done in a more environmental friendly way.

3.2.15 Biodiversity and Wetland

Despite the richness of the biodiversity and abundance of natural resources in the haor basin, degradation in general term is noticeable. The haor basin is being subjected to several acute problems in its various components. Unwise use of natural resources is creating threats for the resource base in terms of sustainability and growth. For making any development plan the first and foremost activity is to have a resource inventory in hand. It is unwise to make any plan without knowing the state and trends of resources. The Asian Wetlands Directory and the baseline survey by the NERP/Water Board/CIDA are the two basic documents that describe the preliminary status of the wetland species and biodiversity of the region. The NCS also carried out some studies to update the database. However, all these are not updated enough to learn about the present status and changes that have taken place. Hence, it is an urgent and immediate task to prepare a comprehensive inventory. There is an increasing trend of encroachment at wetlands for various purposes such as housing, industry and agricultural practices. Over-exploitation of fisheries resources and swamp forests has tremendously increased in the haor wetlands. Unplanned fishing, fishing during breeding season, over fishing, hunting of water birds, duck rearing and other factors are causing depletion of biodiversity. Waters are being polluted by the discharge of untreated solid and liquid waste from various sources such as coal carrying boats, as well as due to discharge of crude oil from mechanised boats, dumping of household waste, waste disposal from fertilizer and cement factories, residual pollution of chemical fertilizers and pesticides.

3.2.16 Tourism

The tourism sector is facing various types of problems. The haor inhabitants of 59 upazilas identify lack of publicity through mass media as one of the main problems. Other problems include lack of accommodation facilities (no standard hotel/ motel for tourists) or sufficient security for tourists as well as poor transportation system. Due to these problems, tourists tend to visit haor areas by launch only during the day and are reluctant to stay the night. Lack of government initiatives is the main cause of the non flourishment of tourist spots in this area. Flash floods and leasing of jalmohals to influential people are the other causes of degradation of tourist spots. Siltation in the river bed has caused poor navigability. This sedimentation process adversely affects the ecological balance. Although the Wildlife Preservation Act prohibits the hunting of migratory birds and wild animals,

illegal hunting still continues. Lack of recreational facilities is also impeding the growth of tourism in this area.

3.2.17 Social Services

Markets and growth centers

The main problems are:

- improper and insufficient road networks
- unavailability of public sanitation facilities in most of the markets
- lack of preservation facilities of raw goods/commodities
- inadequacy of necessary sheds
- lack of drainage system
- lack of electricity supply as well as gas and water services
- undeveloped infrastructure in most of the markets
- inadequacy of local markets
- illegal encroachment in most of the markets
- construction of markets encroaching the bank of rivers
- lack of separate sheds for rice and fish
- faulty leasing system
- Inadiquent protection markets from *Afal* (wave erosion)
- markets are located on lands below flood level
- Inadequate of fish-selling sheds
- most of the markets are congested due to the scarcity of land

Godowns for food, fertilizer and seeds

There are only a few food godowns and cold storages. Moreover, the godowns have a low storage capacity and people are not motivated enough to use them. There is also no ice factory in the area. The other problems are lack of electricity, poor Transportation facilities and inadequacy of proper maintenance and repair work.

Common property resources

Scarcity of land, poor transportation facilities are major problems related to the development of common property resources like religious institutions, graveyards or crematoriums, playgrounds and police stations. Since the graveyards and cremation grounds are few in number, people often face difficulty in burying or burning the deceased during the wet season. Other general problems that prevail in this sector are:

- Inadequacy of necessary infrastructures
- inundation during rainy season
- lack of walls to protect mosques and temples from flood water
- lack of sanitation facilities at religious institutions
- lack of patronage for maintaining the places of worship of ethnic communities
- inadequate number of places of worship, playgrounds and lack of safety & security measures
- fragile infrastructures of religious institutions and insufficient allocation of financial resources

3.3 Prioritisation of Problems

The major problems of some of the key sectors are shown in order of level of priority in the problem matrix (Table 3.1). These problems have been prioritised based on people's perception. Three categories have been assigned to the problems: very highly significant (in more than 50% of the upazilas), highly significant (in15-50% of the upazilas) and significant (in less than 15% of the upazilas). The significance of each problem varies from sector to sector.

Table 3.1 Problem Matrix

Water Resources

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Flash flooding and drainage										
Siltation and sedimentation of major rivers										
Low height of embankments										
Crop damage due to flash flood										
Huge amount of land remain fallow due to the lack of irrigation water										
Water logging										
Insufficient re excavation work										
River bank erosion and wave erosion										
Reduction of navigability due to sedimentation and siltation										
Lack of Govt. patronaze										
Lack of monitoring										
Surface water flow hindered by the waste from stone crushing zone										

Pearl culture

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Insufficient government enterprise										
Ignorance of local people on pearl culture										
Siltation of the rivers and waterbodies										
Indequate training facilities										
Paucity of patronization and initiators										

Agriculture

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Crop damage due to early flood										
Shortage of agricultural labour										
Accessive use of insecticide and pesticide										
Insufficient agricultural loan facilities with easy terms and condition										
Poor drainage facilities										
Lack of proper irrigation system										
Unavailability of cold storage										
Water logging										
Lack of agricultural equipments										
Problems in marketing of products										
Unaccessibility to actual price of crops										
Scarcity of HYV seeds										
Lack of agricultural technology										
Undeveloped infrustructure										
Lack of embankment protection committee										
Lack of training										
Lack of capital for investment										
Poor transportation and communication system										
Lack of Govt. patronaze										
Lack of skilled people										

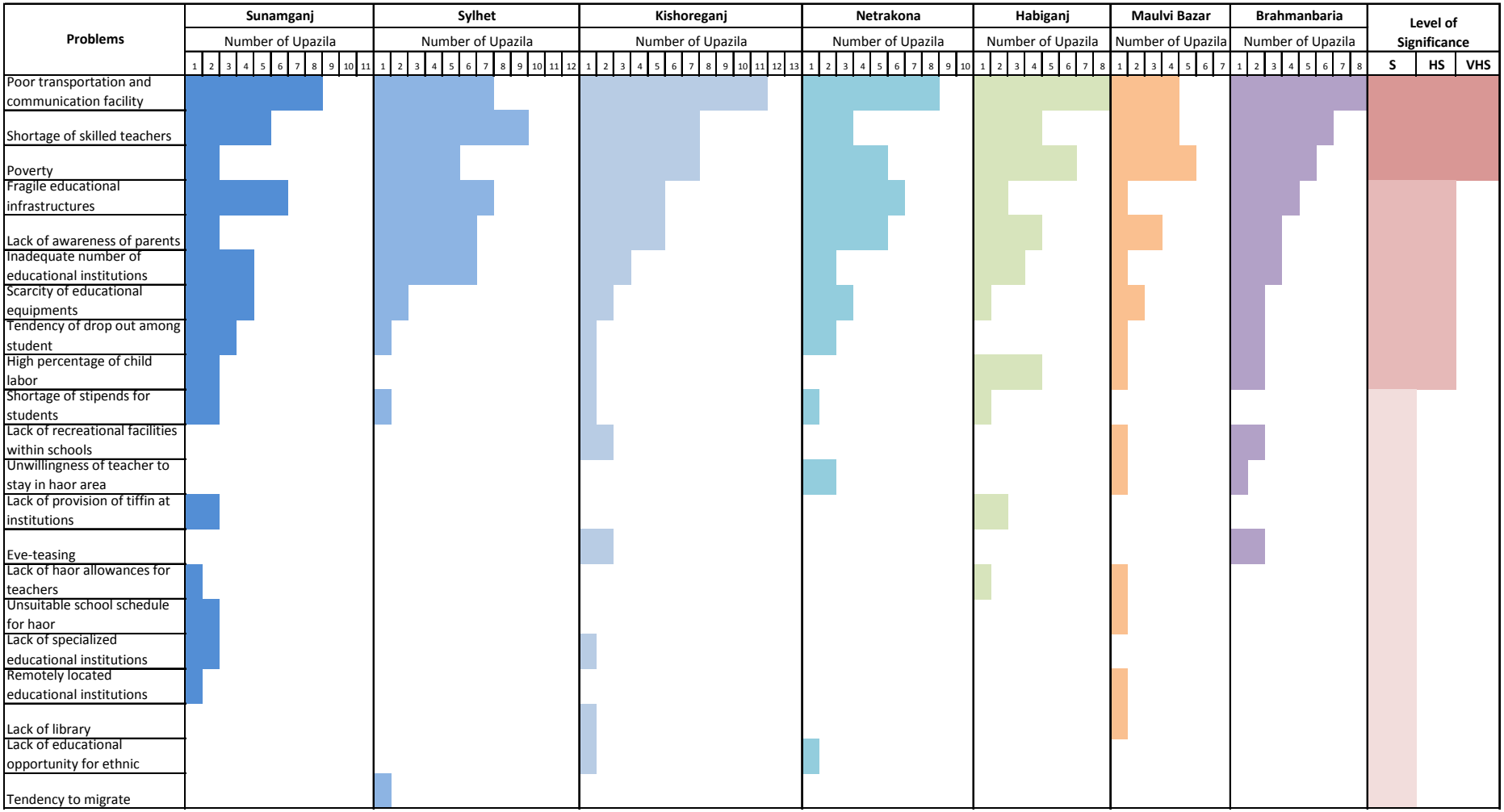
Fisheries

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Illegal harvesting of brood fish and finger lings										
Excessive use of monofilament net										
Indequate number of sanctuaries for fishes										
Indebtedness of fishermen to the rich										
Limited access of actual fisherman to the Jalmahal because of leasing system										
Excessive use of pesticide and chemical fertilizer										
Fishermen are deprived of reasonable price of fishes										
Lack of capital to invest										
Unavailability of facilities for fish preservation										
Siltation of the habitats of fishes										
Lack of fry fish										
Lack of training facilities for fish and aqua culture										
Weak marketing system										
Lack of necessary manpower and proper policy										
Lack of interest for fish farming										

Livestock

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Inadequate skilled veterinary doctors										
Shortage of suitable facilities for loan										
Insufficient medicine and vaccination supply										
Food scarcity for livestock during monsoon										
Low supply of high yield variety seeds										
Poor facilities for poultry transportation										
Undeveloped training opportunity for the farmers										
Inadequate patronization										
Indequate infrastructures										
Low number of hatcheries for livestock and poultry										
Scarcity of space to keep the livestocks										
Absence of public awareness										
Shortage of feeds for the ducks										
High price of necessary equipments										

Education


Problems
Sunamganj
Sylhet
Kishoreganj
Netrakona
Habiganj
Maulvi Bazar
Brahmanbaria
Number of Upazila
Level of Significance
S
HS
VHS
Poor transportation and communication facility
Shortage of skilled teachers
Poverty
Fragile educational infrastructures
Lack of awareness of parents
Inadequate number of educational institutions
Scarcity of educational equipments
Tendency of drop out among student
High percentage of child labor
Shortage of stipends for students
Lack of recreational facilities within schools
Unwillingness of teacher to stay in haor area
Lack of provision of tiffin at institutions
Eve-teasing
Lack of haor allowances for teachers
Unsuitable school schedule for haor
Lack of specialized educational institutions
Remotely located educational institutions
Lack of library
Lack of educational opportunity for ethnic
Tendency to migrate

Health

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Shortage of doctor and health worker										
Poor transportation and communication system										
Lack of awareness										
Shortage of medicine &medical equipment										
Fragile or undeveloped health infrustructure										
High price of medicines										
Lack of proper sanitation facility										
Unavailability of boat ambulance										
Lack of propagation on health awareness										
Insufficient health centres										
Lack of community clinics										
Inadequate number of bed in existing hospitals										
Lack of emergency treatment facility										
Practice of unscientific treatment methods										
Absence of treatment facility at grassroot level										
Arsenic contamination of water										

Sanitation

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Majority of unhygienic sanitation system										
Floodwater intrusion into the sanitation system										
Absence of public awareness										
High percentage of outbreak of water borne diseases										
Poverty										
Weak sewarage system										
Unaffordibility to buy ring slab										
Unavailaibility ofGO and NGO intervention										
Indequate number of factory to make ring slab										

Transportation

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Siltation and sedimentation of waterbodies										
Fragile and insufficient road network										
Lack of linkage road										
Lack of bridges and culverts and existing ones are out of order										
Lack of speedy water vehicles										
Unpaved road at village level										
Unplanned construction of bridges and culverts										
Damage due to water logging, flood and wave erosion										

Power and Energy

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Lack of infrastructure										
Lack of necessary equipment										
Poverty										
Lack of government patronisation										
Insufficient production capacity of solar power										
Lack of enterpreneur										
Shortage of electricity supply & distribution										
Lack of skilled people working in power sector										
No scope to produce hydropowered electricity										
Unavailability of solar energy system										
People's unwillingness to use solar power										
Lack of awarness										

Tourism

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Lack of propaganda through mass media										
Lack of accommodation facilities for tourists										
Poor transportation and communication facilities										
Lack of assistance and patronage of PPP										
Inadequate security at tourist location										
Hunting of migratory birds										
Lack of conservation of historically significant places										

Social Services

Problems	Sunamganj	Sylhet	Kishoreganj	Netrakona	Habiganj	Maulvi Bazar	Brahmanbaria	Level of Significance		
	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila	Number of Upazila			
	1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12 13	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	S	HS	VHS
Lack of different allowances										
Lack of communication and transportation										
Weakness of civil defence system										
Lack of security										
Lack of co-ordination between chairman and member										
Absence of civil defence system										
Inequality in relief distribution										
Limited allotment in social service sector										
Inadequate monitoring										
Lack of flood shelter										
Lack of manpower										

3.4 Cross cutting issues

There are some sectors which have either a positive or a negative influence on other sectors. Sectoral interdependency may stimulate positive growth whereas discrepancy in inter-sectoral resource allocation may result in unplanned growth and wastage of scarce resources. In fact, there are cross cutting issues (Figure 3.1) that have significant impacts on most of the sectors and have been considered in the Master Plan.

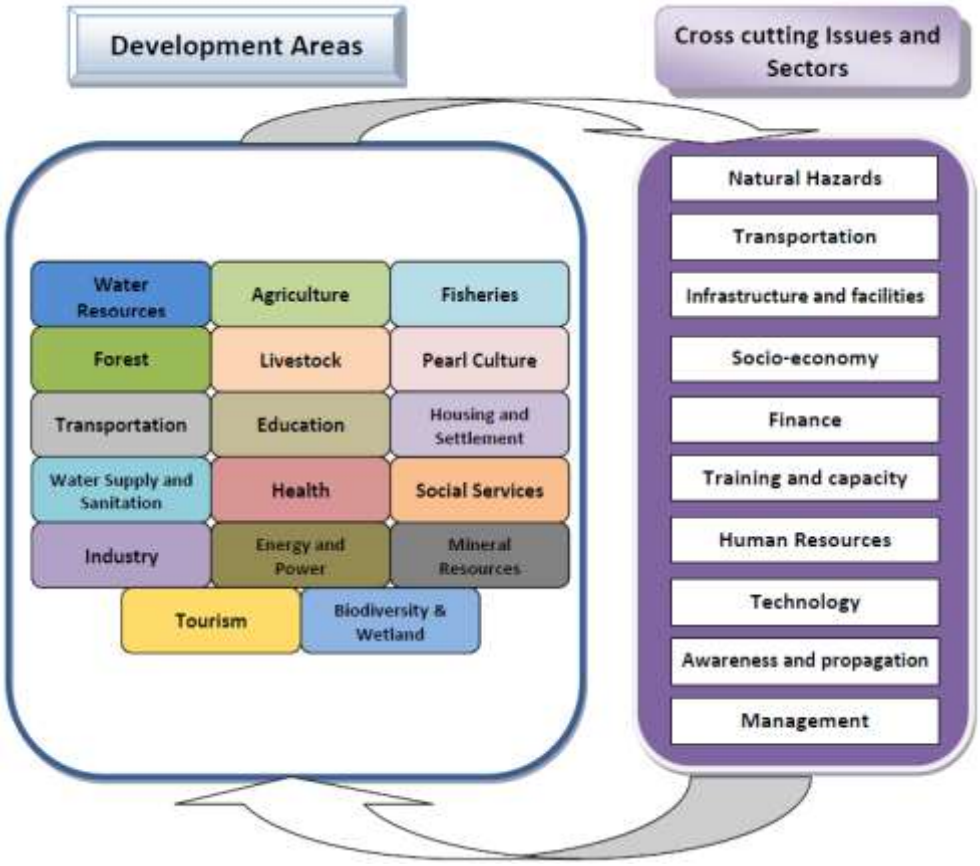


Figure 3.1: Cross cutting issues

Natural hazards and problems like flash floods, wave erosion, soil erosion and siltation &sedimentation of rivers impede the development of all the sectors mainly water resources, transportation, infrastructures, education, health, agriculture and fisheries. Poor transportation and inadequate infrastructure and facilities are significant problems that are causing low growth of many sectors such as agriculture, fisheries, livestock, education, health, tourism, social services, facilities, etc. Technical knowledge gap and lack of technological advancement stand in the way of achieving the desired targets of each sector. This reflects the need for training and capacity building. In certain cases, lack of government patronage and NGO initiatives lead to inadequate fund flow which is a major constraint to undertaking development projects. Raising awareness on education, health, tourism, use of sanitary practices, etc. are vital for sectoral development as well as for an improved quality of life.

Chapter 4 Review of Policies, Strategies and Plans

4.1 Introduction

Over the last decade, Bangladesh has developed the National Water Policy, National Agriculture Policy, National Fisheries Policy, National Land Use Policy, National Environmental Policy, National Policy for Safe Water Supply and Sanitation, Sixth Five Year Plan, Outline Perspective Plan of Bangladesh, National Water Management Plan, Flood Action Plan, National Plan for Disaster Management, Bangladesh Climate Change Strategy and Action Plan, Poverty Reduction Strategy Paper etc.

In the following sub-sections, a number of important and relevant national policies, strategies and plans have been reviewed for the preparation of Master Plan of Haor Area.

4.2 Review of National Policies

National Water Policy, 1999

The National Water Policy was declared by the government in 1999. It has 17 sections dealing with policy directives for particular issues. Among them the sections which can be linked to the haor area are described below.

Water for Preservation of Haor, Baors and Beels: According to the Policy, natural water bodies such as beels, haor and baors should be preserved for maintaining the aquatic environment and facilitating drainage. Only those water related projects will be taken up for execution that will not interfere with the aquatic characteristics of the water bodies. Haor that naturally dry up during the winter will be developed for dry season agriculture.

River Basin Management: To help each other to understand the current and emerging problems in the management of the shared water sources a co-operative attitude and system needs to be developed with co-riparian countries.

Planning and Management of Water Resources: The policy directives focus on designation of flood risk zones and taking appropriate measures to provide desired levels of protection. It also calls for the development of early warning and flood-proofing systems, development of water resources of the major rivers for multipurpose use including irrigation, fisheries, navigation, forestry and aquatic wildlife as well as delineation of water-stressed areas based on land characteristics and water availability. Steps are to be taken to protect water quality and ensure efficiency in its use.

Water Rights and Allocation: The government will exercise its water allocation power in identified scarcity zones on the basis of specified priorities.

Public and Private Involvement: Appropriate public and private institutions will provide information and training to local community organizations for managing water resources efficiently.

Water and Industry, Navigation and Recreation: Zoning regulations will be enforced for establishing new industries in consideration of fresh and safe water availability and possible effluent discharge.

Effluent disposal will be monitored by relevant government agencies to prevent water pollution. Minimum stream-flows in designated rivers and streams will be maintained for navigation after diversion of water for drinking and municipal purposes. Recreational activities at or around water bodies will be allowed provided it is not damaging to the environment.

Research for Information Management: According to the Policy, development and dissemination of appropriate technologies for conjunctive use of rainwater, ground water and surface water need to be done.

National Agriculture Policy, 1999

The National Agriculture Policy (NAP) was declared by the government in 1999 by the Ministry of Agriculture (MoA). The relevant directives of the NAP that relate to the water sector of the haor area are:

- Irrigation from surface water will get priority.
- Infrastructure will be built for capturing surface water from khals, beels and small rivers and increasing availability of irrigation water by using high capacity power pumps.
- Small rivers, khals, dighees, derelict ponds, etc. which have silted up will be re-excavated so as to augment water flow for expanding irrigation facilities and fish production, while tree plantation will be done on both sides of khals.
- Research will be strengthened in order to assess the present status and determine future programmes on the availability of irrigation water, utilisation and impact of irrigation technologies, etc.
- Supplementary irrigation will be ensured in severe and extremely severe drought affected areas.
- Necessary training and technical assistance will be given to farmers for reducing water loss through increased efficiency of the irrigation system and increasing command area per pump.
- Efforts will be made to reduce irrigation cost by improving irrigation efficiency, promoting appropriate technology, increasing irrigation command area and upgrading irrigation management.
- Region-wise research will be done on irrigated and rain-fed cultivation.
- Breeding of crop varieties suitable for high-input and high output agriculture, multiplication of quality seed, balanced development of public and private sector seed enterprises, simplification of seed import for research and commercial purposes will be done.

National Fisheries Policy, 1998

The haor region is the biggest closed wetland of the country and provides a tremendous opportunity for the government to use the haor for fish culture, both domestically and for export. The National Fisheries Policy was first introduced in 1998 by the Ministry of Fisheries and Livestock. The key directives of the Policy that can be directly related to the haors for its sustainable development and development of fish culture are given below:

- Laws will be formulated to ban the disposal of any untreated industrial effluents into water bodies.

- Fish habitats will be preserved from damage. Appropriate care should be taken during the implementation of all development activities such as flood control, irrigation and drainage (FCD/I) projects as well as agriculture, industries, road and urban development projects.
- Lakes, beels, ditches-canals and other open water bodes should not be completely dewatered.
- Proper arrangement will be initiated to develop water control and drainage system for sustainable fish production in baors.
- For increased production and to conserve biodiversity, some areas or the whole jalmohal will need to be converted into fish sanctuaries.
- Water bodies such as haor, baors and beels would be revived for fish culture and not be reduced in size.
- Priority will be given to government owned ponds, baors and other suitable water bodies for fish culture as an alternative source of earning for poor fishers.
- Ponds remaining barren due to multiple ownership or such other problems will be brought under fish culture through the Pond Development Act.
- Soil maps of potential fishery areas of the country will be developed and the required lime and manure will be recommended.
- Baors will be treated as fish production areas.
- Local fisher communities will be given priority for fish culture in baors and technical and socio-economic support will be provided.
- Training programmes will be undertaken for fish farmers and entrepreneurs interested in investing in the fisheries sector.
- Unemployed youths will be trained in fish culture and financial assistance will be provided for post-training fish culture activities.
- Arrangements will be made to conserve threatened and endangered fish species and ensure mass production.
- Proper studies will be undertaken before cultivating exotic fish. Introduced fish species without proper assessment could have negative environmental impacts on indigenous species and the ecology.

National Livestock Development Policy, 2007

The National Livestock Development Policy (2007) has been prepared to address the key challenges and opportunities for comprehensive sustainable development of the livestock sub-sector through creating an enabling policy framework.

The National Livestock Development Policy was found to emphasise on the following policy issues:

- Promotion of smallholder dairy and poultry development through private sectors participation.
- Rearing of goats, buffaloes and ducks in high potential areas through special projects.
- Institutional reforms of the DLS to perform public functions, enactment of laws and strengthening of regulatory functions for quality control of drugs, feeds and breeding materials.
- Privatisation of vaccine production and veterinary services.

The specific objectives of the National Livestock Development Policy are:

- To promote sustainable improvement in milk, meat and egg production including processing and value addition.
- To promote sustained improvement in income, nutrition and employment for the landless, small and marginal farmers.
- To facilitate increased private sector participation and investments in livestock production, livestock services, market development and export of livestock products and by-products.

National Policy for Safe Water Supply and Sanitation, 1998

The National Policy for Safe Water Supply and Sanitation has been formulated with the objective of making water and sanitation services accessible to all within the shortest possible time at a price affordable to all as well as to improve the standard of public health and ensure improved environment. Steps that are relevant to the application of proper water supply and sanitation in the haor region are given below:

- Facilitating access to basic water supply and sanitation services for all citizens
- Bringing about behavioral change regarding use of water and sanitation
- Reducing incidence of water borne diseases
- Building capacity in local governments and communities to deal more effectively with problems relating to water supply and sanitation
- Promoting sustainable water and sanitation services
- Ensuring proper storage, management and use of surface water and preventing its contamination
- Taking necessary measures for storage and use of rain water
- Ensuring storm-water drainage in urban areas
- Increasing the present coverage of safe drinking water in rural areas by lowering the average number of users per tube well from the present 105 to 50 in the near future
- Making safe drinking water available to each household in urban areas
- Ensuring supply of quality water through observance of accepted quality standards
- Removal of arsenic from drinking water and supply of arsenic free water from alternate sources in arsenic affected areas
- Development of the water supply and sanitation sector through local bodies, public-private sector, NGOs, CBOs and women groups involving local women particularly elected members (of local bodies) in sector development activities
- Social mobilisation through publicity campaign and motivational activities using mass media among other means to ensure behavioral development and change in sanitation and hygiene practices

National Forestry Policy, 1994

The National Forest Policy was declared in 1994. The major directives that can be related to the haor area are:

- To bring about 20% of the total area including forest lands, fallow lands, lands not useful for agriculture, hinter lands and other possible areas of the country under various afforestation

programmes to meet the basic needs of the present and future generations and to ensure greater contribution of the forestry sector to economic development.

- To enrich biodiversity in the existing degraded forests by conserving the remaining natural habitats of birds, both local and migratory, as well as animals.
- To strengthen agriculture by extending assistance to those sectors related with forest development, especially by conserving land and water resources.
- To fulfill national responsibilities and commitments by implementing various efforts and government ratified agreements relating to global warming, desertification and the control of trade and commerce of wild birds and animals.
- To prevent illegal occupation of forest lands, illegal tree felling and hunting of wild animals through the promotion of participation of local people to encourage effective use as well as utilisation of forest products at various stages of processing.
- To provide for and implement afforestation programmes on both public and private lands. Therefore as per the Policy, conservation value of forests and wetlands will be identified and developed for ecotourism.

National Education Policy, 2010

The National Education Policy, 2010 formulated some directives and aim(s) concerning different types of education to ensure education for all. Some notable directives are:

- Ensuring favorable environment for mental and physical preparation to initiate education
- Arrangement of pre-primary education through attractive educational equipment and recruitment of extra teachers
- Extending primary education from Class V to Class VIII
- Reduction of drop-out rate through more stipend for poor students
- Proper arrangement for primary education
- Proper training for teachers
- Extending admission age in informal education from 8 to 14
- Upgrading teacher-student ratio to 1:30 by 2018 in secondary education
- IT based education for poverty eradication
- Practical and substantial agricultural education in primary and secondary levels

National Health Policy, 2010

The National Health Policy was introduced in 2010. It covers some issues and directives with respect to the development of the health sector in the haor area. The major statements are:

- Sustainable health within 2015 will be promoted to fulfill the Millennium Development Goals (MDGs)
- Health care facilities will be extended all over the country with the adoption of computerised technologies and modern services (e.g. tele-medicine)
- The policy strategies are to increase the doctor-population ratio and nurse-doctor ratio; establish community clinics in all unions; rationalise the number and size of Upazila Health Care Centers and Family Welfare Centers with the latter located at a distance from the former, especially in big upazilas

- Improvement of public health status can be attained through access to basic health care and sanitation services, upgrading the level of health service, behavioral change, preventing contamination of water supply and integrated health & family planning
- Training and education on health, nutrition, balanced diet and hygiene for both men and women

National Land Transport Policy, 2004

The Policy was introduced in 2004. The major statements related to haor are:

- To provide safe and dependable transport services
- To maintain economic and environmental balance
- To promote growth of traffic commensurate with economic development
- To Introduce an integrated transport system
- To increase access to transport and services in rural areas
- To establish a multi-modal transportation system with proper integration between road, rail and waterways
- To improve rural Transportation and as such develop a Rural Road Master Plan and a Maintenance Plan with priority given to maintenance over new construction
- To promote more involvement of LGIs and ensure utilisation and maintenance of constructed facilities
- To ensure that construction of new roads do not impinge upon the wetland ecosystem in any way and that EIA is conducted prior to the construction

National Energy Policy, 1996

The National Energy Policy was introduced in 1996. It covers some aspects with respect to the development of the industrial sector in the haor region.

- The Geological Survey of Bangladesh and Petrobangla are to complete a geological and geophysical survey of the whole country. The survey results could be used to assess the prospects of mineral and fuel resources of the country.
- For the purpose of energy planning, assessment of all types of energy resources (e.g. oil, gas, coal, nuclear minerals, hydropower, biomass fuel, solar, wind, tidal, wave etc.) are to be undertaken on a regular/continuing basis by relevant authorities.
- Special incentives are to be given for the survey, exploration and development of oil and gas.

National Tourism Policy, 2009

The Policy, formulated in 2009, clearly stresses the need for bringing the haor area under tourism development. The main objectives of the Policy are to –

- Ensure sustainable tourism by developing the tourism sector
- Create employment opportunities for ensuring socio-economic development involving local people
- Maintain environmental balance

According to the Policy some of the areas in the haor region that are suitable for development of ecotourism are Tamabil, Jaflong, Madhabkunda, Sreemangal, the Lawachara forest in Sylhet and the haor of Sylhet-Sunamganj. Potential sites should be identified and developed for attracting tourists

from both home and abroad. Funding for the development of facilities is to be sought from the government and development partners. The government will play a vital role in developing required transportation infrastructure. Necessary measures will be taken with support from the relevant ministry, district office, local government, BPC and other relevant agencies.

National Environment Policy, 1992

The National Environmental Policy was introduced in 1992 by the Ministry of Environment and Forest. The Policy directives that directly or indirectly relate to the water sector of the haor and wetland region are stated below:

- Keeping haor, baors, beels, jheels and rivers pollution free
- Introducing "ecosystem"-wise land use systems
- Conservation of wetland and migratory birds
- Re-evaluation of water resources projects and infrastructure that may pose a threat to fish habitat
- Conservation of wetlands which are exclusive to fish culture and prevention of encroachment of wetlands
- Bringing highway transport, railway transport, airways, inland water transport and dockyards under preventive measures against water and local environmental pollution
- Giving utmost importance to water bodies for urban beautification
- Taking necessary measures against industrial pollution
- Taking necessary measures against chemical and artificial pesticide and fertilizer used in agriculture
- Overall improvement of sustainability of nature and environment through conservation and development of the environment

National Land Use Policy, 2001

The main objectives of the Land Use Policy (2001) are preventing excessive land use due to the ever increasing demand for crop production, maximum utilisation of lands, preservation of 'Khas Lands' and helping in reducing the number of landless people in Bangladesh.

Some statements are made in the land use policy which could be related to haor:

- Regulation should be imposed over the wetlands so that they are not filled up but kept available for fish culture
- Reservation of large water bodies (e.g. haor, baors. beels, rivers etc.) are the responsibility of the government
- Regular maintenance and rehabilitation of wetlands need to be done when necessary
- Maintenance of the embankments need to be done so that they do not cause drainage congestion
- Re-excavation is to be done in filled-up wetlands
- Strict laws need to be imposed against un-treated effluent discharges from industries so that it does not pose a threat to the environment and land
- Water bodies should be used in a way that does not contradict the Fisheries Policy and still contributes in agricultural irrigation
- The Policy includes a prohibition against encroachment of existing wetlands

- Regular maintenance of the existing water bodies need to be confirmed
- The Policy calls for plantation of trees along embankments and provision of drainage facility for embanked areas
- Cultivation of crops need to be done according to soil characteristics so that land is not overused and misuse of water is reduced
- Fish production should not be hampered in rivers, haor, baors, khals etc. due to crop production

National Jute Policy, 2002

The National Jute Policy was developed in 2002. The statements that correlate with the development of jute production in the haor area are stated below-

- Keeping jute production at a desirable level, stabilising supply and prices of jute
- Developing commercially viable jute industries, accelerating privatisation of jute industries and developing multiple use of jute and jute goods

National Rural Development Policy, 2001

The National Rural Development Policy was introduced in 2001. Several statements of the Policy can be directly linked to the Master Plan of Haor Area. These are stated below-

- Construction of buildings, new settlements etc. on cultivable agricultural land will be discouraged and measures for planned construction of houses will be taken
- Research for innovation and development of technologies of low cost housing for rural areas will be undertaken
- Residential areas and cultivable areas in villages will be separately demarcated wherever possible for more profitable use of agricultural land and for facilitating improved technology-based cultivation
- Initiatives for expansion of planned infrastructure will be taken on a priority basis in residential areas
- Prior to new settlement in village areas, especially in island and char areas, necessary layout design has to be done
- Families that have become landless, displaced and shelter less due to river erosion, will be provided with shelter within a short time on a priority basis and rehabilitated in the nearest government Ashrayan/ Adarsha Gram Project area
- Access to credit will be facilitated for those entrepreneurs who are involved in the extension of modern housing facilities or construction of houses in rural areas. In addition, loan distribution from the Rural Housing Fund will be continued
- Special facilities will be provided and concessions made to private house building societies and co-operatives for the construction of multi-story buildings (apartment buildings) within the purchasing capacity of people with low and medium income
- With the objective of building educated and skilled community leadership in the village, measures will be taken by the government to distribute rural land or apartments on rent/purchase basis among officials in order to encourage retired government employees to live in villages

- Proper implementation of the "Go Back Home" initiative must be taken. Since initiation of the project in May 1999, 11,600 people have been sent back to villages in 132 upazilas and rehabilitated by the Bangladesh Krishi Bank.
- The One House One Farm Programme has been started with a view to converting every house into a self-sufficient farm unit through optimal utilisation of all available resources of the family and developing the human resources of every rural family by imparting training. Proper implementation of this Programme is also required.

National Industrial Policy, 2005

The Industrial Policy was introduced in 2005. The relevant policy statements with respect to the development of the industrial sector in the haor region are given below:

- Set up planned industries considering the real prospect of domestic demand for exporting goods abroad
- Accept private initiatives as the main driving force of economic development
- Provide assistance to augment the industrial sector's contributions to the GDP of the national economy
- Meet the general demands of local consumers and earn more foreign exchange so that local industrial entrepreneurs can attain further capacity to establish industries
- Provide inspiration for the speedy expansion of cottage industries and Small and Medium Enterprises (SMEs) and for further investment in these sectors so that new employment opportunities are generated
- Provide women entrepreneurs with all necessary assistance for establishing industries in various sectors
- Priorities the expansion and development of agro-based and agricultural processing industries
- Increase productivity at enterprise level
- Further enrich the industrial sector with proper utilisation of the country's various natural and mineral resources
- Provide all necessary assistance for producing environment-friendly products with the objective of creating a pollution-free environment in the industrial sector
- Establish SMEs at a greater scale across the country in order to bring about poverty alleviation, unemployment reduction and to create more employment opportunity
- Make an all-out effort to encourage the production of diversified jute goods and the diverse use of jute development, acceptance and transfer of environmentally friendly appropriate technology
- Ascertain the industries that pollute the environment and endanger public health, ensure safety measures in respect of environmental pollution control

National Information and Communication Technology Policy, 2009

The National Information and Communication Technology (ICT) Policy was introduced in 2009. It covers some statements which could be directly linked to the development of different sectors in the Haor area.

- Development of industrial production system by ICT
- Education and Research in the ICT sector

- Employment through ICT
- Development in export-import technology
- Improvement of medical facilities
- Developing E-commerce and E-business
- Development of Internet and telecommunication facilities
- Environment, climate and disaster management through ICT
- Overall development by means of ICT

National Jalmohal Management Policy, 2009

The government adopted the Jalmohal Management Policy in 2009 for increased production and biodiversity conservation of fisheries resources as well as leasing of khas water bodies in favour of real fishers and for earning revenue. The basis of the Policy is "*Jal jaar, jolataar*" which basically means "right is might". The Policy defines jalmohals as "the water body where water remains sometimes or throughout the year and is known as haor, baor, beel, jheel, pond, ditch, lake, dighi, khal, river, sea etc." Such jalmohals could be closed or open. Closed jalmohals have a defined boundary unlike open jalmohals. For increased production and to conserve biodiversity, some areas or the entire jalmohal will need to be converted into fish sanctuaries. Jalmohals designated as fish sanctuaries will be transferred to the Directorate of Fisheries according to the Policy.

National Renewable Energy Policy, 2008

The National Renewable Energy Policy was introduced in 2008. The relevant policy statements with respect to the development of the industrial sector in the haor region are given below:

- Solar photovoltaic and thermal power/Concentrating Solar Power (CSP) technology involves harnessing solar radiation for generating electricity. Solar power and wind produced energy is encouraged in the Policy to meet electricity demand in a sustainable manner not adversely affecting the environment.
- Biomass which is used for electricity production from rice husk, crop residue, wood, jute stick, animal waste, municipal waste, sugarcane etc. could be disseminated on a larger scale for electricity generation. Biogas is made mainly from animal and municipal wastes and is a promising renewable energy resource for Bangladesh.
- The Policy concentrates on scaling up contributions of renewable energy both to electricity and heat energy.
- The Policy suggests facilitating training on the use of renewable energy at every level of energy usage so that wastage can be avoided and efficiency is increased.
- The Policy states that collection of data and assessment of the renewable energy resource base, especially in the context of the Rural Energy Master Plan, will be done.
- For large biomass electricity projects (i.e. greater than 1 MW) the project developer must demonstrate that it is being sustainably harvested and that no adverse social impact will result from that development.
- Production and use of bio-fuel may be encouraged but it shall not jeopardise existing crops or be a replacement of such crops.

4.3 Review of National Strategy

Poverty Reduction Strategy Paper, 2009

The Second Poverty Reduction Strategy Paper 'Steps toward Change: National Strategy for Accelerated Poverty Reduction II; Revised; FY 2009-11 consists of five strategic blocks and five supporting strategies.

Hazards like floods, cyclones and droughts are noted for aggravating poverty through destruction of food stock and insufficient assets of the poorer households and through making employment opportunities scarce. Poverty, in its turn, often leads to vulnerability to disasters, particularly to floods, riverbank erosion, coastal cyclones and tidal surges.

The strategies of water resources development and management are grouped under six major heads which are-

- Dredging of main rivers and their development for multipurpose use of water resources, management for navigation, erosion control and development of hydropower
- Flood protection and storm-water drainage measures through rehabilitation and maintenance of existing FCD and FCDI systems in a participatory manner and protection of rural and urban areas from floods
- Disaster management programmes including provision of cyclone protection, early warning and forecasting systems with adequate lead time, flood proofing of shelters, control of riverbank erosion, drought management and rationalisation of groundwater resources and climate change adaptation
- Adequate provisions for water management for agriculture through public sector irrigation development and flood management and drainage
- Ensuring protection of the natural environment and aquatic resources through water pollution monitoring and control, water management for fisheries and ecologically sensitive areas and raising awareness of all stakeholders for supporting environmental measures
- Ensuring development of institutions in the water sector

Bangladesh National Conservation Strategy, 1987

The National Conservation Strategy (NCS) has been an important step towards achieving the objective of environmental conservations and integrating policies on environment. The updated Strategy builds on the Poverty Reduction Strategy Paper and the World Summit on Sustainable Development and Millennium Development Goals.

By adopting the Strategy, the government has reinforced its national and international commitments for conservation of resources and sustainable development and strengthened the economy in the long run as well. The Strategy is divided into 17 chapters on the basis of sectoral profiles. The sectors span all the important areas that require inter-sectoral and intra-sectoral considerations: human resources, land resources, water resources, forest resources, biodiversity, fisheries resources, crop agriculture, industry, rural development, energy and minerals, urbanization, health and sanitation, transport and communication, disaster and disaster management, environmental education and awareness, gender Issues and environment and international obligations. The NCS has set forth the parameters of policy and legislative change, institutional responsibility, reorientation, strengthening and coordination needs, research, survey and monitoring and complementary aspects to reverse

environmental degradation and establish sustainable development practices in Bangladesh. Under the National Conservation Strategy Implementation Project, pilot interventions have been undertaken for Tanguar haor Wetland Biodiversity Conservation and Conservation of Coral Resources of Narikel Jinjira. While the Strategy provides for coordination in conservation of natural resources, it does not explicitly address issues of biodiversity conservation. For example, measures which promote conservation of fisheries, but which nevertheless result in a narrowing of the genetic base that supports such fisheries, would be possible under the Strategy.

Bangladesh Climate Change Strategy and Action Plan, 2009

The Bangladesh Climate Change Strategy and Action Plan (2009) is a 10-year programme (2009-2018) to build the capacity and resilience of the country to meet the challenges of climate change. The BCCSAP has six main pillars with a number of related programmes and objectives. The water issues related to haor that are linked to the thematic programmes of the BCCSAP are described below.

Under the theme T1 i.e. Food Security, Social Protection and Health, the programme P2 focuses on the development of a climate resilient cropping system appropriate for different agro-climatic regions and sub-regions. Climate change will result in increasingly frequent and severe flooding and flash floods in the north-eastern and eastern parts of Bangladesh where farmers may need to modify their current cropping system. Programme P4 focuses on adaptation in the fisheries sector as climate change is likely to adversely affect freshwater and marine fisheries in Bangladesh. Programme P5 focuses on adaptation in the livestock sector. The programme mentions that floods, droughts and higher temperatures are likely to affect poultry and livestock adversely. Programme P7 focuses on water and sanitation programmes for climate vulnerable areas and mentions how poor drainage and flooding will affect sanitation and access to drinking water. Programme P8 focuses on livelihood protection in ecologically fragile areas and justifies its relation with haor by mentioning that special attention must be given to inland wetland areas, as they will become more vulnerable to climate change impact.

Under the theme T2 i.e. Comprehensive Disaster Management, programme P1 focuses on improvement of flood forecasting and early warning systems by increasing lead times and strengthening dissemination mechanisms. This is a major requirement as monsoon and flash floods are common in the haor region.

Under the theme T3 i.e. Infrastructure, programme P1 focuses on repair and maintenance of existing flood embankments and ensuring continued flood protection by repairing and rehabilitating existing flood embankments and ancillary infrastructure. Programme P5 focuses on adaptation against floods to make flood prone areas more resilient by flood zoning and management. Programme P8 focuses on planning, design and implementation of resuscitation of the network of rivers and khals through dredging and de-siltation work.

Under the theme T4, programme P2 considers climate change modeling at national and sub-national levels which also incorporates the water sector.

Under the theme T5, Mitigation of Low Carbon Development, several programmes can be linked to issues related to the water-sector of the Haor wetlands. Programme P5 focuses on raising productivity of agricultural land and lowering emissions of methane by efficient use of water and

land-use practices. Programme P9 focuses on water efficiency in built environments with further mention to groundwater lowering in major cities including Sylhet. Last but not least, programme P10 focuses on improving the energy consumption pattern in the transport sector, which can be easily related to the navigational facilities possible to implement in the Haor area without much use of fuel.

4.4 Review of Plans

Outline Perspective Plan, 2011 (Vision 2021)

The purpose of the Outline Perspective Plan of Bangladesh (2010-2021) is to project an image of Bangladesh for 2021 that meets the hopes and aspirations of the citizens of the country for an economically inclusive and politically accountable society. Two five year plans namely Sixth Five Year Plan ADB Seventh Five Year Plan will be implemented by 2021 to achieve the objectives of the vision 2021. The Sixth Five Year Plan has been in implementation since fiscal year 2010-2011. The Sixth Five Year Plan focuses on measures to bring down poverty level to 15 % and ensure housing for all by 2015. The Five Year plan will also focus on remittance, manpower export, export diversification, population control, foreign investment and capacity building of the country's economy as well as ensure a business friendly environment.

The major Perspective Plan strategies that could be related with the haor area are as follows:

- To follow the Integrated Water Resource Management (IWRM) framework for best allocation of water to various uses
- Encouraging research and development in designing appropriate adaptive activities to manage climate change impacts on the water sector
- Encouraging research on crop varieties that are water efficient and resistant to salinity
- Focusing on surface water irrigation and stabilising a reduced use of groundwater
- Increasing irrigation efficiency and reducing wastage and losses through better technology and management
- Encouraging greater use of rainwater and its local storage for use in the dry season
- Protection of erosion of water courses and enhancement of land reclamation
- Undertaking planned and phased dredging and river training activities
- Examining the government’s water sector agencies and institutions and, if necessary, redesign, reorient and further equip them for more effective implementation of policies and strategies
- Prioritising disaster management through flood/drought management
- Decentralisation of the administration and education systems
- Negotiating with India for equitable water sharing arrangements for all Transboundary rivers, particularly major rivers and actively seeking cooperation with India and Nepal in augmenting the dry season Ganges flows and their equitable sharing, as provided for in the Ganges Water Treaty between Bangladesh and India
- Mounting efforts to improve cooperation on flood and drought management with other coriparians, to the benefit of all the countries, including Bangladesh
- Coverage of all types of health care to be increased steadily till 2015 when the MDGs are expected to be achieved
- Public health facilities such as pure drinking water and sanitation to be improved

- Promoting equitable, environment friendly, inclusive and socially sustainable pro-poor accelerated growth
- Thrust on SME-based industrialisation that will be labour-intensive, decentralised in terms of location, have users of indigenous raw materials, need low inputs and will be serviced by adequate human resources and technology adoption/adaptation and transfer
- Developing Bangladesh as an exotic tourist destination in Asia and increase contribution of tourism to the GDP from 0.70% to 2% by 2015 and then to 5% by 2021
- Mitigating effects of climate change

Sixth Five Year Plan of Bangladesh, 2011

The Sixth Five Year Plan of Bangladesh: FY2011-FY2015 focuses on a number of core targets to monitor the progress of the Sixth Plan. These targets have been set according to the vision and objectives of the Outline Perspective Plan 2021 as well as the goals of the MDGs. These monitor able targets fall in seven broad categories:

- Income and Poverty
- Human Resource Development
- Water and Sanitation
- Energy and Infrastructure
- Gender Equality and Empowerment
- Environment Sustainability
- ICT

All these categories could be directly or indirectly linked to the haor region. Points that relate to the water sector of the haor area are given below.

- Safe drinking water to be made available for all urban population and proportion of rural population with access to safe drinking water to be increased to 96.5%
- Proportion of urban population with access to sanitary latrines to be increased to 100% and proportion of rural population with access to sanitary latrines to be raised to 90%
- Maintenance of ecological balance and overall progress and development of the country through protection and improvement of the environment
- Protection of the country from natural disasters
- Identification and control of all types of activities related to pollution and degradation of the environment
- Environmentally sound development programmes undertaken in all sectors

National Water Management Plan, 2001

Government of Bangladesh adopted the National Water Policy in 1999 and the government approved the National Water Management Plan (NWMP) in 2004. The overall objectives of the NWMP are to contribute in a balanced fashion to the overall national goals of economic development, poverty alleviation, food security, public health and safety, decent standard of living for the people and protection of the natural environment. The purpose of the NWMP has been to operationalise the directives given in the National Water Policy. The NWMP has been a framework plan to guide (but not prescribe) in an integrated and comprehensive manner. The Plan has been structured in a manner that the objectives of 84 different programmes planned for the next 25 years

contribute individually and collectively to attain the overall objectives as well as intermediate sub-sectoral goals. The programmes have been grouped into eight sub-sectoral clusters and have been spatially distributed across hydrological regions of the country. Information on each, together with a wide range of planning data, has been contained in the National Water Resources Database (NWRD), accessible through a Management Information System (MIS).

There are twenty-five programmes for the northeast region. Of these, one has been exclusive to the region and concerns improved water management in the ecologically important haor basin.

The other programmes that are related to the water sector are:

- FCD and FCD/I Management Rationalisation
- Regional River Management and Improvement
- North East and South East Regional Surface Water Distribution Networks
- Urban Arsenic Mitigation
- Rural Arsenic Mitigation
- Large and Small Town Water Supply and Distribution Systems
- Rural Water Supply and Distribution Systems
- Large and Small Town Sanitation and Sewerage Systems
- Rural Sanitation
- Large and Small Town Flood Protection
- Large and Small Town Storm water Drainage
- Flood Proofing in the Charlands and Haor Basin
- National, Regional and Key Feeder Roads - Flood Proofing
- Railway Flood Proofing
- Supplementary Irrigation and Drought Proofing of Rural Water Supplies
- Promotion of Expanded Minor Irrigation and Improved On-farm Water Management
- Improved Performance of Existing Public Surface Water Irrigation Schemes
- New Public Surface Water Irrigation Schemes
- Improved Water Management at Local Government Level
- Improved Water Management at Community Level
- Rationalisation of Existing FCD Infrastructure
- National Fish Pass Programme
- Unspecified Regional Programmes
- Environmentally Critical Areas and Integrated Wetland Management

EPWAPDA Master Plan, 1964

The Master Plan 1964 has stated that the entire economy of the erstwhile East Pakistan has to be strengthened and improved to satisfy the basic needs and rising aspirations of the people. The Master Plan emphasized to meeting agricultural demand of water through large scale public sector development for both dry season (irrigation) and wet season (flooding) water management. The Plan identified 63 water development projects. This initiated the implementation of large scale FCD and FCDI projects including protection of most of the coastal zone against tidal flooding and also hydro power generation. The Master Plan however also provided some insights on how to develop the power and water sectors of the country. They are:

- A summary estimation of the capital costs for both water and power plants
- Identification of power development opportunities and analysis of total capital costs and foreign exchange components for power projects
- Recommendation for developing gas fields for power generation to replace import of coal and oil
- Recommendation for prioritising studies on the scope of nuclear plant development
- Possibility of a large block of power to be generated if a barrage on the Brahmaputra-Jamuna is constructed depending on the economic growth of the country
- Recommendation for development of the water sector to confine flood flow to the river channels and thus permit intensification of cropping
- Most of the recommended projects incorporated drainage facilities
- Defined amount of areas to be irrigated and protected from floodwater after proper implementation of the proposed projects
- Recommendation for taking full advantage of local resources and materials
- Recommendation on fishing, navigation and employment based on the development of the water sector

North East Regional Water Management Plan (FAP 6), 1993

The North East Regional Water Management Project (FAP 6), prepared under the auspices of the Flood Action Plan to assist the GoB in planning and guiding the development of the haor region with particular emphasis on water management. A portfolio of 44 initiatives was developed from the eight regional strategy thrusts divided into four priority groups.

The objectives of this plan related with the water sector are as follows:

- Minimise flood damage
- Increase the amount of flood free land to accommodate the rising population
- Meet the needs of fisheries, navigation, communication and public health

The guiding principles related to the water sector are:

- Protection of rural infrastructure
- Controlling floods to meet the needs of agriculture, fisheries, navigation, urban water flushing and annual recharge of surface and ground water resources
- Effective land and water management in protected and unprotected areas
- Measures to strengthen flood preparedness and disaster management
- Improvement of flood forecasting and early warning system
- Safe conveyance of the large cross border flow into the Bay of Bengal through major rivers with the help of embankments along both sides if necessary
- River training to protect embankments and urban centers
- Reduction of flood flow in major rivers by diversion into major distributaries and flood relief channels
- Channel improvement and structures to ensure efficient drainage and to promote appropriate water conservation and regulation
- Floodplain zoning where feasible and appropriate
- Co-ordinated planning and construction of rural roads, highways and railway embankments with provision for unimpeded drainage

- Expanded popular support and beneficiary involvement in the planning, design and operation of flood control and drainage works

The strategic thrusts in the water management strategies are:

- Protect urban centers and infrastructure from floods and improve the urban environment
- Facilitate intensive agriculture for urban consumption
- Enhance production systems in seasonally flooded areas
- Facilitate integrated development of deeply flooded areas
- Facilitate biodiversity enhancement and sustainable development
- Improve living conditions of rural settlements
- Improve water transport in the region
- Facilitate institutional strengthening and development

National Environment Management Action Plan, 1995

The National Environmental Management Action Plan (NEMAP) covers wetlands and the sustainable use of their resources. In fact, it has a section entitled 'Wetland Issues' which is concerned solely with freshwater resources. There is, however, a section on Coastal and Marine Resource Management Issues and Fisheries and Livestock Issues both of which deal with specific areas of concern.

The section on 'Fisheries and Livestock Issues' has identified the following key problems regarding fisheries:

- Ecological alterations due to environmentally unplanned Flood Control, Drainage and Irrigation (FCD/Is) projects can be considered as a major constraint to the viability of open water capture fisheries
- Construction of coastal embankments and closure of tidal streams and channels have reduced fisheries productivity. It has also damaged the traditional "gher" fish culture and replaced it with a modified brackish water aquaculture
- Water abstraction from permanent water bodies, such as beels and haor, during the dry season reduces available habitat for fisheries
- Inadequate regulation of shrimp culture in the coastal belt has, in addition to some socio-economic impacts, contributed to increased soil salinity and damage to sensitive ecosystems like mangrove forests
- The auction of freshwater bodies on lease basis has led to over-exploitation of fish resources to maximize short-term profits
- Over-fishing and harvesting of fish fries are contributing significantly to the depletion of fish resources

In the "Wetland Issues" section the NEMAP emphatically has pointed out that "the reduction of wetlands is one of the marked features of environment degradation in Bangladesh". The following key problems have been identified in the plan:

- Reduction of area of major wetlands due to increased agricultural practice
- Loss of wetland biodiversity
- Unplanned infrastructure construction leading to increased flooding and drainage problem

- Mineralisation of perennial water during the dry season from residual fertilizer has led to eutrophication of the water bodies making them unfriendly for fish growth
- Poisoning of wetlands by aquaculture project interventions in the open water environment (Haor areas)
- Absence of integrated management of wetlands
- Reduction of wildlife

National Plan for Disaster Management, 2008

The National Plan for Disaster Management for the period of 2008-2015 has been a long desired document based on the global and regional commitment of the GoB and its vision on disaster management.

Bangladesh is exposed to natural hazards such as, floods, river erosion, cyclones, droughts, tornadoes, earthquakes, drainage congestion/water logging, arsenic contamination, salinity intrusion etc. In the haor area, flash floods and monsoon floods are most frequent. Drainage congestion caused by heavy rains, sometimes called rain floods, is also prevalent in the area.

The key factors that relate to sustainable development of the haor area through disaster management are:

- Existence of a “culture of coping with crisis” and a “culture of disaster reduction”
- Risk assessment process involving participation of people and incorporating their perception of vulnerability and capacity
- Community and supporting agencies for sharing common motivation and ownership for the initiation and sustainability of community based disaster management
- Capacity building objectives, with specific focus on sectoral groups like women, the elderly, children and ethnic minorities
- Well-delivered training inputs in accordance with the objectives of the plan and the needs of the community for training
- Wider stakeholder involvement and participation
- Accumulation of physical, technological and economic assets to reduce hazards and vulnerability
- Sectoral development planning incorporating disaster risk reduction
- Hazard specific multi-sectoral disaster management plans
- Cyclone and flood shelter management plan
- Comprehensive risk assessment (hazard assessment and vulnerability assessment), including tsunami inundation modeling and evacuation mapping
- Warning guidance, including seismic and sea level monitoring, data valuation, processing and interpretation, forecasting methods and warning dissemination (a detailed plan of action is prepared)
- Mitigation and preparedness, including education and awareness programmes, structural and non-structural mitigation and government policy and emergency management procedures
- Development of a rescue, relief and rehabilitation plan of action based on comprehensive risk assessment

Biodiversity Strategy and Action Plan, 2004

The National Biodiversity Strategy and Action Plan of Bangladesh has provided a framework for conservation, sustainable use and sharing of the benefits of the country's biodiversity. A major focus of the NBSAP is the need for cross-sectoral linkage, reflecting the fact that in Bangladesh, more than in most other countries, biodiversity conservation is closely inter-woven with social and economic development. The NBSAP also provides a framework for securing the necessary environmental conditions to reduce poverty, ensure sustainable development and respond to the implementation of elements of the country's Poverty Reduction Strategy Paper. Sixteen strategies have been developed to shape and direct the actions towards achieving the goals and objectives of the NBSAP (MoEF, 2004). These are:

- Recognise the value and importance of biodiversity for the people of Bangladesh and document properly its components, distribution and value.
- Conserve ecosystems, species and genetic pool of the country to ensure that the present and future well-being of the country and its people are secure.
- Restore ecosystems and rehabilitate endangered species.
- Adopt national measures and standards to deal with invasive alien species and genetically modified organisms.
- Promote equitable sharing of biodiversity conservation costs and benefits among different sectors of the society.
- Contribute to raising awareness and building capacity for biodiversity conservation among the different sections of the society.
- Promote use of traditional knowledge for conservation, use and protection of the intellectual property rights of local communities.
- Establish institutions for inter-sectoral implementing mechanism for the Bangladesh National Biodiversity Strategy and Action Plan.
- Enhance protected area management, recognising the benefits of collaboration with local communities in their management (co-management).
- Ensure wise use of wetland resources.
- Establish participatory mechanisms to receive and utilise inputs from the private sector, civil society, academia and local communities about the different processes leading to biodiversity conservation, use and sharing of benefits.
- Review and develop biodiversity related legislation(s) and establish a specific branch in the Judiciary to deal with biodiversity and environmental issues.
- Establish an open and transparent monitoring and reporting system status and trends of implementing the principles of the Convention on Biological Diversity (CBD).
- Develop a financial strategy that is innovative and sustainable.
- Address issues of synergies with other Multilateral Environmental Agreements (MEAs) and processes that deal with climate change, disaster management, livelihoods, food security and sustainable development.
- Integrate biodiversity conservation into national development, its planning and processes.

4.5 Multilateral Environmental Agreements

Ramsar Convention, 1972

The Convention on Wetlands of International Importance, called the Ramsar Convention was adopted by the international community in 1972. It is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Ramsar Convention is the only global environmental treaty that deals with a particular ecosystem and the Convention's member countries cover all geographic regions of the planet. Bangladesh became a member of the Convention in 1992.

The Convention uses a broad definition of the types of wetlands covered in its mission, including lakes and rivers, swamps and marshes, wet grasslands and peat-lands, oases, estuaries, deltas and tidal flats, near-shore marine areas, mangroves and coral reefs and human-made sites such as fish ponds, rice paddies, reservoirs and salt pans.

The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". At the center of the Ramsar philosophy is the “wise use” concept. The wise use of wetlands is defined as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development". The pioneering ‘Wise Use Guidelines’ emphasised the importance for the contracting parties to:

- Adopt national wetland policies, involving a review of their existing legislation and institutional arrangements to deal with wetland matters.
- Develop programmes of wetland inventory, monitoring, research, training, education and public awareness.
- Take action at wetland sites, involving the development of integrated management plans covering every aspect of the wetlands and their relationships with their catchments.
- The Wise Use Guidelines also emphasised the benefits and values of wetlands for sediment and erosion control, flood control, maintenance of water quality and abatement of pollution; maintenance of surface and underground water supply; support for fisheries, grazing and agriculture; outdoor recreation and education for human society; and climatic stability.

Convention on Biological Diversity, 1992

The Convention on Biological Diversity (CBD) has been a legally binding treaty that seeks to preserve the diversity of life forms through conservation and sustainable use. The CBD has been agreed upon during the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. It has been the first and only global agreement to address all aspects of biological diversity including genetic resources, species and ecosystem. The GoB is signatory to the Convention that is aimed at achieving three explicit objectives: the conservation of biological diversity; the sustainable use of its components; and the equitable sharing of benefits arising from the utilization of genetic resources.

The purpose of the Strategic Plan for Biodiversity of the period 2011-2020 is to promote effective implementation of the CBD through a strategic approach comprising a shared vision, a mission, strategic goals and targets that inspire broad-based action by all parties and stakeholders.

Furthermore, it provides a flexible framework for the establishment of national and regional targets and for enhancing coherence in the implementation of the provisions of the Convention and the decisions of the Conference of the Parties, including the Programmes of Work and the Global Strategy for Plant Conservation as well as the International Regime on Access and Benefit-sharing.

It also serves as a basis for development of communication tools capable of attracting the attention of and engaging stakeholders, thereby facilitating the mainstreaming of biodiversity into broader national and global agendas.

Millennium Development Goals, 1992

Eight goals as stated in the Millennium Development Goals have to be achieved by 2015.The haor region is prioritised in the MDGs by the statement reported in Bangladesh Progress Report (2009) that "There are pockets in the eastern region (e.g. haor areas in Sylhet division) that reveal high vulnerability to natural disasters and persistence in severe poverty and hardship. In high risk areas such as river banks, char lands, haor areas and the coastal belt, livelihood options are limited." Each of the goals can be related to the development of the haor region. The goals are:

- Eradication of poverty and hunger
- Achievement of Universal Primary Education
- Promotion of gender equality and empowerment of women
- Reduction of child mortality
- Improvement of maternal health
- Combating HIV/AIDS, malaria and other diseases
- Ensuring environmental sustainability
- Development of a global partnership for development

Some of the goals are explained below with respect to different development sectors of the haor region.

- Increase of agricultural production and crop diversification
- Prevention of degradation and rapid reforestation of public forest lands, expansion of social forestry programmes and reforestation/afforestation of private lands
- Sustainable management of land and integrated water resources management that protects the precious deep groundwater
- Linking ecosystems with strategic poverty reduction interventions to support restoration of rivers and other wetlands
- Implementation of the National Biodiversity Strategy Action Plan and Biodiversity Programme of Action
- Mainstreaming of migration into development, climate change and environment policy and vice versa should be a priority issue for policy makers as they seek to plan for the challenges of environmental change and human mobility over the coming years
- Rapid implementation of sustainable energy programmes and technologies that have local environment and development benefits

- Allocation of adequate resources and formation of strategic partnerships that include community level involvement for pollution abatement
- Development and implementation of sustainable land-use zoning and enhancement of institutional capacity for effective urban and rural planning and implementation
- Improvement in quality and quantity of ecologically sound innovative sanitation facilities, expansion of sewerage systems and waste water treatment capacities in large urban areas and sludge removal/ disposal systems for rural latrines
- Monitoring and supervision of country level progress towards MDGs based on credible environmental and associated statistics

Safety net mechanisms must be put in place and provide services in low performing regions and hard-to-reach areas (e.g. haor, hills, char islands and urban slums) through GoB-NGO and public-private collaboration and partnership.

4.6 Policy Directives for the Master Plan

The policy statements above provide an extensive framework for the preparation of the Master Plan for the Haor Areas. Review of these policies, strategies and plans indicates that there are no major contradictions between them, however there are gaps in terms of best use of natural resources, integration of different sector objectives and coordination for implementing and monitoring the development activities.

The main policy gap is in landuse planning and land zoning. Principles need to be established that will guide management of the agricultural land and water bodies over the next 20 year plan period. The land management and leasing system of land in the haor area is still complex. Land zoning is very crucial for sustainable development of the area keeping the fragile ecosystem of the wetlands intact and alive. Proper enforcement of law is also essential for sustainable management of wetland resources.

Chapter 5 Context of the Plan

5.1 Introduction

The analytical framework for preparation of the Plan has been presented below which includes definition, delineation and identification of haor, the physical setting of the area and its major resources. The description of these resources includes the present status (2010) and development potentials which have been taken as baseline information for the Master Plan. These resources have been broadly grouped into three categories: human, economic and natural resources based on an understanding of the possible size, composition, resource management and growth potential for resources in the area. Furthermore, the economic resources have been sub-divided into primary productive and service areas.

5.2 Analytical Framework of the Plan

5.2.1 Definition of Haor

Normally haor are almost round shaped tectonically depressed and marshy lands. Originally the word “Haor” is derived from the Sanskrit word “*Shagor*” which means sea. The main characteristics of haor are flooding by normal flood during the rainy season every year. For more than six months haor remain submerged and with the passing of the rainy season some deep beel areas at the deepest point of the haor region remain submerged. Under the Ramsar International Wetland Conservation Treaty, wetlands are defined as follows:

Article 1.1: "...wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters."

Article 2.1: "[Wetlands] may incorporate riparian and coastal zones adjacent to the wetlands and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands".

Haor of the North East region of Bangladesh can be divided into three categories (Figure 5.1) depending on the geographical location and flooding characteristics of the area:

- Foothill and near hill haor
- Floodplain area haor
- Deeply flooded haor

The haor area of Sylhet and Maulvibazar districts are situated near hills or at foothills. The haor areas of Netrakona, Kishoreganj and Brahmanbaria are floodplain haor while those of Sunamganj, Netrakona and Habiganj are deeply flooded haor. Out of the seven haor districts Sunamganj may be termed as the mother of the haor region.

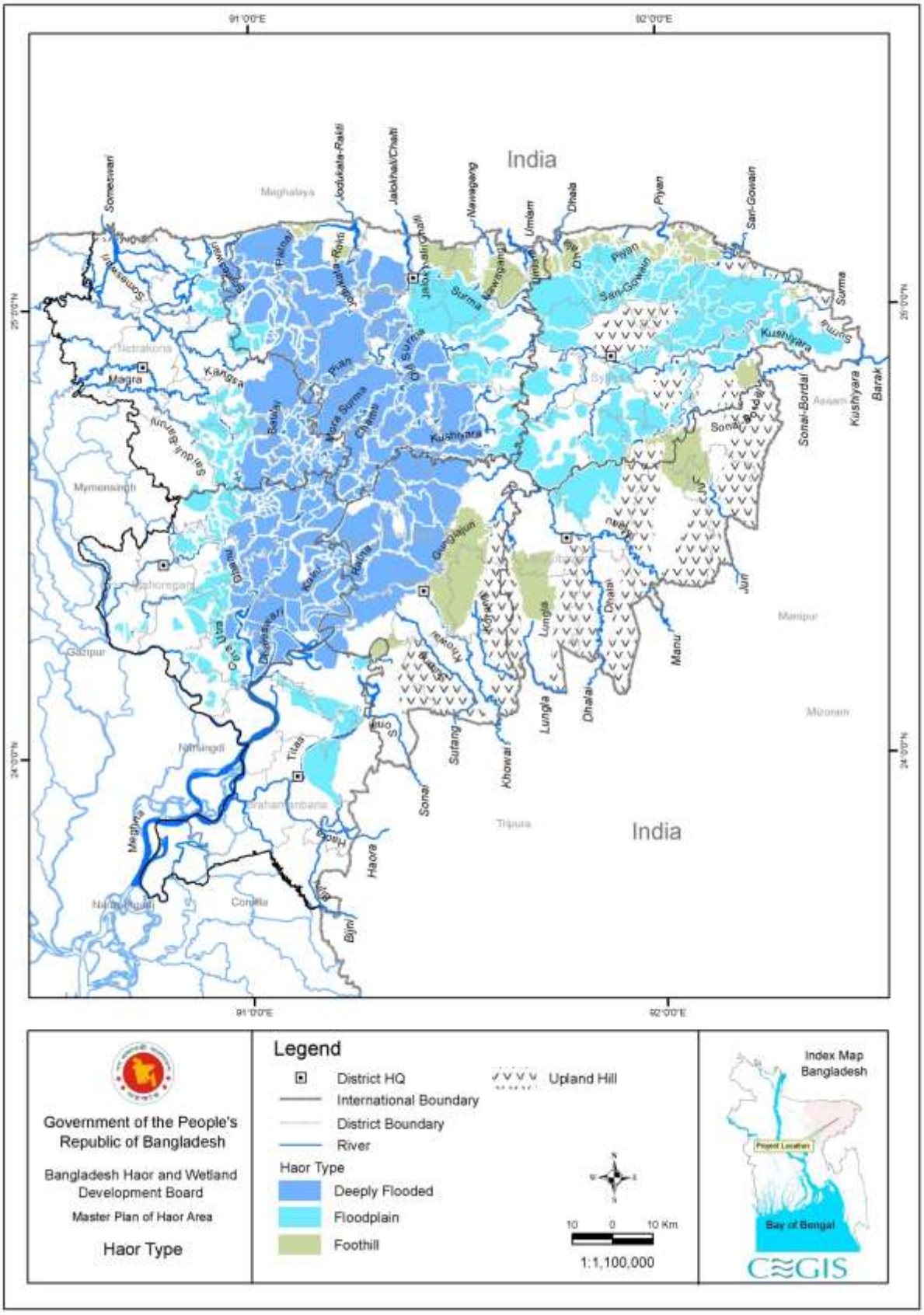


Figure 5.1: Category of haor

5.2.2 Delineation of Haor areas

A haor is a combination of cluster of beels, which make it difficult to differentiate between all the water bodies. In the wet season haor look like a sheet of water and it is hard to identify haor specifically as the whole area is covered by water and the haor and other water bodies appear to be the same in remotely sensed images as they have similar patterns. Initially as the first step of delineating haor areas, the total water extent area was extracted through classification of images. The classified images have been then overlaid with historical maps, digital elevation model and administrative boundaries to demarcate a tentative boundary of haor. The haor boundary has been further refined through application of the Participatory Resource Mapping (PRM) approach in consultation with BWDB officials and local stakeholders. Table 5.1 shows district-wise upazila, total area, haor area and number of haor.

Table 5.1: District-wise upazila, total area, haor area and number of haor

District	Upazila	Total District area in ha	Haor area in ha	No. of Haor
Sunamganj	Bishwambharpur, Chhatak, Dakshin Sunamganj, Derai, Dharmapasha, Dowarabazaar, Sulla, Tahirpur, Jagannathpur, Jamalganj, Sunamganj Sadar	367,000	268,531	95
Habiganj	Ajmiriganj, Bahubal, Baniachang, Chunarughat, Habiganj Sadar, Lakhai, Madhabpur, Nabiganj	263,700	109,514	14
Netrakona	Atpara, Barhatta, Durgapur, Khaliajuri, Madan, Kalmakanda, Kendua, Mohanganj, Purbadhala, Netrakona Sadar	274,400	79,345	52
Kishoreganj	Austagram, Bajitpur, Bhairab, Hossainpur, Itna, Karimganj, Katiadi, Kishoreganj Sadar, Nikli, Kuliar Char, Mithamain, Pakundia, Tarail	273,100	133,943	97
Sylhet	Balaganj, Beani Bazaar, Bishwanath, Zakiganj, Companiganj, Dakshin Surma, Fenchuganj, Golapganj, Gowainghat, Jaintiapur, Kanaighat, Sylhet Sadar	349,000	189,909	105
Maulvibazar	Barlekha, Juri, Kamalganj, Kulaura, Rajnagar, Maulvibazar Sadar, Sreemangal	279,900	47,602	3
Brahmanbaria	Akhaura, Banchharampur, Ashuganj, Kasba, Sarail, Brahmanbaria Sadar, Nabinagar, Nasirnagar	192,700	29,616	7
	Total	1,999,800	858,460	373

5.2.3 Identification of Development Area

Different sub-sectors which have potentials for development in the haor region have been considered as Development Areas (DA) under this Master Plan of haor Area. These DAs have been preliminarily identified through consultation meetings at upazila level and discussed with beneficiary groups, representatives of civil society, local government officials and representatives from respective line agencies through interviews and meetings. Tentative priorities of these DAs have also been prepared during the consultation process at upazila level workshop. An individual plan with a complete set of investment portfolio has been prepared based on these DAs. Following are the 17 DAs identified for the Master Plan:

- Water Resources
- Agriculture
- Fisheries
- Pearl Culture
- Livestock
- Forest
- Education
- Health
- Transportation
- Housing and Settlement
- Water Supply and Sanitation
- Industry
- Energy and Power
- Mineral Resources
- Biodiversity and Wetland
- Tourism
- Social Services

5.3 Physical Setting

5.3.1 Geology and topography

The evolution of the Indian sub-continent has been the result of a collision between the northward moving Indian plate and the Stationary Eurasian Plate since the Cretaceous times. Part of the north-east Indian plate has fractured and sank below the sea-level during the Oligocene times. Since then the Bengal Basin has started to form, filling up with sediment by a process of deltaic sedimentation into a slowly subsiding tectonic basin. The following (Table 5.2) summarises the topography and Figure 5.2 shows the Digital Elevation Model (DEM) of the haor area.

Bangladesh constitutes the eastern continuation of the central broad Indo–Gangetic plains of India, which serve to physiographical divide the Peninsular (shield) area to the south from the extra-Peninsular region (Himalayan mountain ranges) to the north and northeast. The Bengal Basin is located primarily in Bangladesh, with a lesser part in the West Bengal State of India. The basin is surrounded by India on three sides.

The Sylhet Trough is a sub-basin of the Bengal Basin and consists of 13-20 km thick alluvial and deltaic sediments underlain by much older gneiss and granite rocks. The basin is bounded by the Shillong Plateau in the north, by the Indian Burmese ranges in the east and by the Indian Shield in the west. The southern and eastern parts of the Sylhet Trough are characterised by a series of north trending folds which have formed as a result of deformation from the Indo-Burmese ranges. The anticlines constitute the Tripura Hills along the southern border of the region.

Table 5.2: Topography of Haor area

Elevation (m)	Area (km^2)	Elevation (m)	Area (km^2)
<= 1	4	8 - 10	2,673
1 – 2	160	10 – 12	1,345
2 – 3	1,225	12 – 15	1,007
3 – 4	2,418	15 – 20	634
4 – 5	2,905	20 - 50	773
5 – 6	2,339	50 - 100	223
6 – 7	2,099	100 - 310	19
7 – 8	1,837		

The northeast region of Bangladesh has experienced some of the greatest subsidence. The Sylhet Basin has subsided 30-40 feet (10-12 m) in the last several hundred years. A subsidence rate of 21 mm/y in the Surma Basin has been reported by the Master Plan Organization (1985) and FEC (1989). This value appears to be arrived at by using Morgan and McIntire's estimate of 10 m subsidence in 500 years. Therefore, if it is considered that the Sylhet Basin is subsiding at a rate of 2-4 mm every year and that the soil compaction rate is 1-2 mm/yr, then the actual subsidence rate of the Sylhet Basin might be 3-6 mm/yr.

Broad topographic ranges are presented in Table 5.2 derived from the DEM furnished in Figure 5.2.

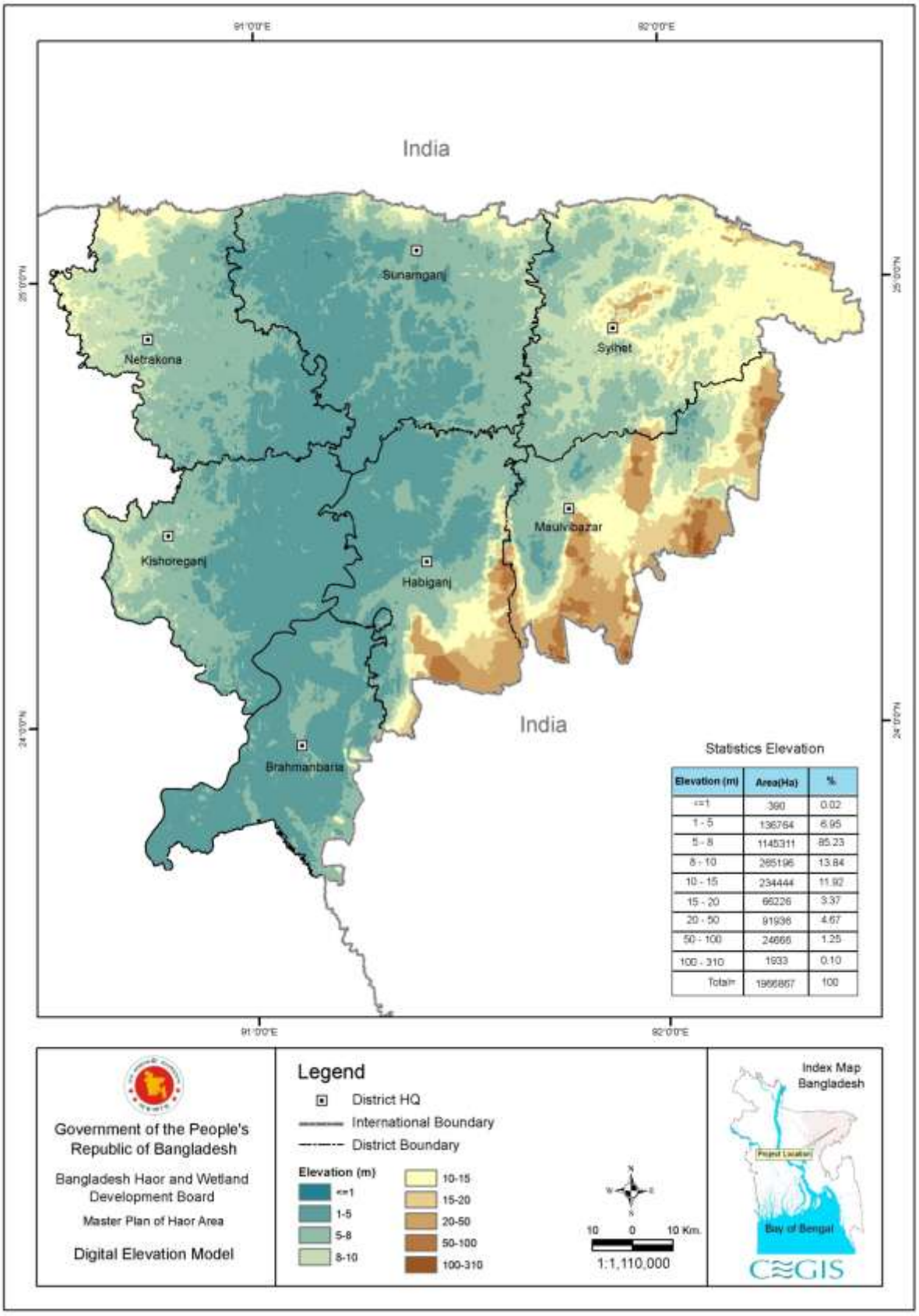


Figure 5.2: Digital elevation model of the haor area

5.3.2 Soil and Landuse

The natural resources in an area determine the potential physical uses of that land. Certain environmental characteristics indicate the suitability of the land for supporting various types of development. Topography, drainage patterns, floodplains, soil characteristics and groundwater properties are the major features that determine if an area is physically suitable for a specific type of development.

The haor directs encompass nine Agro-Ecological Zones (AEZs) namely: (1) the Sylhet Basin, (2) the Eastern Surma Kushiyara Floodplain, (3) the Old Meghna Estuarine Floodplain, (4) the Old Brahmaputra Floodplain, (5) the Middle Meghna River Floodplain, (6) the Young Brahmaputra and Jamuna Floodplain, (7) the Northern and Western Piedmont Plains, (8) the Northern and Eastern Hill and (9) the Akhaura Terrace (Figure 5.3). Among these, the main haor basin includes only three AEZs. They are the Sylhet Basin, the Eastern Surma Kushiyara Floodplain and the Old Meghna Estuarine Floodplain. Land type classification is based on the depth of inundation during monsoon season due to normal flooding on agriculture land. There are five land type classes (MPO): F_0 High land (above flood level), F_1 Medium highland (flood depth of 0-90 cm), F_2 Medium lowland (flood depth of 90-180 cm, F_2), F_3 Lowland (flood depth of 90-270 cm) and F_4 Very lowland (flood depth of >270 cm) (Figure 5.4).

About 21% of cultivable area does not drain properly, where floodwater recedes within 15 days and 61% of cultivable areas are poorly drained and remain under floodwater from 15 days to eight months. About 10% of cultivable areas are very poorly drained, where floodwater stays more than eight months keeping the area wet during most of the dry season. The rest of the area (8%) where rainwater recedes quickly from soil surface is well-drained.

Table 5.3: landuse pattern of the haor area

Land Type	2010	
	Area (ha)	Area in %
Agriculture Land	1,310,945	65.55
Settlement(homestead, pond and Road)	372,413	18.62
Hill	133,417	6.67
Forest(Excluding hill forest)	66,345	3.32
Perennial water bodies	48,360	2.42
River	41,872	2.09
Canal/Khal	26,448	1.32
Total	1,999,800	100.00

The soils within the same haor system can vary in texture, drainage class, fertility and other parameters. The transition from the wettest to the driest areas in the floodplains occurs over distances varying from several kilometers to several meters. Table 5.3 and Figure 5.5 are showing the landuse pattern of the haor area.

The soils of the area are grey silty clay loams and clay loam on the higher parts that dry out seasonally and grey clays in the wet basin. Peat occupies some wet basin centers. The soils have a moderate content of organic matter and soil reaction is mainly acidic. The fertility level is medium to high.

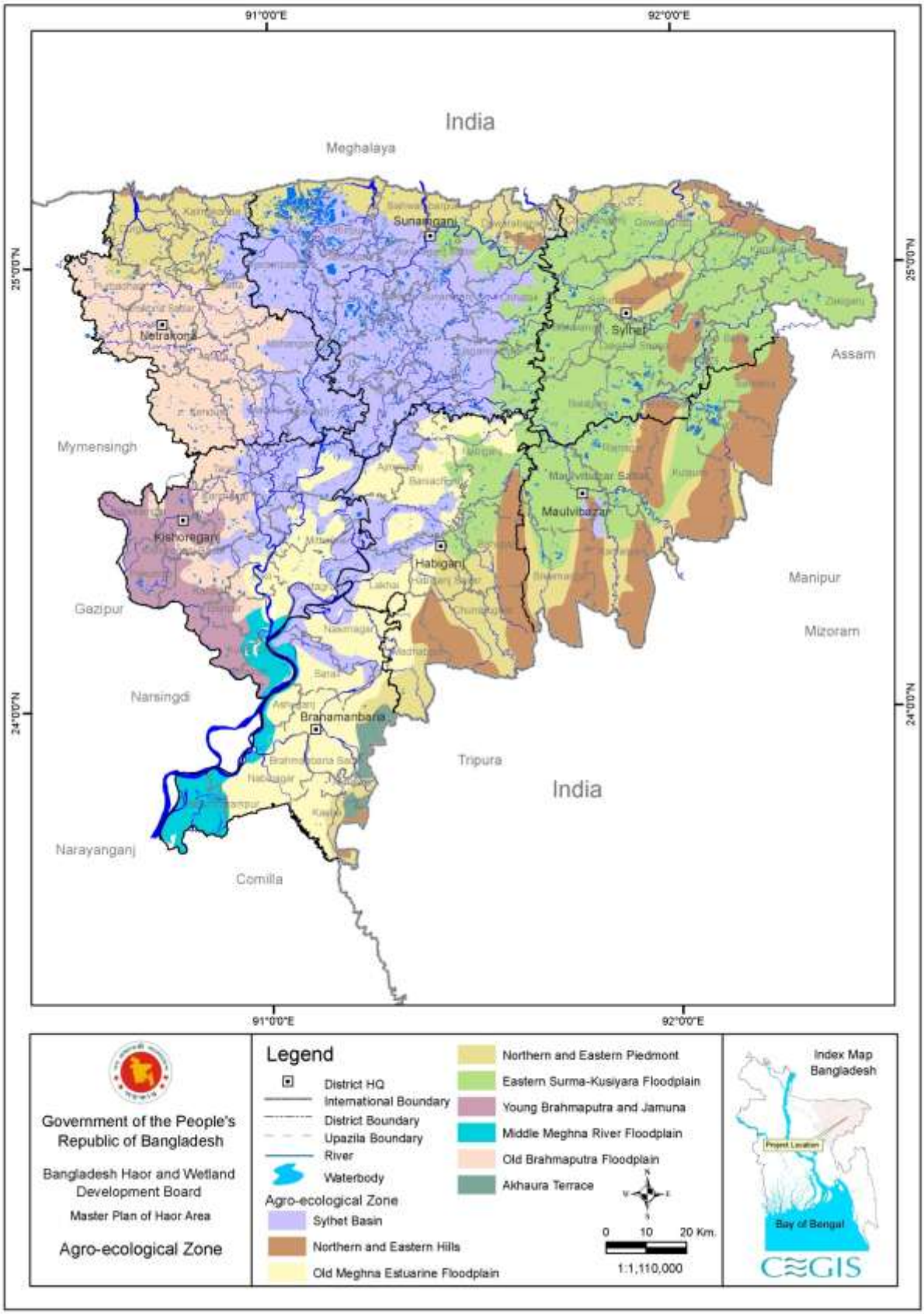


Figure 5.3: Agro-ecological zones of the haor area

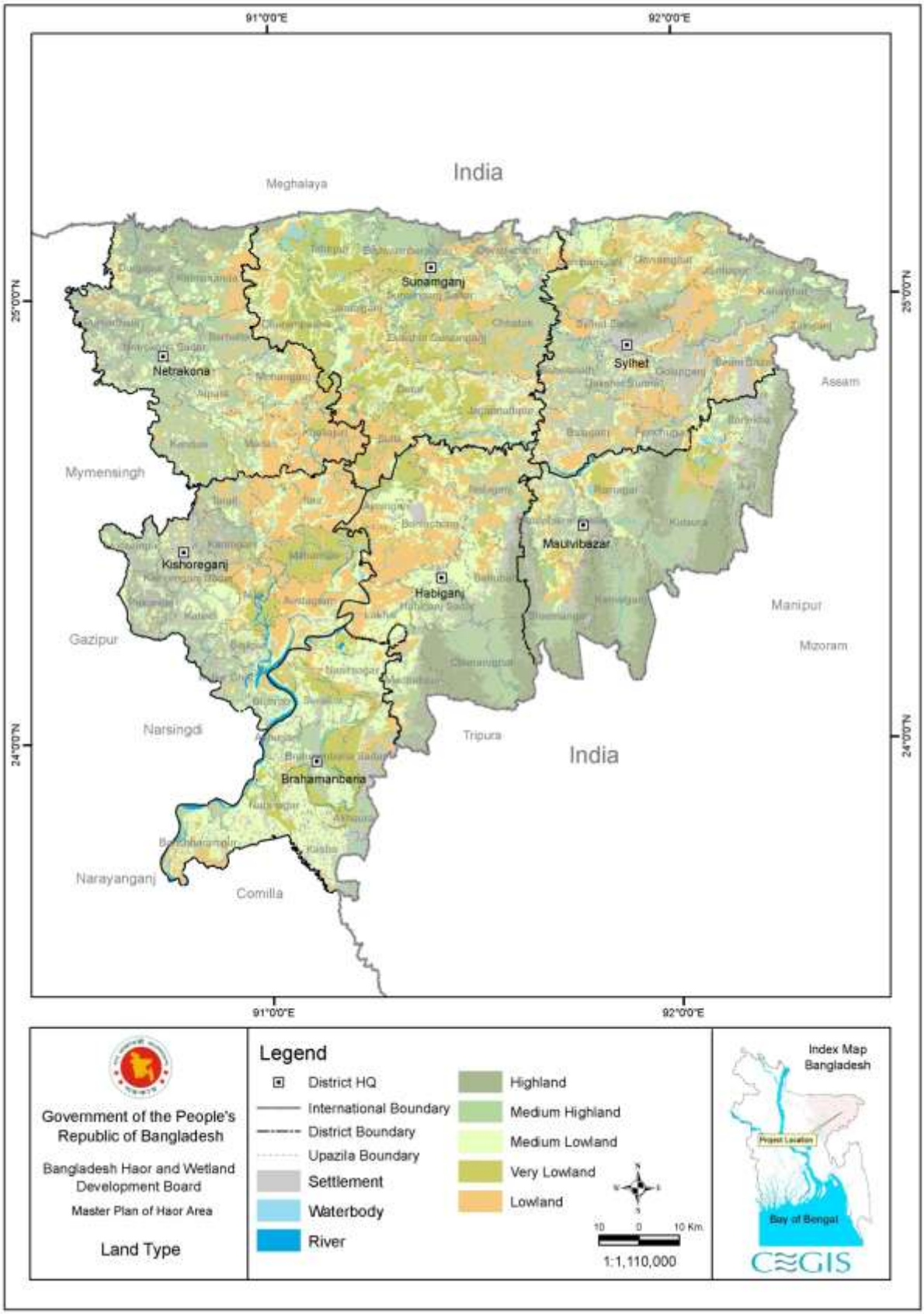


Figure 5.4: Classification of the land type of the haor area

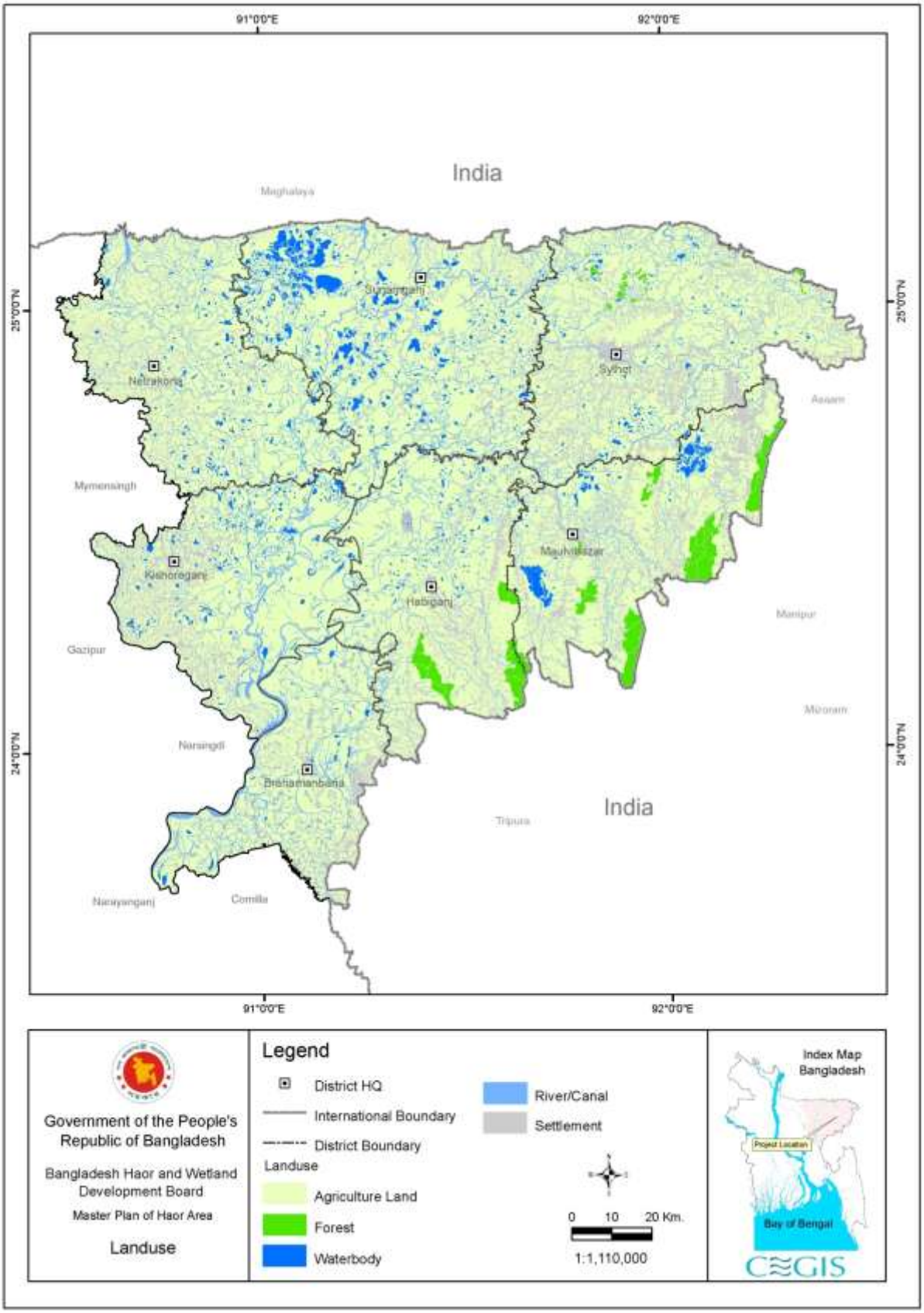


Figure 5.5: Land use in the haor area

About 74% of the top soil texture of the haor region is clay to clay loam, 21% loam and the rest are silty loam, sandy loam and sand.

At the end of the monsoon season, floodwater recession depends on soil and topography. As a result, Rabi crop cultivation starts in different times in the haor region. Recession of surface water starts from the first week of October and ends in the middle of November in about 25% of cultivable area. Nineteen percent of cultivable area becomes free of floodwater from the middle of November to the middle of December and 38% from the middle of December to the beginning of January.

Organic matter helps the soil to soften making land preparation easy. It helps to increase the moisture holding capacity and retains the nutrient status of soil. About 44% of the area is covered with high to medium high organic matter where organic content is more than 3.4%.The rest of the area has low to very low organic matter content.

Food security is an important consideration in planning land use in the area. Food production and means of storage have to be planned to carry the community through unfavourable adverse circumstances. Therefore land use must be planned in a way that the needs of future generations are met in a sustainable manner.

For sustainability, a number of different forms of land use plans based on land suitability are required to give direction for the management and allocation of public lands and resources over a defined area. Land use plans and agreements should be used by the public sector, private sector, local governments and other resource managers when making strategic level decisions about land and resource management.

5.3.3 Climate

Rainfall

Rainfall is the most distinctive component of climate in the haor region. Climate is dominated by distinctive geographical characteristics of the region which ultimately plays a major role in determining the spatial and temporal distribution of rainfall, evapotranspiration and hydrology of surface and groundwater. The region is located entirely to the north of the tropic of cancer; hence its monsoon climate is known as sub-tropical. The sub-tropical monsoon climate tends to have more sharply defined seasons than the tropical climate. The following Table 5.4 summarises the average annual rainfall of the seven haor districts.

Table 5.4: Average annual rainfall

District	Avg Annual Rainfall (in mm)
Sunamganj	3,600-7,800
Sylhet	3,400-7,400
Netrakona	3,200-4,800
Maulvibazar	2,600-3,800
Habiganj	2,200-3,500
Kishoreganj	2,000-3,400
Brahmanbaria	2,000-2,500

Since rainfall on the adjacent Indian side largely affects flooding in the haor area, the rainfall pattern of the upstream catchment has great influence. There is a huge variation in rainfall in the different catchments of the river systems of the upstream area in India. Annual average rainfall in the haor districts are huge and found to have substantive variation over the area as observed from available data of 1960-2009. Among the locations of the haor districts, the highest rainfall was recorded in Sunamganj closest to Cherrapunji (annual ppt. is 12m), which is the highest precipitation area in the world. Even the mean annual rainfall varies between 3,600 mm and 7,800 mm in Sunamganj. Figure 5.6 and Figure 5.7 show the locations of hydro-meteorological stations and the isolines of mean annual rainfall respectively.

Evapotranspiration

Evapotranspiration has been estimated using data from the Bangladesh Meteorological Department (BMD) for the period of 1960-98 and has been found to be the highest in April in most haor areas whereas it has been found minimum in December. The average monthly evapotranspiration varies from 2.00-3.40 mm/day during dry period and from 3.90-4.80 mm /day during wet period throughout the haor region.

Temperature and Wind Speed

Data on temperature and wind speed for the same period from BMD stations show that the average maximum temperature occurs in Sreemangal (33.02^0C) in the month of April. On the other hand, January is found to be the coolest month (9.09^0C) considering average minimum temperature. Maximum temperature of the past decade (1960-90) has an increasing trend for most of the months. However, minimum temperature has had an increasing trend in the recent decade (1990-2008). The average monthly maximum temperature has varied from 25-33 degree Celsius. Similarly, the monthly minimum temperature has varied from 9-26 degree Celsius.

Daily maximum and daily average wind speed is observed to be the highest in the months of April and May which varied from 26-37 km/hr. The average wind speed in different decades has had a decreasing trend over the last fifty years. The minimum monthly average wind speed is found to vary from 5-11 km/hr over the region.

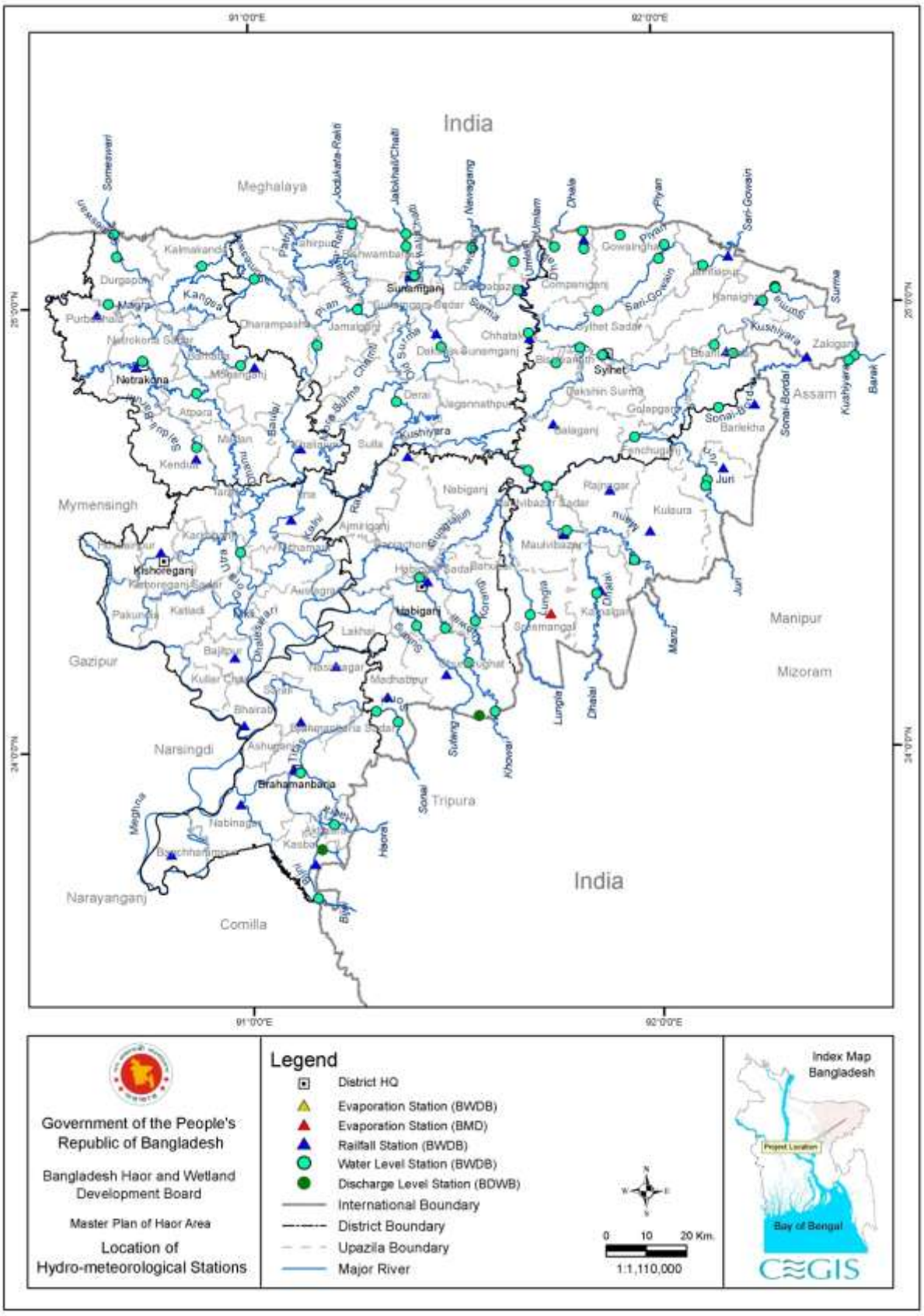


Figure 5.6: Locations of hydro-meteorological stations in the haor area

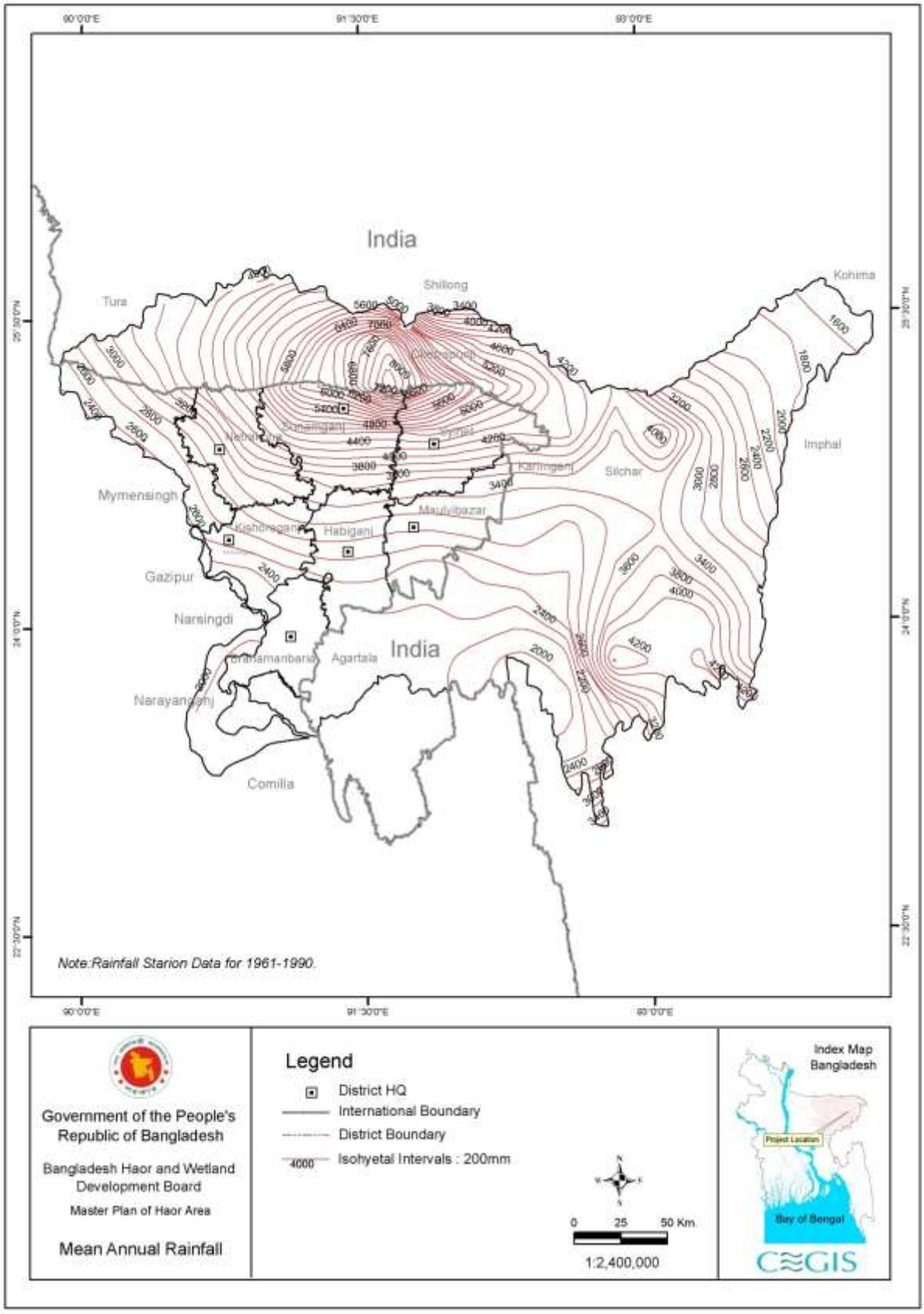


Figure 5.7: Isoline of mean annual rainfall of the haor region

5.3.4 River Morphology

Similar to the other parts of the region, there is a tendency of rivers shifting their courses in the haor basin. During the delta development process, the Brahmaputra shifted its course several times between the east and west sides of the Madhabpur Tract. The general tendency of a river is to find a new course after raising its floodplain to a higher level and the old course in the lower level to silt up gradually. By this continual process, when the Brahmaputra turned into the Sylhet Basin, the lowlands became an immense tract of submerged area covered with clean still water of no great depth. Consequently, every particle of silt that was brought into the area was seized upon and deposited. The Sylhet Basin once again started to feed sediment from the Brahmaputra River and the river continued its delta building process and began adjusting with the sea level.

The avulsion of the Brahmaputra River from the east of the Madhabpur Tract to the west has a pronounced effect on the shifting characteristics of rivers like the Surma and the Kushiyara. The depressed Sylhet Basin attracts the rivers from both east and west sides. Presently all the rivers, the Surma, the Kushiyara, the Kangsha and the Someswari fall into the depressed basin before they flow south to meet with the Meghna.

The Surma and the Kushiyara, the main distributaries of the Barak River, are common/border rivers between Bangladesh and India. The Barak River divides into the Surma (northern branch) and the Kushiyara (southern branch) at the Indo-Bangladesh border in Amalshid of Sylhet district. In Kishoreganj district, upstream of Bhairab Bazaar, these two rivers meet to form the Meghna River and ultimately flow into the Bay of Bengal. The Sarigowain, the Piyan, the Jadukata, the Jhalukhali, the Baulai and the Kangsha are the tributaries of the Surma River. The Sonai-Bordal, the Juri, the Dhalai, the Khowai, the Sutang and the Sonai are the left bank tributaries of the Kushiyara River.

Sediment concentration and its distribution are changing the morphology of the area. An estimation of sediment yields and budget for the NE Region was carried out by FAP-6 study. Table 5.5 shows the average annual suspended load of different rivers.

The sediment budget shows an estimated amount of net accumulation of 8 million ton/year.

Table 5.5: Average Annual Suspended Load (million ton/year)

Name of River	Name of Station	Sediment Load
Kushiyara	Sheila	8.60
Surma	Sylhet	3.70
Manu	Rail Crossing	4.90
Dahlia	Kamalganj	1.60
Kowhai	Shaistaganj	1.70
Someswari	Durgapur	0.68
Meghna	Bhairab	16.90

Though the rivers are very dynamic in the context of erosion-accretion process, shifting of river course is of main concern in this area. Over the last centuries the rivers have shifted their courses several times. The historical developments of the Surma and Kushiyara rivers have been studied by analysing old maps available in the archives of CEGIS, such as Renell's map (1776), Tassin's map (1840), the Cadastral Survey map compiled during (1910-1930), as well as the river network extracted from the 2010 satellite image.

It has been found that subsidence is the dominating process in the Sylhet basin, especially at the northern part of the basin which controls the shifting of river courses. Thus the net subsidence during the last 200 years might be reflected on the shifting of the river courses. A comparison between the present river courses and that of the end of the eighteenth century shows that the

rivers from both the west and the east shifted towards the north before turning towards the south, which is possibly an indicator of net subsidence in the north.

5.3.5 River System

Situated just below the hilly regions of the states of Assam, Meghalaya and Tripura of India, the haor area has some of the most severe hydrological conditions like extreme rainfall and subsequent flooding. The area receives water from the catchment slopes of the Shillong Plateau across the borders in India to the north and the Tripura Hills in India to the southeast. The principal rivers of the area include the Surma, the Kushiyara, the Manu, the Kalni, the Baulai, the Kangsha, the Someswari, the Jadukata and the Khowai. Haor are connected with the main rivers by numerous small rivers and khals. A large number of Transboundary rivers enter into Bangladesh in the Northeast region. The major parts of the catchments of these rivers are outside of the country.

5.3.5.1 Transboundary River System

Out of 54 Transboundary rivers between Bangladesh and India, Twenty-three enter into Bangladesh in the North East Region. The major parts of the catchments of these rivers are outside the country (in India). In the haor area, three major Transboundary river systems are the Meghalay, Barak and Tripura systems. Figure 5.8 shows the transboundary rivers and Table 5.6 shows the transboundary catchment area of the three river systems in India.

Table 5.6: Catchment area of different transboundary rivers

Transboundary river system	River name	Catchment Area (km^2) of India
Barak River System (India)	Barak(Surma and Kushiyara)	26,165
	Sub-total	*26,165*
Meghalaya River System (India)	Bughai	592
	Dhala	358
	Jadukata	2407
	Jhalukhali/Dhamol	547
	Nitai	400
	Nowagang	173
	Piyan	996
	Sari Gowain	965
	Shameswari	2,740
	Umlam	634
	Sub-total	*12,580*
Tripura River System(India)	Bijni	169
	Dhalai	614
	Haora	643
	Juri	549
	Khowai	1,281
	Lungla	50
	Manu	2,155
	Salda	485
	Sonai	239
	Sutang	11
	SonaiBordal	1,238
	Sub-total	*7,425*
	Total Catchment Area	46,103

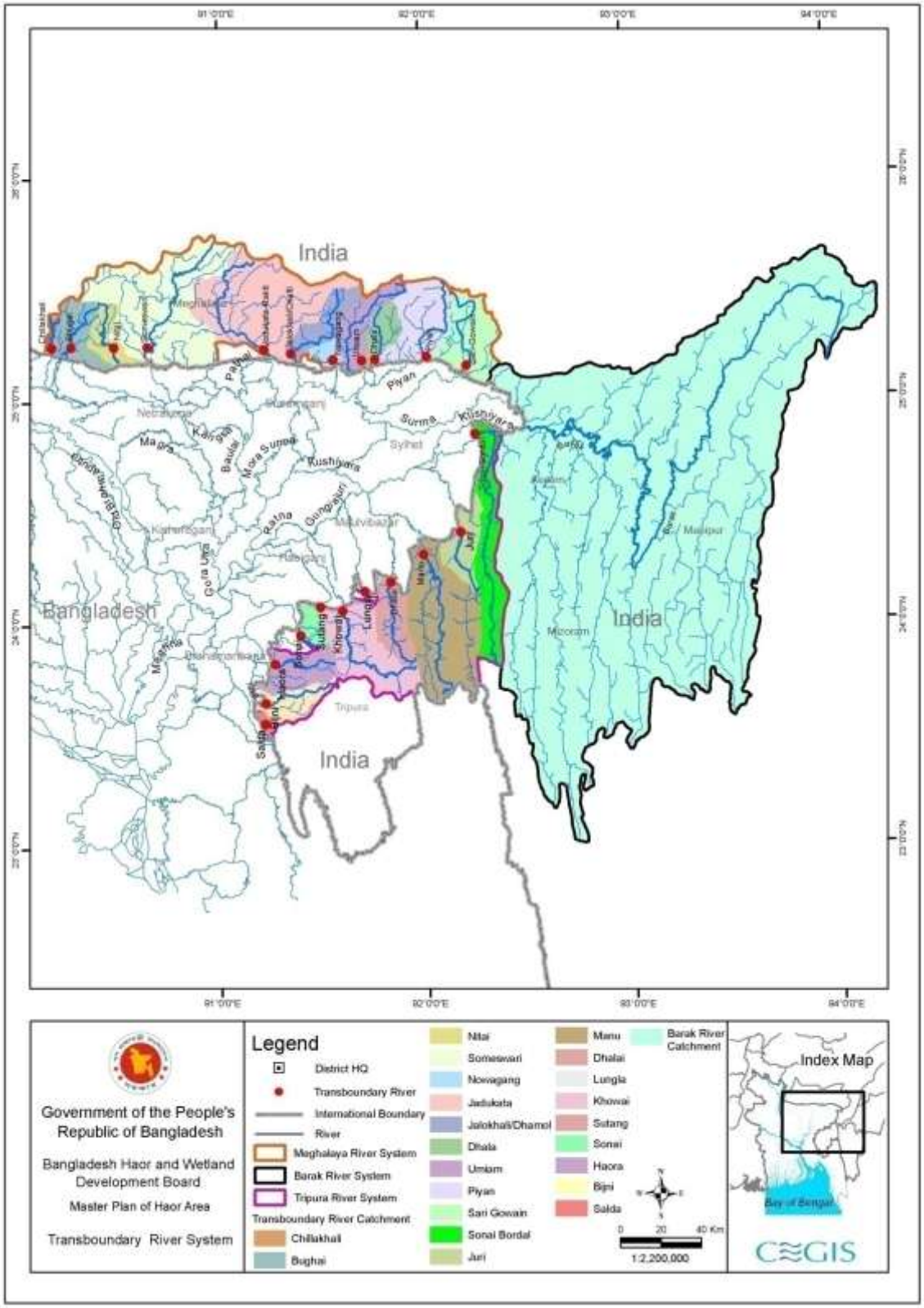


Figure 5.8: Sub-catchments of different rivers in the haor area

5.3.5.2 Internal River System

Three major river systems govern the haor area inside Bangladesh: the Surma-Baulai, the Kalni-Kushiyara and the Kangsa-Dhanu (Figure 5.9). The Barak River (Indian River) feeds the Surma and the

Kushiyara. Consequently it plays an important role in the two major systems, the Surma-Baulai and the Kalni-Kushiyara. The rivers contributing in these systems are described below:

Surma-Baulai System: This system carries the flow of the Surma and a large number of transboundary rivers flowing from the north to south. The Surma, the Baulai, the Old Surma, the Sari-Gowain, the Piyan, the Dhala, the Nowagang, the Jhalukhali/Dhomali, the Chalti, the Jadukata, the Rakti etc. are the major rivers in this system among which the Sari-Gowain, the Piyan, the Dhala, the Nowagang, the Jhalukhali/Dhomali, the Chalti, the Jadukata and the Rakti are transboundary. This river system meets the Kalni-Kushiyara system at Bajitpur upazila of Kishoreganj district.

Kalni-Kushiyara System: The Kushiyara, the Kamarkhali, the Kalni, the Sonai-Bordal, the Juri, the Manu, the Dhalai, the Lungla, the Sutang, the Khowai, the Sonai and the Haora are the major rivers of this system. Among these rivers the Sonai-Bordal, the Juri, the Manu, the Dhalai, the Lungla, the Sutang, the Khowai, the Sonai and the Haora are transboundary. The Gungaijuri, the Titas, the Ratna etc. are rivers which are part of this system. The Kalni-Kushiyara system meets the Surma-Baulai system at Bajitpur upazila of Kishoreganj district.

Kangsa-Dhanu System: The Someswari, the Malijhi, the Chillakhali, the Bhogai and the Nitai enter the Bangladesh border along the periphery of the haor region. The Kangsha and the Dhanu are the major rivers of this system. The Saiduni-Baruni and the Gorautra are other contributing rivers of this system. This system ultimately drains at the Meghna River at the borders of Bajitpur and Bhairab upazilas. The combined flow of these three systems ultimately drains through Bhairab Bazaar at the Meghna River.

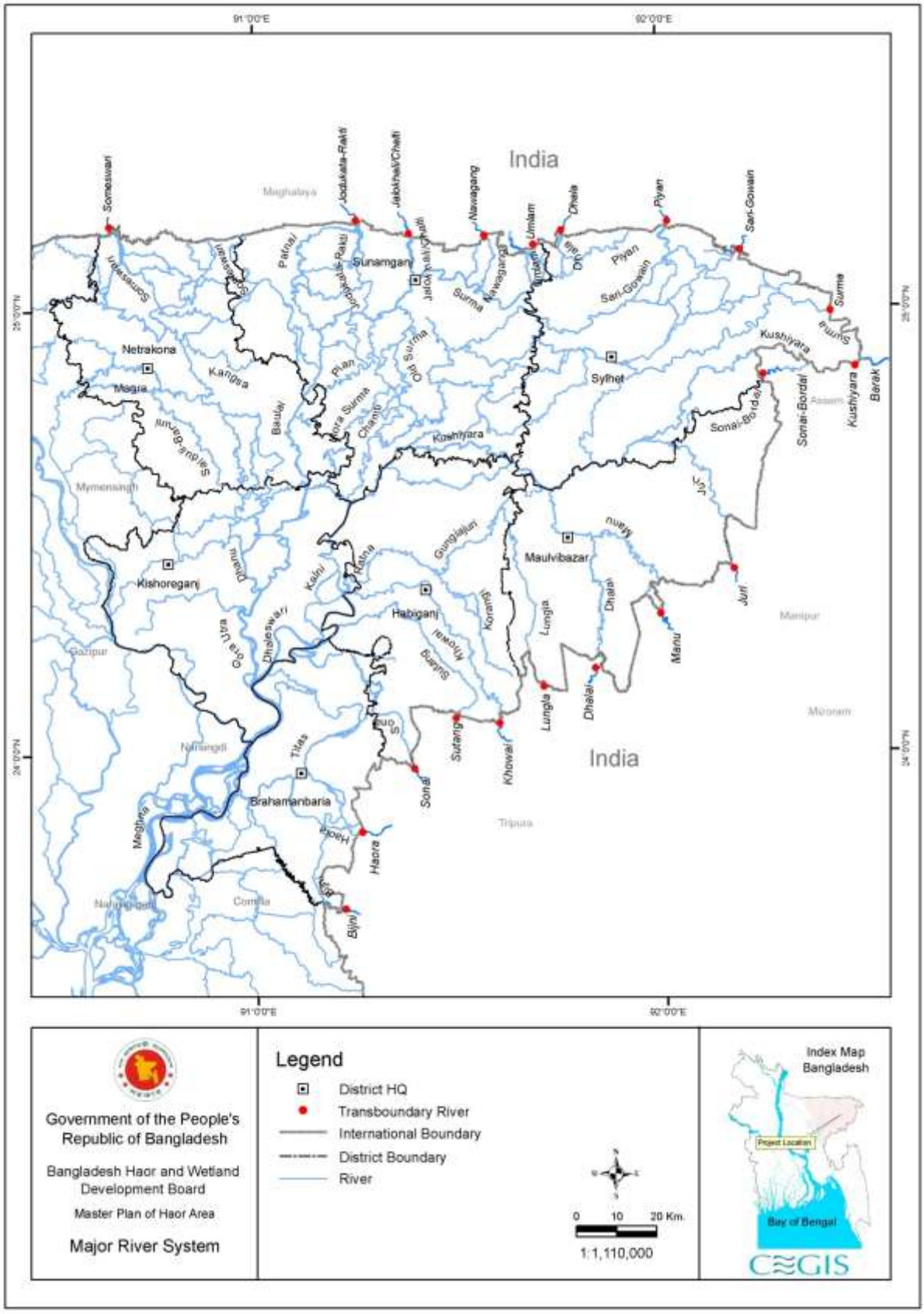


Figure 5.9: River system of the haor area

5.4 Human Resources

The human resources of the haor area are described in the following sub sections: Total population

The total projected population of the seven haor districts is 19.37 million for 2010 (BBS, 2001 census) (Table 5.7). The population growth rate per annum for the overall haor region is 1.09% which is lower than the national rate. There are about 3.66 million households in the haor districts. The highest number of population lives in Sylhet (3.36 million) and the lowest in Maulvibazar (2.10 million). Similarly, Sylhet has the largest household size of 6.0 while Kishoreganj has the smallest size of 4.4. The sex ratio in the haor districts on average is 99.27:100, which indicates that there are 99 males per 100 females. The national sex ratio is 105:100. Brahmanbaria district has the highest population density (1593 per km^2) while only 722 people live per km^2 area in Sunamganj district. The overall population density in the haor districts is 987 per sq km which is lower than the average population density in Bangladesh which is 1142 per sq. km. Figure 5.10 and Figure 5.11 show the population distribution and density respectively.

Table 5.7: Total population statistics of haor districts, 2010

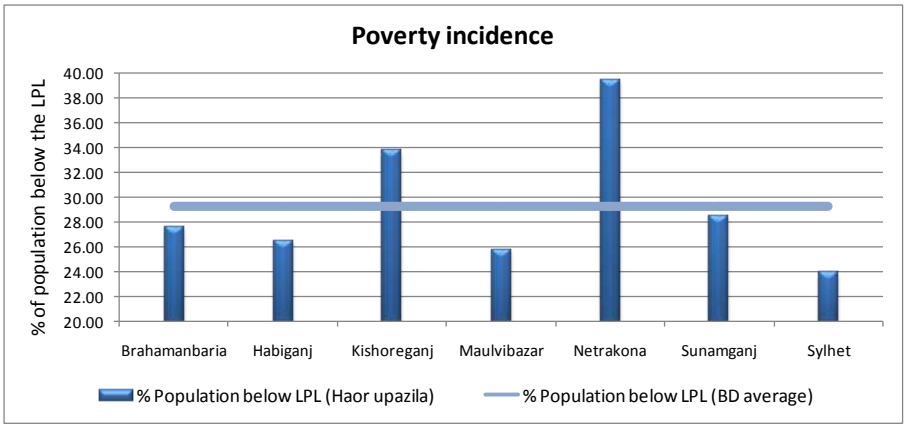
Districts	Population in million	Sex Ratio (M:F)	Population density/km^2
Sunamganj	2.65	102.06	722
Habiganj	2.28	98.18	865
Netrakona	2.60	100.87	924
Kishoreganj	3.31	98.43	1,232
Sylhet	3.36	102.53	963
Maulvibazar	2.10	98.55	877
Brahmanbaria	3.07	94.25	1,593
Haor	19.37	99.27	987

5.4.1 Urbanisation

The rate of urbanisation is defined as the proportion of people living in the area commonly recognised as an urban area. Around 19.6% of people of the haor area live in urban centers. The rate of urbanisation is the highest in Sylhet district where the current rate is 27.1% followed by Brahmanbaria which is 26.4%. Urbanisation in other haor districts is below average and shows a decreasing trend in Netrakona, Habiganj, Maulvibazar and Sunamganj districts.

5.4.2 Poverty incidence

The poverty situation is generally expressed as percent of population below the Lower Poverty Line (LPL). In the haor area, 29.56% of the population lives below the LPL, which is slightly higher than the national average of 29.26%. Out of the seven haor districts, poverty incidence is the worst in Netrakona followed by Kishoreganj while other districts lie within deviation range of 5%. Figure 5.12 shows the poverty incidence in the haor area.



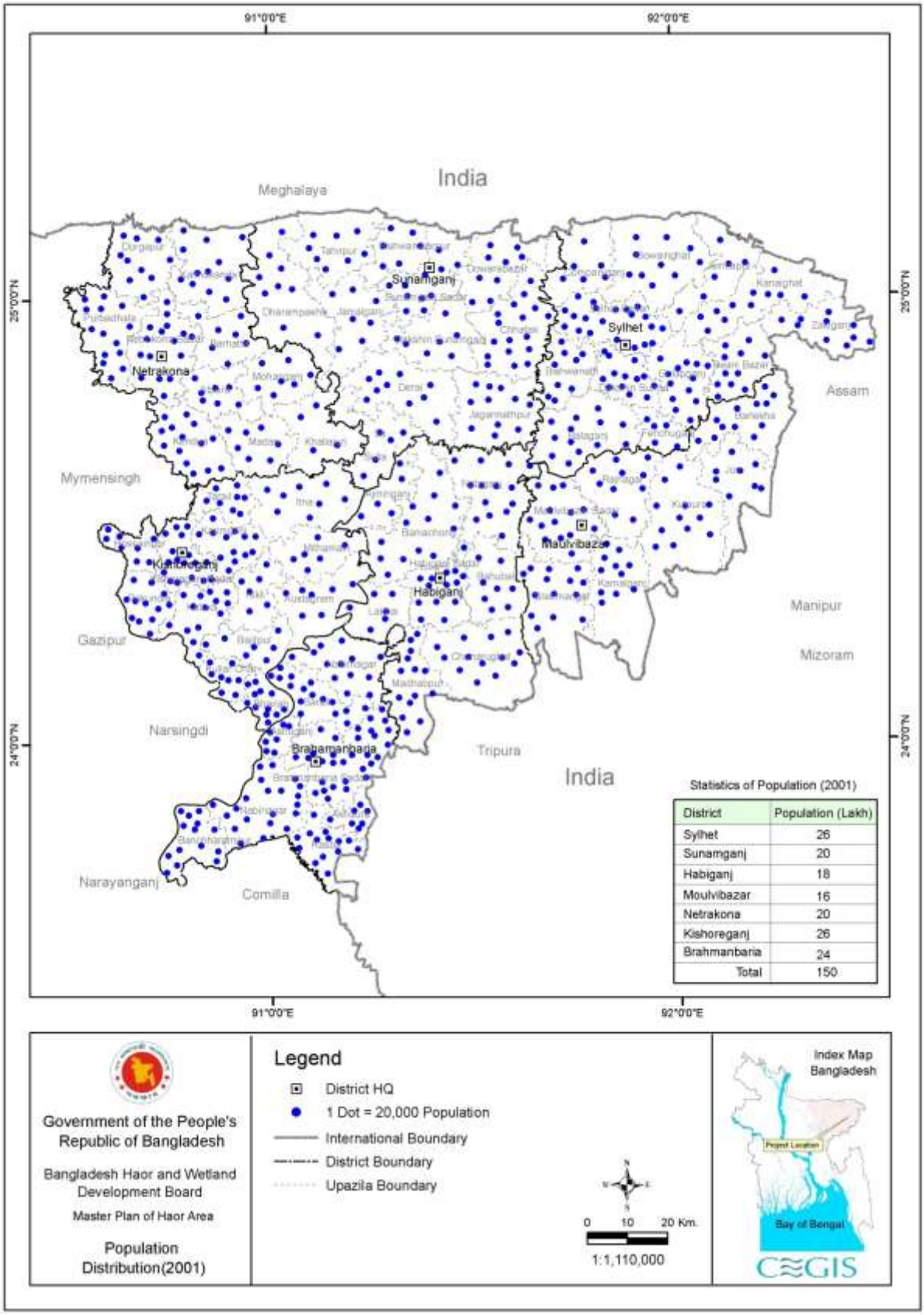


Figure 5.10: Population distribution in the haor area

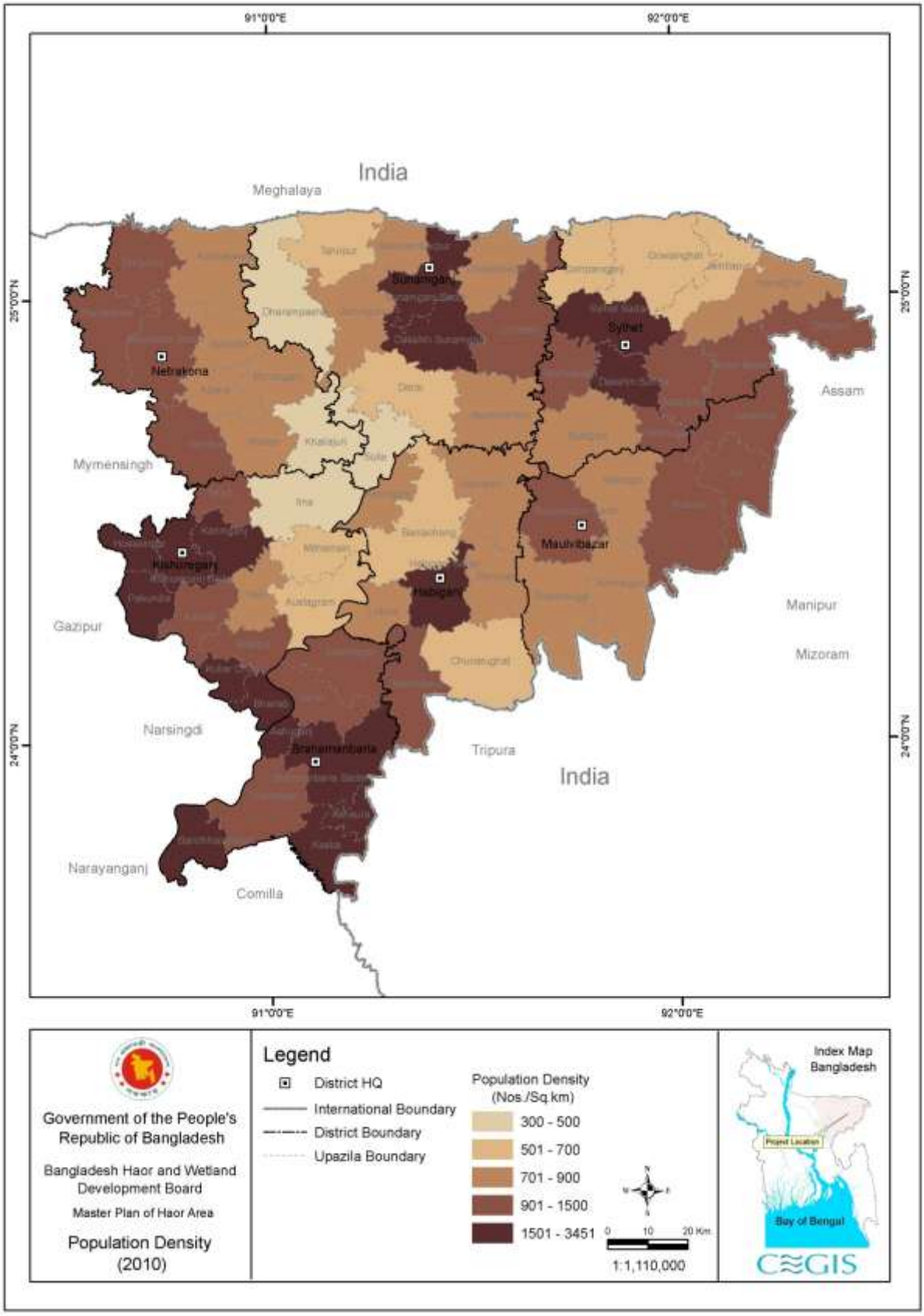


Figure 5.11: Population density in the haor area

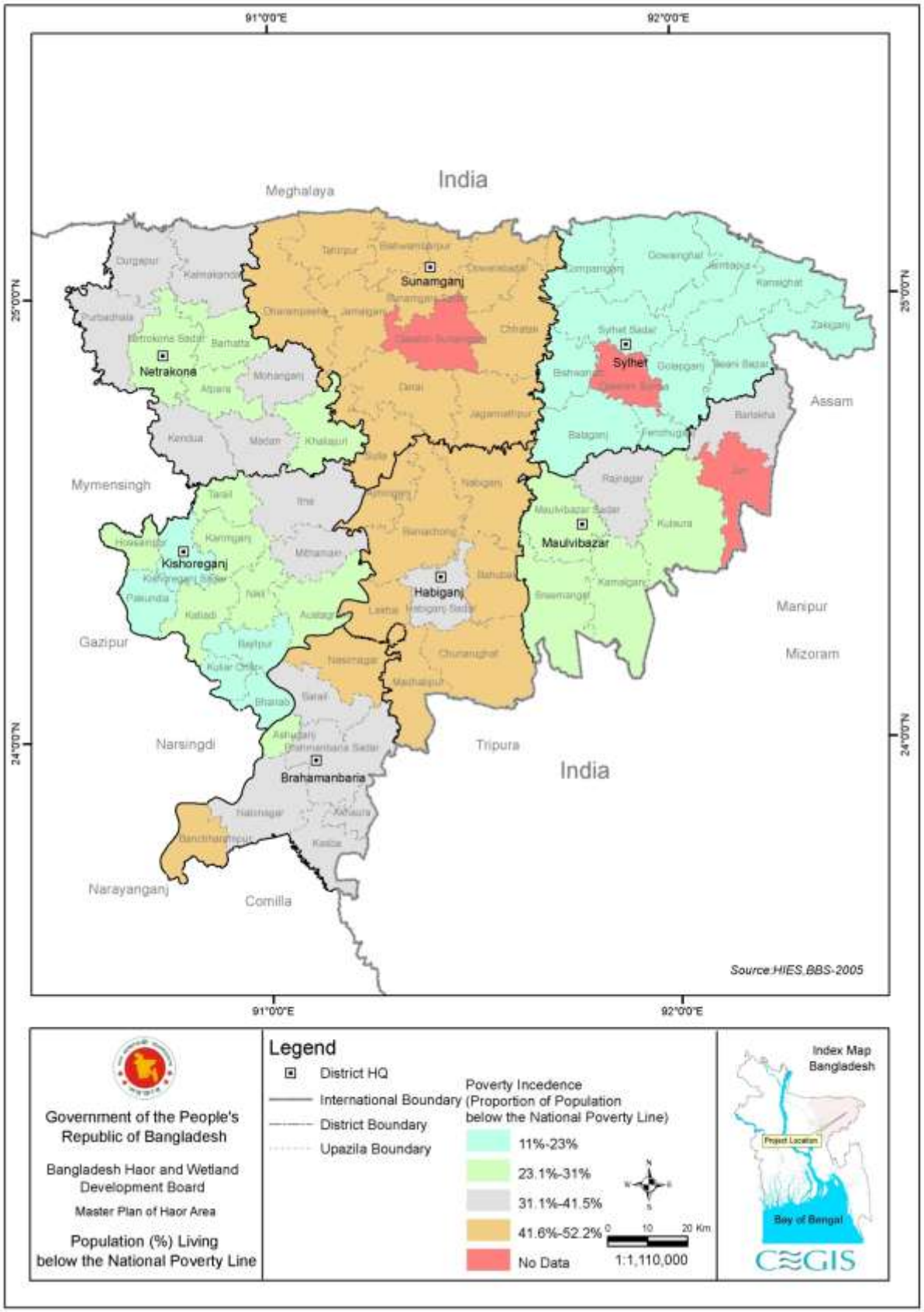


Figure 5.12: Population living below the lower poverty line in the haor area

5.4.3 Employment status

Employment potential is generally expressed as the participation rate (%) of the number of economically active population above the age of 15. At present 61.84% of the economically active population in the haor area can serve in the labour force which is higher than the national average (58.74%). Currently, 28.5% of the population of the area is not engaged in any kind of employment generating activities. Development plans should include this percentage of population on a priority basis. It should be mentioned that in the year 2010 a total of 5.4 million people belonged to the age group of 20 to 34 years which could be targeted for primary interventions.

5.4.4 Landless population

Currently, only 3% of the haor population has no cultivable area where as the national Figure is much higher at 14%. On the other hand, 81% of non-farm holdings have no cultivable area which is higher than the national average (74%) (Figure 5.13). In the farm holding category, 34% of farm households are marginal, which is 5% below the national average. Similarly 51% of the farm households are small farmers while the national Figure is 49.5%.

5.4.5 Occupation

The occupation of a population depends on the availability of resources, opportunity of employment, etc. in their localities. The major occupation of the people of haor districts is agriculture. In the context of the Master Plan, agriculture refers to agriculture/forestry/livestock and agricultural labour. Although a little more than half of the population (53.67%) depends on agriculture, their corresponding Figures for Sylhet and Netrakona districts are not similar; only 35%in Sylhet district depends on agriculture and 71% in Netrakona. There is a remarkable variation in the occupation of the haor population. A great portion earn their livelihood from business (12.52%) followed by non-agricultural labour (6.13%), service (5.65%), fishery (2.59%) and transport (2.39%). A good number of the population (3.41%), especially in Sylhet (10.32%), Maulvibazar (4.64%) and Brahmanbaria (4.56%), depends on remittances coming from home and abroad.

5.4.6 Land ownership

The total house holdings of the haor area can be considered as two types- Farm (52%) and Non-farm holdings (48%). The non-farm holdings can be further sub-divided into (i) holdings with no operated area, (ii) holdings with no cultivated area and (iii) holdings with 0.01-0.04 acre cultivated area. The farm holdings can be sub-divided into – (i) holdings with marginal farming (0.05-0.49 acres) (ii) holdings with small farming (0.50 to 2.49 acres) (iii) holdings with medium farming (2.50 to 7.49 acres) and (iv) holdings with large farming (7.50 acres and more). The following graphical representations show the comparison of the holdings in the haor region (both non-farm and farm) with the national condition (Figure 5.13).

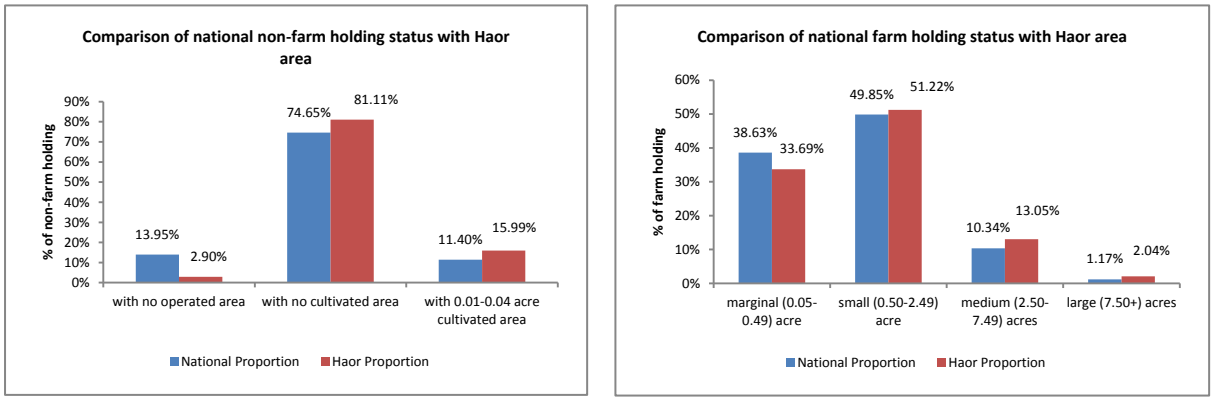


Figure 5.13: Comparison of non-farm and farm holding status in national and haor level

In case of non-farm holdings, it is seen from the graphs that "Holding with no operated area" is 2.9% in the haor region while the national Figure is 13.9%. Percentage of holdings with "No cultivated area" is about 81.1% in haor in comparison with national percentage of 74.71%. "Holdings with 0.01-0.04 acre cultivated area" is about 16% in the haor region, while the national Figure is 11.40%. In case of farm holdings, comparison between haor and national percentage are for marginal holdings - 33.69% and 38.63%, for small holdings-51.2% and 49.9%, for medium holding 13% and 10.3% and for large holdings 2 % and 1.2% respectively.

The tenural pattern depends on the prevailing practices of land use and crop cultivation. There are three types of tenural groups in the area such as tenant (4%), owner (68%) and owner-cum-tenant (25%). Landowners either cultivate their land themselves or/and have them cultivated by hired labourers. The owner-cum-tenant cultivates land of other people along with their own land while tenant farmers (7%) cultivate land belonging to others only.

5.5 Natural Resources

The natural resources include water, forest, biodiversity and wetlands and mineral resources. Each of these resources has been described in the following section.

5.5.1 Water Resources

The haor region lies in the Meghna Basin which is one of the largest GBM basins. About 66,640 km^2 of the Meghna Basin is drained ultimately into the Bay of Bengal through the Kalni-Kushiyara and Surma-Baulai system. Of this area 35 %, or 23,137 km^2, lies in Bangladesh. The total inflow in the haor area comes from India through Meghalaya, Barak and Tripura catchment. In addition, Old Brahmaputra carries water from Indian part. The combined flow of Meghalaya, Barak and Tripura system and Old Brahmaputra finally drain out through Meghna River at Bhairab Bazar. Bhairab Bazar also drains internally generated flow by local rainfall (inside Bangladesh) of the haor areas.

The analysis of BWDB data (1960-2009) shows that, the volume of water contributes into Bangladesh through the river system is 162,619 million m^3. Water contribution from transboundary river of Barak, Meghalaya and Tripura system are 42,670 million m^3, 30,376 million m^3 and 15,716 million m^3 respectively. The contributions of water from tranboundary river system from India and Bangladesh in the region are described below:

- Catchment area of Barak river system is 26,165 km^2 which contributes 26% of the total inflow in the region

- Catchment areas of Meghalaya river system are 9,904 km^2 which contribute about 19 % of the total inflow in the region
- Catchment areas of Tripura river systems are 7,434 km^2 which contribute about 10 % of the total inflow in the region
- The contribution inside Bangladesh is 69,422 km^2 which is about 43% of the total inflow in the region
- The contribution from the Old Brahmaputra in the region is about 2%.

The water balance for the haor area is presented in Table 5.8. The proportion of annual average flow between India and Bangladesh is 57% and 43%.

Table 5.8: Water balance in the haor area (1960-2009)

System contribution	Pre-monsoon (Mm^3)	Monsoon (Mm^3)	Post-monsoon (Mm^3)	Dry (Mm^3)	Total Flow (Mm^3)
(A) Barak	6,086	29,518	5,515	1,266	42,670
(B) Meghalaya	3,318	23,284	2,763	926	30,376
(C) Tripura	3,109	7,549	2,827	2,251	15,719
(D) Brahmaputra	664	1,923	529	488	3,532
(E) Total inflow from India (A+B+C+D)	*13,177*	*62,274*	*11,634*	*4,931*	*92,297*
(F) Local contribution from Bangladesh	*5,622*	*42,121*	*19,879*	*1,251*	*69,422*
Total Inflow (E+F)	19,599	105,145	32,213	6,982	162,619

The flow from the Barak, Meghalaya and Tripura river systems occur in the form of flash floods which usually rise to a peak in a day within a few hours. In the Bangladesh reaches of the rivers, the flood peaks are not diminished to any significant extent mainly because a huge volume of flashy water enters in a short span of time. Figure 5.14 reperesents the extent of flood by depth in haor area. Since all the rivers tend to flood simultaneously, the hydrologic regimes of the main rivers of the region are also complex and erratic.

Table 5.9: Status of BWDB schemes/projects up to 2010

Type	Number of Project	Area coverage(ha)
Drainage	1	3,058
Flood Control and Drainage	60	363,253
Flood Control	10	33,565
Flood Control Drainage and Irrigation	46	324,165
Irrigation	1	688
Total	118	724,729

The vast volume of water creates a lake like situation in the central part of the haor basin during the monsoon season and smooth out the fluctuations in discharge to some extent. The Meghna River outflows from this lake at Bhairab Bazar still features substantial flood rises and recessions. Floods are the characteristic of the entire river system of the North East region. Since there are no other feasible means to control flood in the haor region, water management has always utilized embankments for flood protection.

The rivers of the haor region are characterised by a natural alluvial system and are unstable by nature. The area becomes inundated during monsoon and sometimes in pre-monsoon by flash flood. Interventions in the haor area have been made by the BWDB through different projects namely the EIP, SRP, FAP, haor Rehabilitation Schemes, etc. From 1975-76 until now about 118 schemes have been implemented (Table 5.9 and Figure 5.15). These schemes are maintained every year by the BWDB with budget allocated by the GoB.

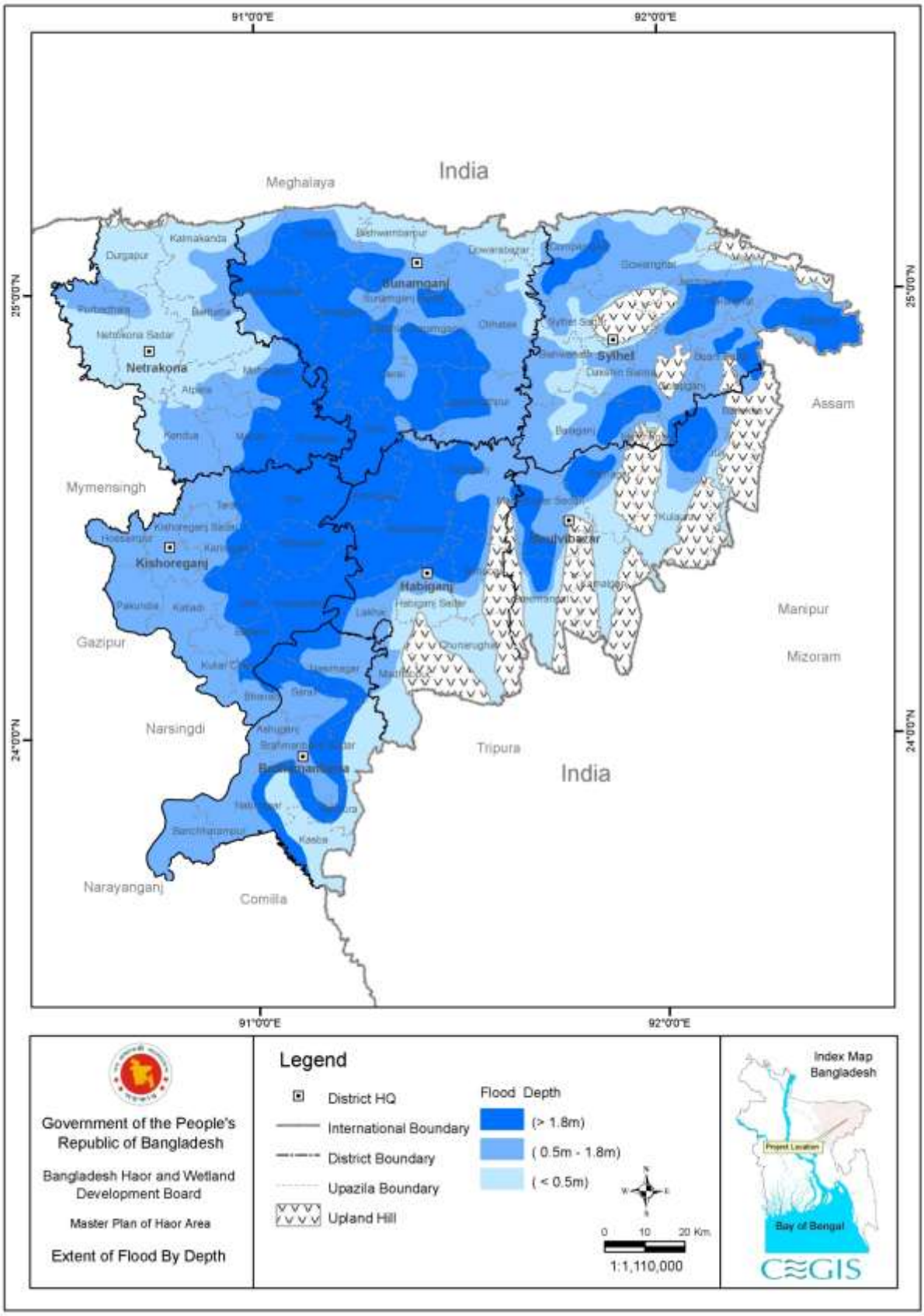


Figure 5.14: Extent of flood by depth in the haor area

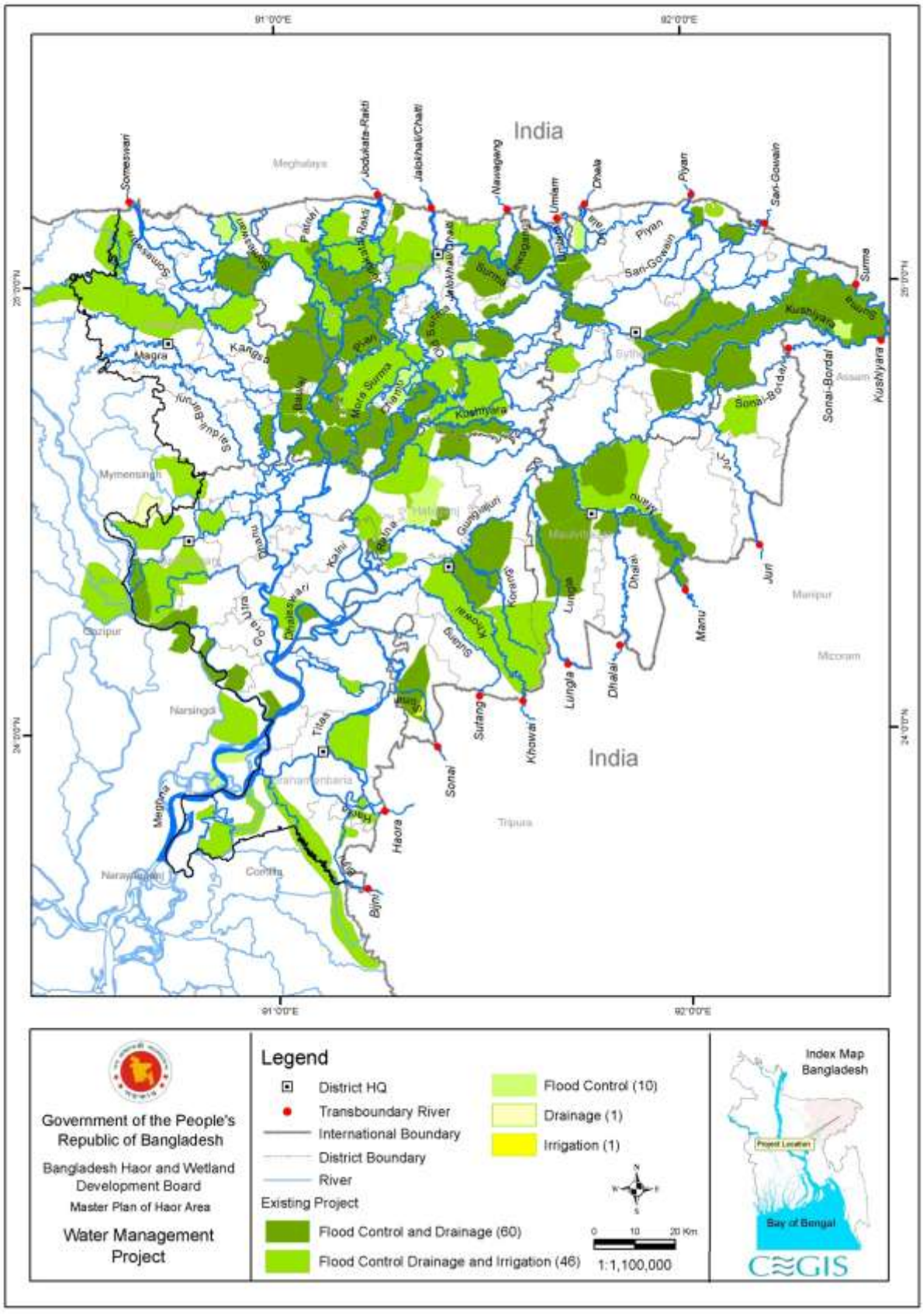


Figure 5.15: Water management projects in the haor region

5.5.2 Forest

In the haor basin there are hill forests, social forests, fresh water swamps, reed swamp forests, cane and murta forest, bamboo and homestead vegetation etc. Table 5.10 and Figure 5.16 show the natural forest coverage in haor districts. The vegetation of the area can be broken down into a number of classes or types. Each type is an aggregated assemblage of particular plant species and is a characteristic of particular environmental conditions (hydro-period, flow regime, water quality and soil). Wetland condition ranges from perennial aquatic lowlands to seasonally dry uplands.

Table 5.10: Natural forest coverage in haor districts

District	Natural forest Area in ha
Sunamganj	7,293
Habiganj	13,153
Netrakona	739
Sylhet	262,832
Maulvibazar	25,142
Total	296,005

Ecologists have grouped the typical haor vegetation areas into nine classes, which are 1) Submerged plants, 2) Free floating plants, 3) Rooted floating plants, 4) Sedges and meadows, 5) Floodplain grassland, 6) Reed swamp, 7) Fresh water swamp forest, 8) Crop field vegetation and 9) Homestead vegetation. Fresh water swamp forest consists of flood-tolerant evergreen trees. A fully-developed stand exhibits a closed canopy with mature trees standing ten to twelve meters tall. *Barringtoniaacutangula* (hijal) and *Pongamiapinnata* (Koroch) occur in varying proportions to form this vegetation type. *Crataevanurvala* (barun), Bias, wild rose, *Trewianudiflora* (gotagamar/panidumur) and *Salix tetrasperma* (bias, panihijal) are also frequently found in the haor area. The swamp forest is adapted to monsoon flooding for three to four months to depths of 0.5 to 2.5 m.

Since the target area is reasonably big and since it involves varieties of ecosystems coupled with multi-dimensional socio economic situations, the problems will take too long to handle under the given context. Thus, the issues and problems have been lumped into a number of 'Major Issues' and 'Major problems' to ease out the whole process. The major issues for further development of forest resources in connection with the forestry sector are, richness of the ecosystem and ecosystem diversity, socio economics of the people especially the rural power structure, resource users, land tenure system, access & benefit sharing, lack of scientific data & availability of information and GO-NGO involvement. The major problems especially in connection with the forestry sector are due to lack of community involvement, indiscriminate harvest of natural resources, no management plans for the natural resources, land tenure problems, very few NGOs working on natural resources & environment and widening gap of supply and demand for forest products.

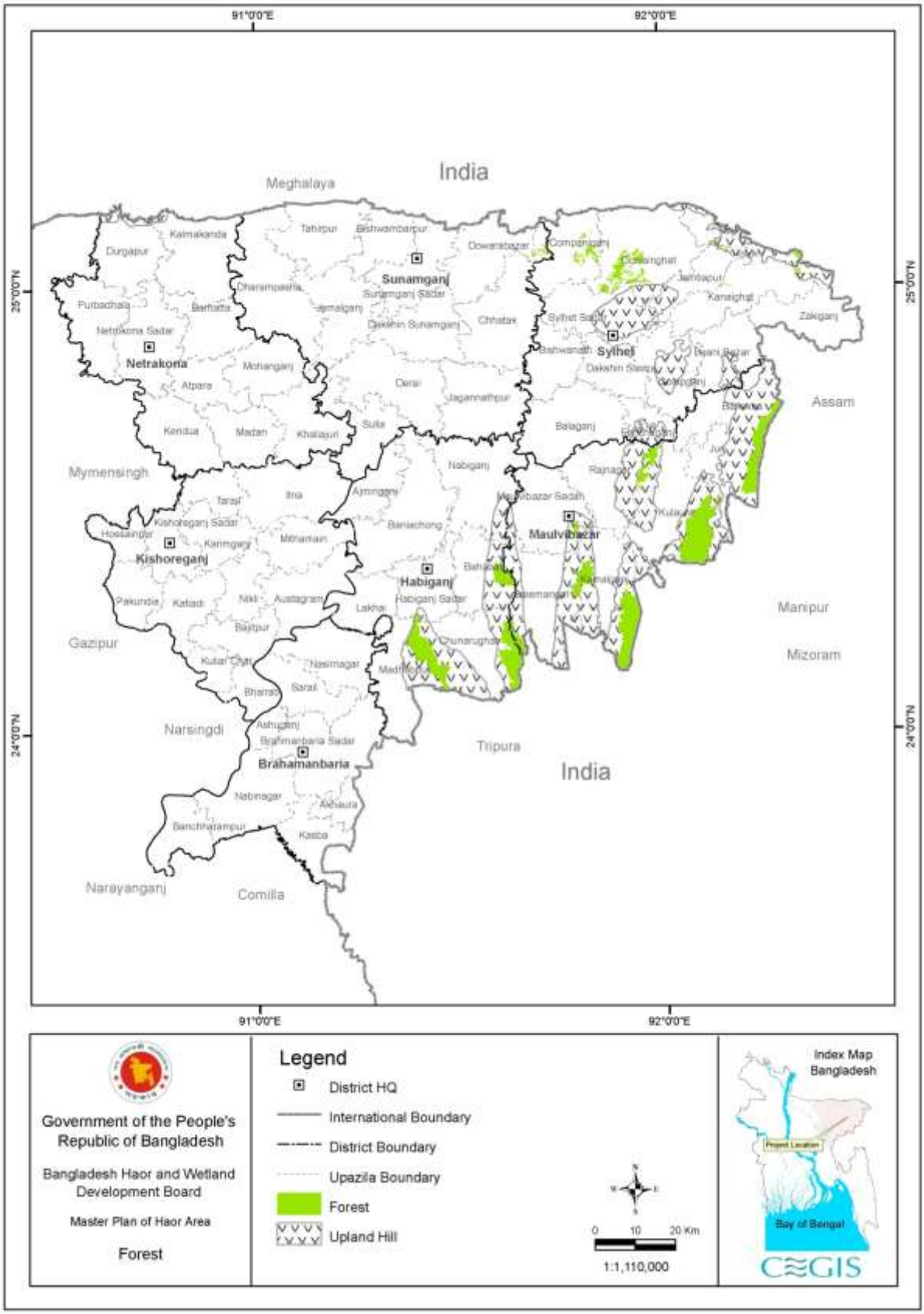


Figure 5.16: Forest areas in the haor region

A huge number of depressed water bodies in the haor area are inundated by fresh water during monsoon and gradually dry up in winter except for the deep pockets. These areas are more suitable

for the development of swamp forests. Kandi and the edges of kea plantations (Hijal, Koroch, Pitali, Baron and Babla etc.) have high potentials in the haor area. The areas along submersible roads, embankments, institutions, riverbanks and canal sides are suitable and sustainable for plantation of mixed plantation, water tolerant and other types of species. Marshland plantation (water tolerant species), plantation on government land, homestead plantation, plantation of Patipata, Rattan and reeds and other native species as well as establishment of three layered vegetative protection for homesteads are suitable for the development of forest resources in the haor area. Awareness building at community, user, management and institution levels through different established organizations would also be important for sustainable management of forest resources. Capacity development of local people is also required for nursery development.

5.5.3 Biodiversity and Wetland

There are a large number of wetlands of significant national and regional importance and many sites have significant local value (Table 5.11). The sites support biodiversity at all scales especially communities (species and within the species) and are home to several internationally threatened species. The biodiversity of haor wetlands is very rich. The most significant wetlands are Hakaluki haor, Tanguar haor, Hail haor, Matian haor, Pasuar Beel haor, Dekar haor, Baro haor, Gurmar haor, Sonamorol haor, Baram haor, Kalni haor, Kawadighi haor and Pagner haor. These wetlands have a rich wildlife community including birds, reptiles, mammal and amphibians. Most of the important haor areas are also enriched by wetland plants through lowland plantation.

Table 5.11: Biodiversity and Wetland of Haor area

Wildlife Community	No of Species in haor	No of Species in Bangladesh	Threatened in haor	Threatened in Bangladesh
Amphibians	9	34	1	8
Birds	257	650	18	41
Mammals	29	120	13	40
Reptiles	40	154	24	58

Many initiatives are taken to restore the natural environment and local heritage by conserving water, improving agriculture and fish production and making the haor a secure zone for birds and wildlife. In 1999, the GoB declared some haor as 'Ecologically Critical Areas' (ECA). Tanguar haor has been declared as a Ramsar site. It is also an important bird area of Bangladesh. The other bird areas are: Hakaluki haor, Hail haor, Pasuar and Panna beel. A survey by the Bangladesh National Herbarium (BNH) recorded 78 plant species in the area (Khan, 2001). These include 11 free-floating species, such as *Pistiastratiotes* (Topapana), *Salvanianatans* (Tetulpana) etc., 38 anchored, submerged species, such as *Potamogetoncrispus* (keorali), *Aponogetonechinatus* (Ghechu) etc., 5 suspended species, such as *Utricullariaaurea* (Chhotojanghi), *Cerato-phyllumdemersum* (also known as chhotojanghi), etc., 20 rooted species with floating leaves, such as *Nymphaeanouchali* (Padma), *Trapamaximowiczii* (Paniphal), etc., 116 emergent species, such as *Phragmiteskakra* (Nalkhagra), *Polygonumbarbatum* (bishkatali) etc., 5 climbers, such as *Clematis cadmia, Oxystelmasecamone* (dudhilata), *Cascutaaustralis* (sarnalata) etc. and 8 swamp forest trees and shrubs, such as *Barringtoniaacutangula* (hijal), *Pongamiapinnata* (Koroch,) etc. Haor ecosystems are the major habitat of birds and fishes in Bangladesh. It has been found from various sources that Tanguar haor is characterised by approximately 141 fish species including some exotic introduced species which represents more than half of the country's fresh water fish species (266 spp.). Among them noteworthy species are; *Air*, *Gang Magur*, *Baim*, *Tara Baim*, *Gutum*, *Gulsha*, *Tengra*, *Titna*, *Garia*, *Beti*, *Kakia,* etc. There are 208 bird species avifauna in the haor area.

The Asian wetlands directory and the baseline survey of NERP/Water board/CIDA are the two basic documents that describe the preliminary status of the wetlands species and biodiversity. It is generally mentioned by various parties that the haor wetlands are degrading and have incurred massive loss of natural habitats. However, in reality there is no quantified data to evaluate the status and rate of habitat loss, with the exception of Hail haor and Hakaluki haor. There is an increasing trend to encroach into/fill up wetlands for various purposes such as housing, industry and agricultural practices. Over-exploitation of fisheries resources and swamp forests has been tremendously increased in the haor wetlands. Unplanned fishing, fishing in breeding season, over fishing, hunting water bird and other factors are causing depletion of biodiversity. Water is being polluted from discharge of untreated solid and liquid waste from various sources such as coal

carrying by boats, discharge of crude oil from mechanised boats, dumping of household waste, waste disposal from fertilizer and cement factories, residual pollution of chemical fertilizer and pesticides.

Development of biodiversity and wetland management of haor could be achieved through establishment of a Global Wetlands Center of excellence for research, education and nature tourism, as well as through ecological zoning and restoration of swamp forest with natural regeneration and afforestation, aquaculture, wildlife farming and eco-products. Figure 5.17 shows bio-ecological zones of the haor area. Figure 5.18 shows the bio diversity and Figure 5.19 shows ecosystem of haor region.

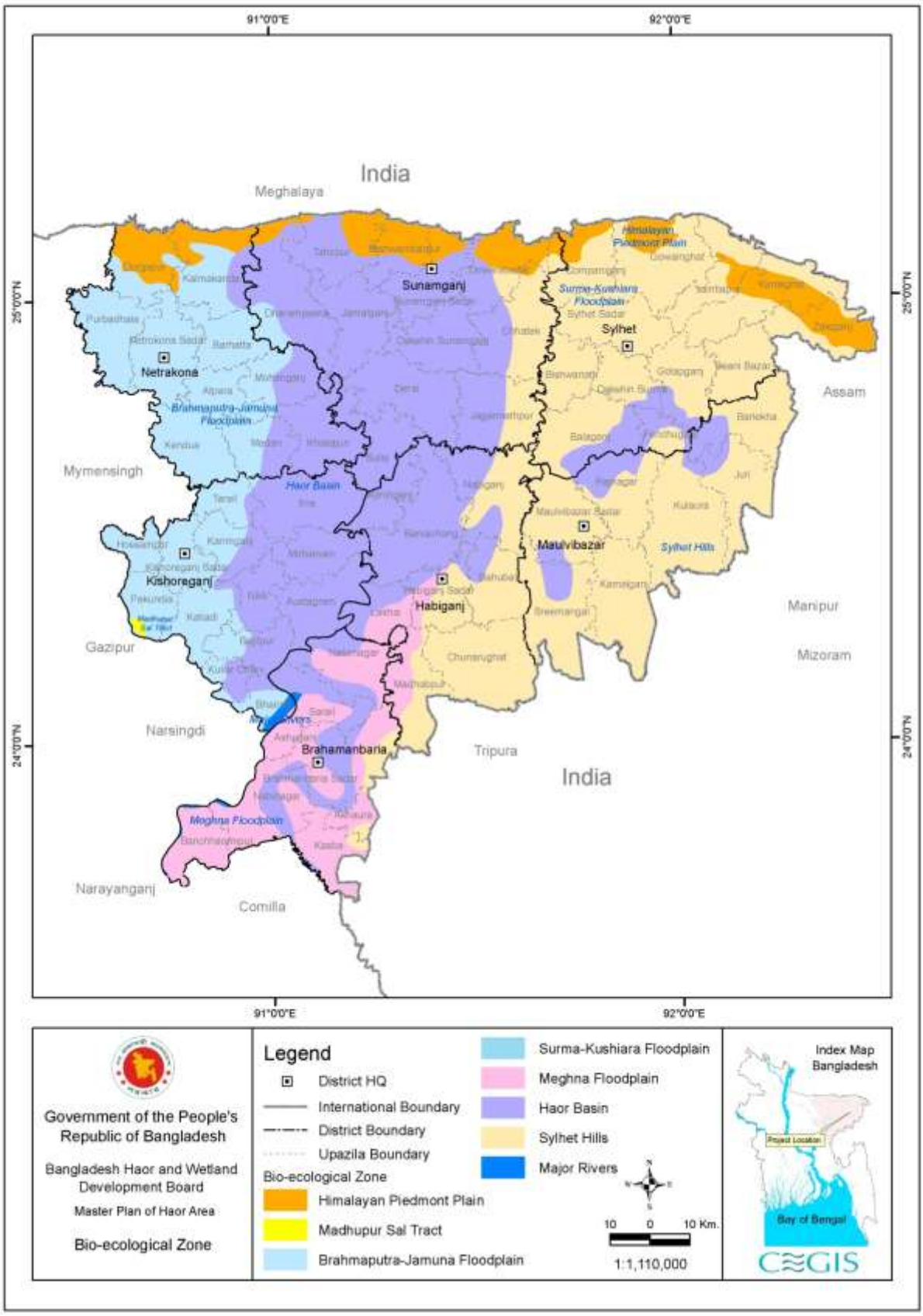


Figure 5.17: Bio-ecological zones of the haor area

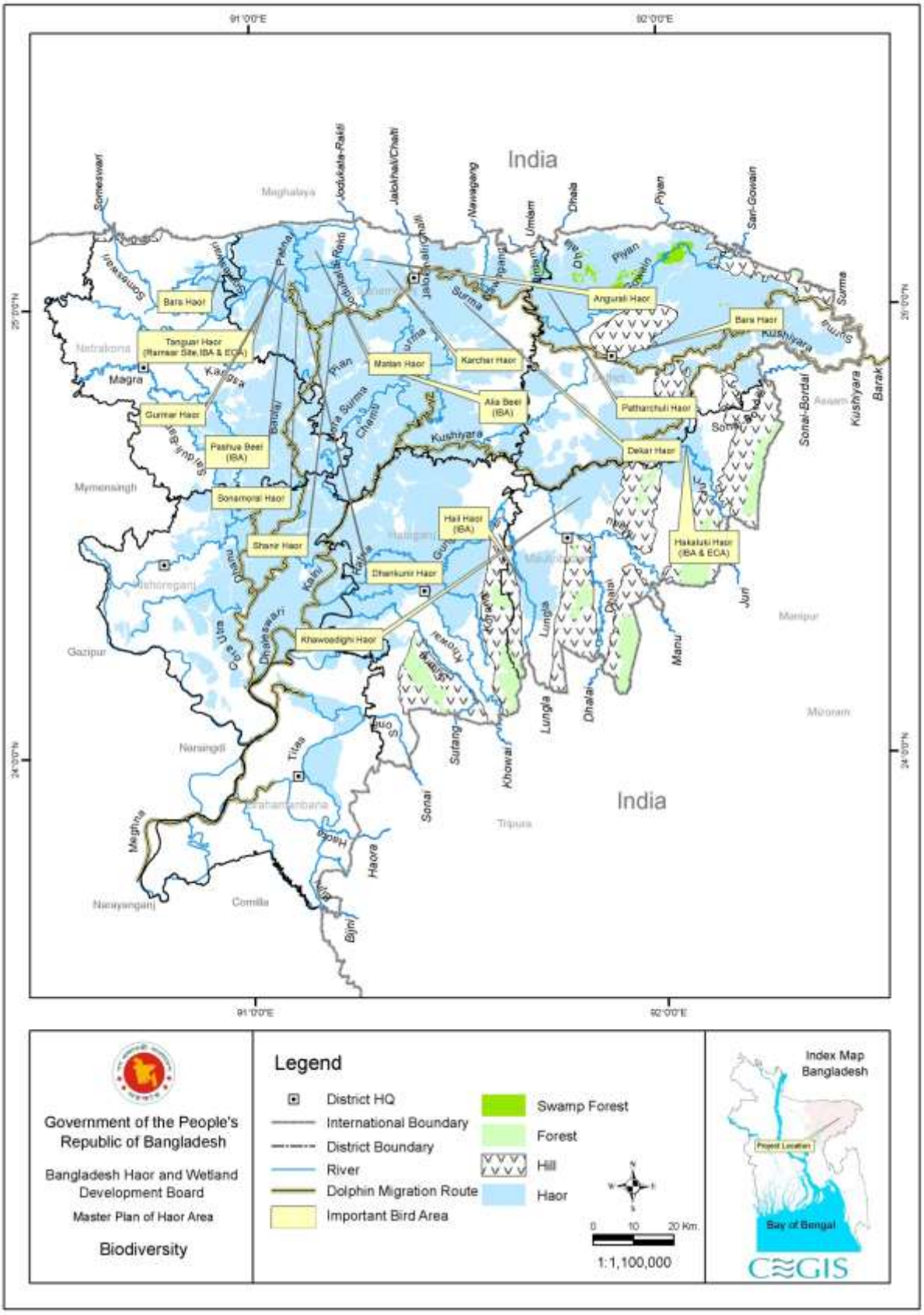


Figure 5.18: Biodiversity of the haor region

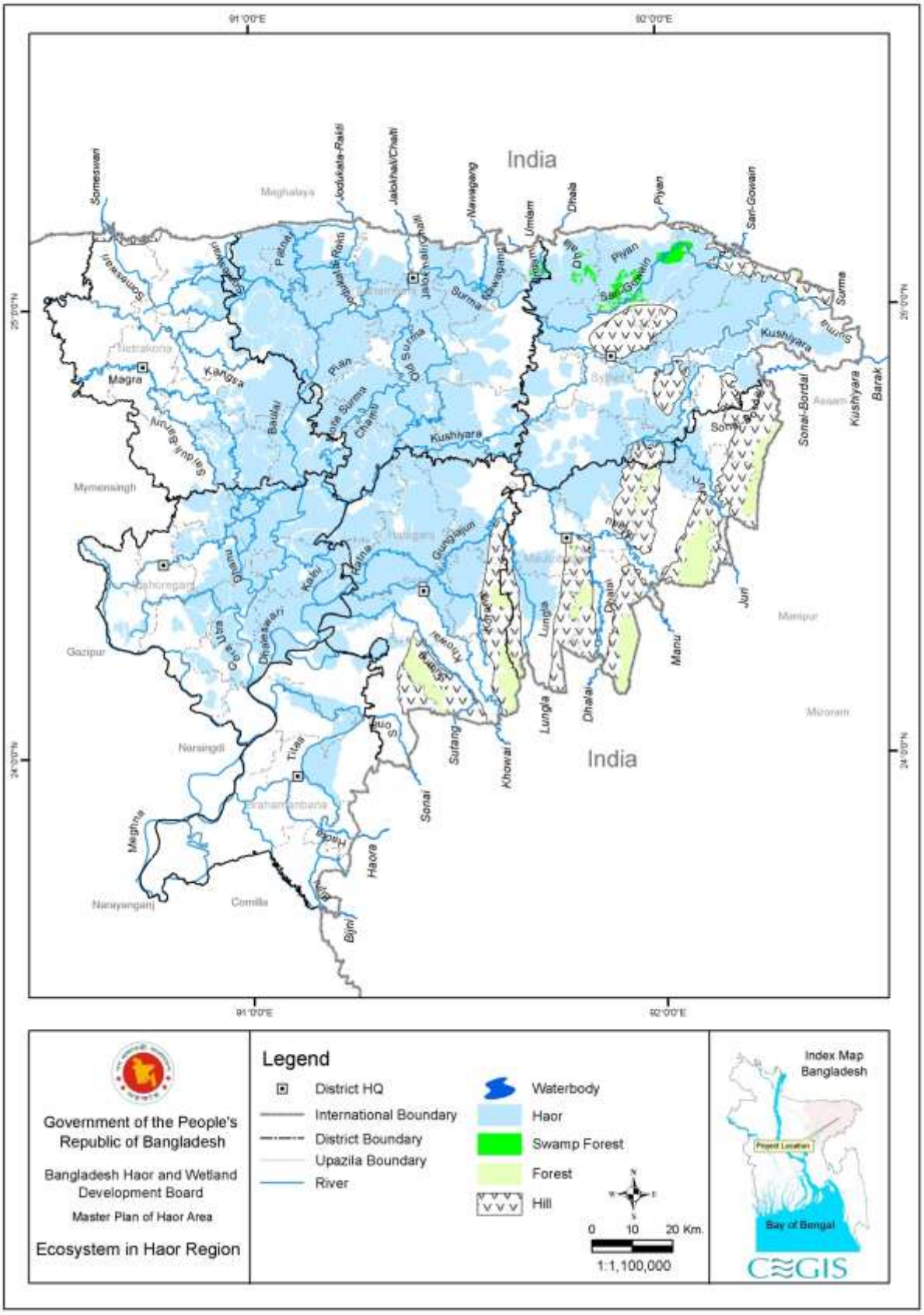


Figure 5.19: Ecosystems of the haor region

5.5.4 Mineral Resources

The haor basin is a large, gentle depression, bounded by the Old Brahmaputra floodplain in the west, the foothills of the Meghalaya Plateau in the north, the Sylhet High Plain in the east and the Old Meghna floodplain in the south. This depression is created by subsistence and tectonic adjustment. Both gas and mineral resources are present in this area in comparatively higher proportions (Table 5.12). About 90% of the total gas production of the country is obtained from the haor districts. The area is mostly covered by the Surma Basin (SB), which is the depressed part of the Bengal Basin. The Surma-Kushiyara floodplain and Meghna River Floodplain constitute the geomorphology of the haor zone. The geological map of the Surma Basin shows that the area is mostly covered by Holocene deposits with exposure of Pleistocene Dupitila deposits in the small hillocks locally called *tila*. At the foothills of the Shillong Massif and to the north of the haor basin, Eocene Sylhet Limestone is found in isolated exposures.

Table 5.12: Mineral Resources of Haor area

Type	Brief description of Mineral Resources
Coal	The coal consists of 18.96-39.32% carbon, 15-46.16% ash, 0. 62-1.44% moisture and 32.64-48.22% gaseous materials.
Crude Oil	Small commercial oil discovered at Haripur, Sylhet, was in operation for about 7 years only.
Glass Sand	Glass Sand is found in Habiganj, Shajibazar and Noapara.
Gravel	Gravel is composed of rock types like quartzite, granite, amphibolite, basalt, sandstone, conglomerate, etc.
Lime Stone	Limestone is mainly found in subsurface at Boglibazar, Lalghat, Takerghat and Bhangerghat of Tahirpur Upazila, Sunamganj district.
Natural Gas	Among the 23 natural gas fields, 10 fields are located in the haor region
Peat	Peat is available around Maulvibazar district; Chatal beel of Maulvibazar district; Pagla, Derai and Shalla of Sunamganj district; Charkai of Sylhet district; Katanga of Brahmanbaria district and Mukndapur of Habiganj district
White Clay	White clay deposit is found nearly surface to subsurface at Bijoypur and Gopalpur of Durgapur upazila in Netrakona District.

Haor areas in Sylhet have a thick stratigraphic succession of mostly tertiary sediments. The stratigraphic sequence in Bangladesh represents silt, sand, gravel and clay, pebbly sandstone, sticky clay, sandstone, coarse quartz pebbles, petrified wood, clay stone with siltstone and sandstone, marine shale, basalt, volcanic ash, coal etc. The geological setting and formations of the north-eastern part of Bangladesh favours the deposit of various types of mineral and energy resources. The mineral resources discovered are natural gas, crude oil, limestone, white clay, glass sand, peat, coal, gravel and construction sand. The box shows the types of available mineral resources in the haor region. Figure 5.20 shows the extraction sites of different mineral resources.

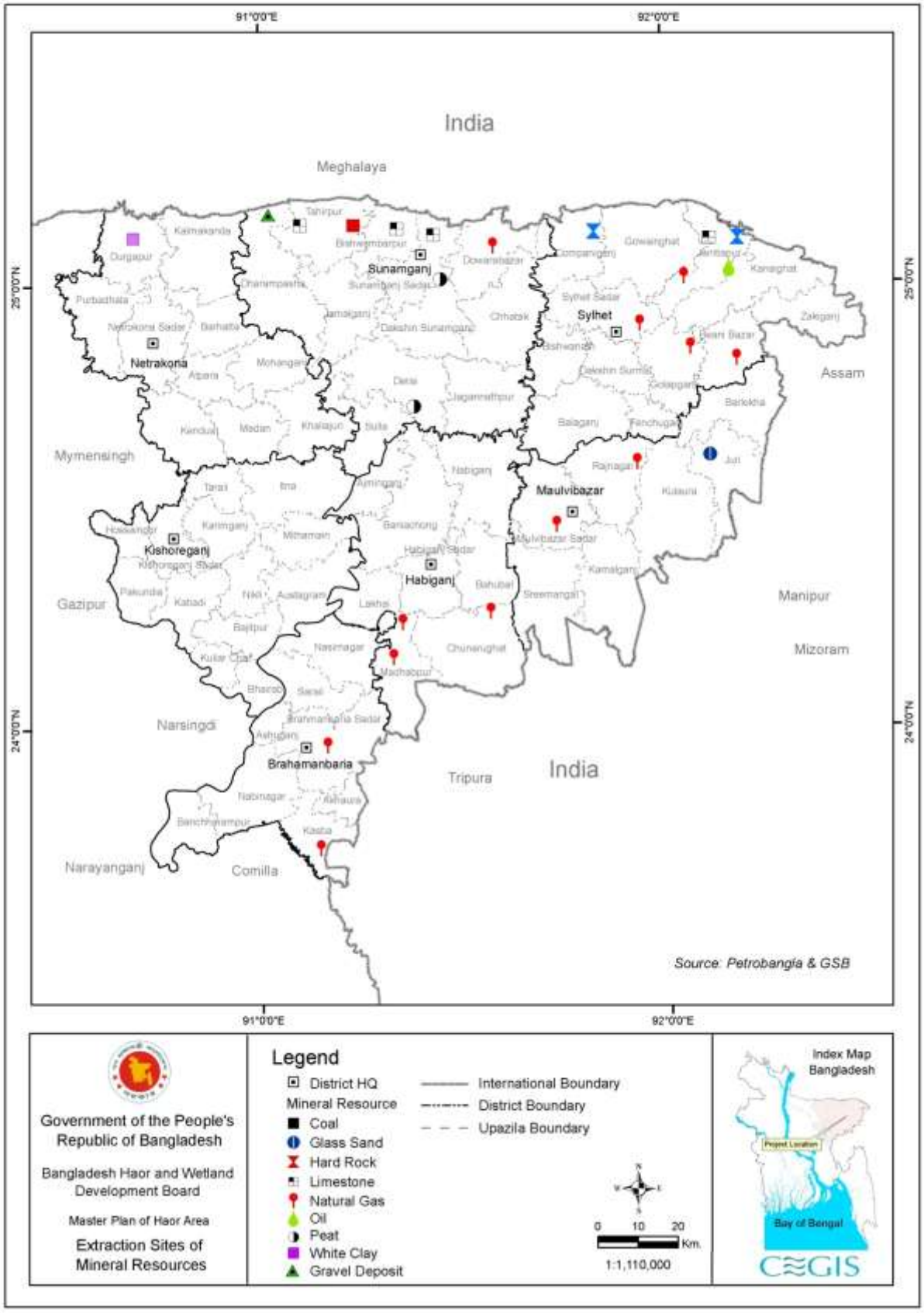


Figure 5.20: Mineral resources of the haor area

The Table 5.13 presents some statistics on the gas fields of the haor area.

Sand stone will contribute substantially to the government exchequer as well as local employment. Gravel and white clay will continue to contribute in construction and ceramic industries in the future. Gravel exploitation in the area needs to be done with proper environmental management plans. Sand stone, gravel and white clay are valuable resources that are gradually being exhausted. Field observations reveal that at least 100,000 people from haor districts are involved in dredging the river beds and quarrying the foothills for stone and gravel.

Table 5.13: Present status of gas field of haor area, 2010

Gas Field	Total Reserve (BCF)	Recoverable Reserve (BCF)	Year of Discovery
Beanibazar	243.1	170.2	1981
Bibiyana	3144.5	2400.8	1998
Chhatak	677	473.9	1959
Fenchuganj	404	282.8	1988
Habiganj	5139	3852.3	1963
Jalalabad	1195	836.5	1989
Kailashtila	2720.1	1903.3	1962
Maulvibazar	448.9	359.6	1997
Rashidpur	2002	1401.2	1960
Sylhet	683.9	478.7	1955
Titas	7325	5127.5	1962
Total	23982.5	17286.8	

5.6 Economic Resources

Economic resources are divided mainly into two categories which are primary production area and service area. The primary production sector considered under the Master Plan includes agriculture, fisheries, livestock, power and energy and industry. Similarly service area includes water supply and sanitation, education, health, tourism, transportation and communication, housing and settlement and social services.

5.6.1 Primary Productive Area

Agriculture

The seven districts of haor areas cover a gross area of about 1.99 million ha of which net cultivated area is about 1.31 million ha (**Table 5.14**). The total rice area of Bangladesh is 11.35 million ha of which 15.3% (1.74 million ha) fall in the haor region.

Table 5.14: Primary Productive Haor area

District	District NCA(ha)	Haor NCA(ha)	Haor NCA in %	Cropping Intensity haor	District wise production ('000 mt)	Haor Wise production ('000 mt)
Sunamganj	276,434	217,777	79	116	801	741
Habiganj	162,926	103,760	64	128	692	411
Netrakona	211,130	66,000	31	130	911	209
Kishoreganj	196,900	123,340	63	113	932	536
Sylhet	208,680	138,200	66	143	861	548
Maulvibazar	126,928	33,100	26	135	479	116
Brahmanbaria	150,381	23,420	16	122	571	87
Total	1,333,379	705,597			5,248	2,690

About 5.25 million metric ton of rice is produced in the haor region, which is 16.5% of the total rice production of Bangladesh. About 90.2% of the total crop area is under rice crop cultivation. Thus the major cropping patterns are rice based and almost all segments of cultivated land are used for at least one rice crop a year. Recent data indicate that 1.74 million ha are under different rice culture: Aus (0.14 million ha), broadcast/deep-water Aman (0.06 million ha), transplanted Aman (0.66 million ha) and Boro (0.87 million ha). Among rice crop, about 22% is covered with local variety and the rest 78% is under high yielding varieties (HYVs). The HYVs occupy about 90% of the total area of Boro rice compared to about 75% of Aus and 67% of Aman. Non-rice cropped area is about 9.8% of the total cropped area. Wheat and maize are the other major cereal crops that occupy about 0.7% of the total cropped area. Potato, including sweet potato, occupies 1.2% of the total cropped area. The other non-rice crops (pulses, oilseeds, vegetables, etc.); occupy 6.7% of the total cropped area. Jute is a major cash crop occupying about 1.1% of the total cropped area. Sugarcane also covers a very minor area. Tea is the major industrial crop, occupying about 3.7% of the Net Cultivated Area (NCA) while fruits occupy about 0.42% of the NCA.

The region produces about 5.25 million tons of rice a year, of which 60% is Boro, 33% Aman and 7% Aus. The average rice yield is 3.02 ton/ha. About 20,560 tons of wheat and 21540 tons of maize are produced annually, with average yields for wheat and maize are of about 2.13 ton/ha and 4.74 ton/ha respectively. The annual production of tea is about 54,000 tons and the average yield of tea is 0.38 ton/ha. The average yield of jute is 1.58 ton/ha and the annual production is about 34,770 tons. The annual production of sugarcane is about 13,770 tons and the yield rate is 44.42 ton/ha. About 12,500 tons of pulses and 26,590 tons of oilseeds are produced in the region annually. The average yields for pulses and oilseeds are about 1.02 ton/ha and 1.09 ton/ha, respectively. The

yields are very low since traditional varieties are cultivated. The annual production of spices and condiments is 53,200 tons. The average yield is 1.1 ton/ha for chili, 5.3 ton/ha for onion, 3.6 ton/ha for garlic, 5.3 ton/ha for ginger, 5.7 ton/ha for turmeric and 0.85 ton/ha for coriander. The annual production of vegetables is 1.04 million tons, of which 75% is produced in winter and 25% in summer. The annual production of potato is about 0.31 million tons and the average yield is about 12.70 ton/ha.

Presently, about 3,277 metric tons/kilo liters of pesticides are used, of which insecticides are about 1,810 tons in granular form, about 322 kilo liters in liquid form and about 42 tons in powder form. In addition, about 743 tons of fungicide, 357 tons of herbicide and 3 tons of rodenticide are applied for crop protection.

Irrigation coverage during dry season is about 62% of the NCA. In Rabi season, about 83% of Boro crop area is irrigated and the rest of the area is irrigated by traditional method or is under rain fed condition. Other dry land Rabi crops are grown mostly under rain fed condition. In Kharif-I and Kharif-II seasons the major crops, Aus and Aman, are cultivated under rain fed condition. The total irrigation coverage during dry season is about 817 thousand ha. Irrigation coverage by ground water is about 345 thousand ha of which coverage of Deep Tube Wells (DTWs) is about 37 thousand ha and Shallow Tube Wells (STW) is about 308 thousand ha. Irrigation coverage by surface water is about 472 thousand ha of which about 381 thousand ha is covered with Low Lift Pumps (LLPs). About 57 thousand ha of Boro crop area is irrigated with the help of gravity flow and 34 thousand ha is irrigated with traditional methods such as sewing basket, dhon, etc. About 54 thousand ha Boro crop is transplanted in ponding water and later stage of this crop mainly depends on rainwater. Figure 5.21 and Figure 5.22 show the Land Zones and cropping patterns of the haor areas.

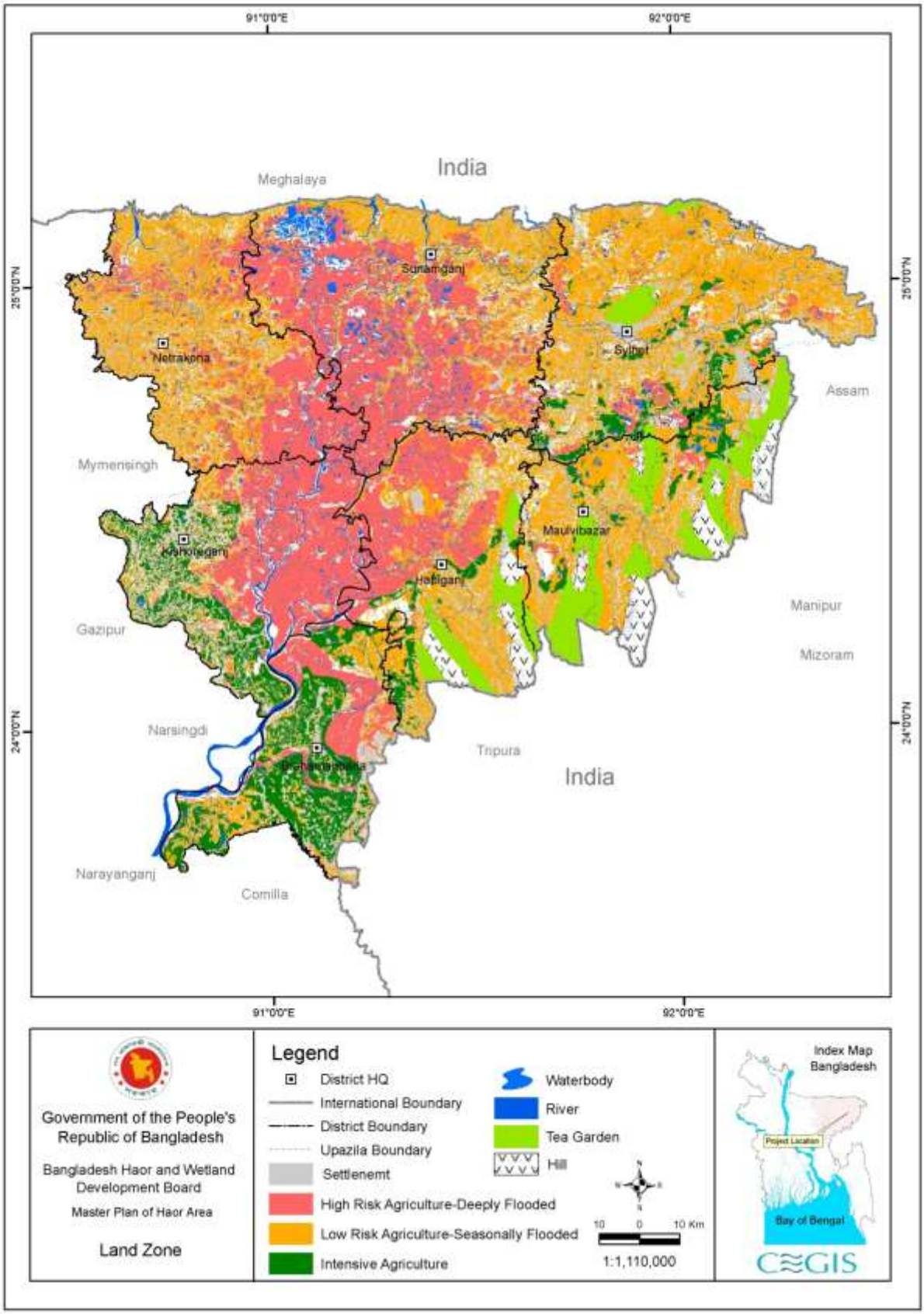


Figure 5.21: Land zones of the haor area

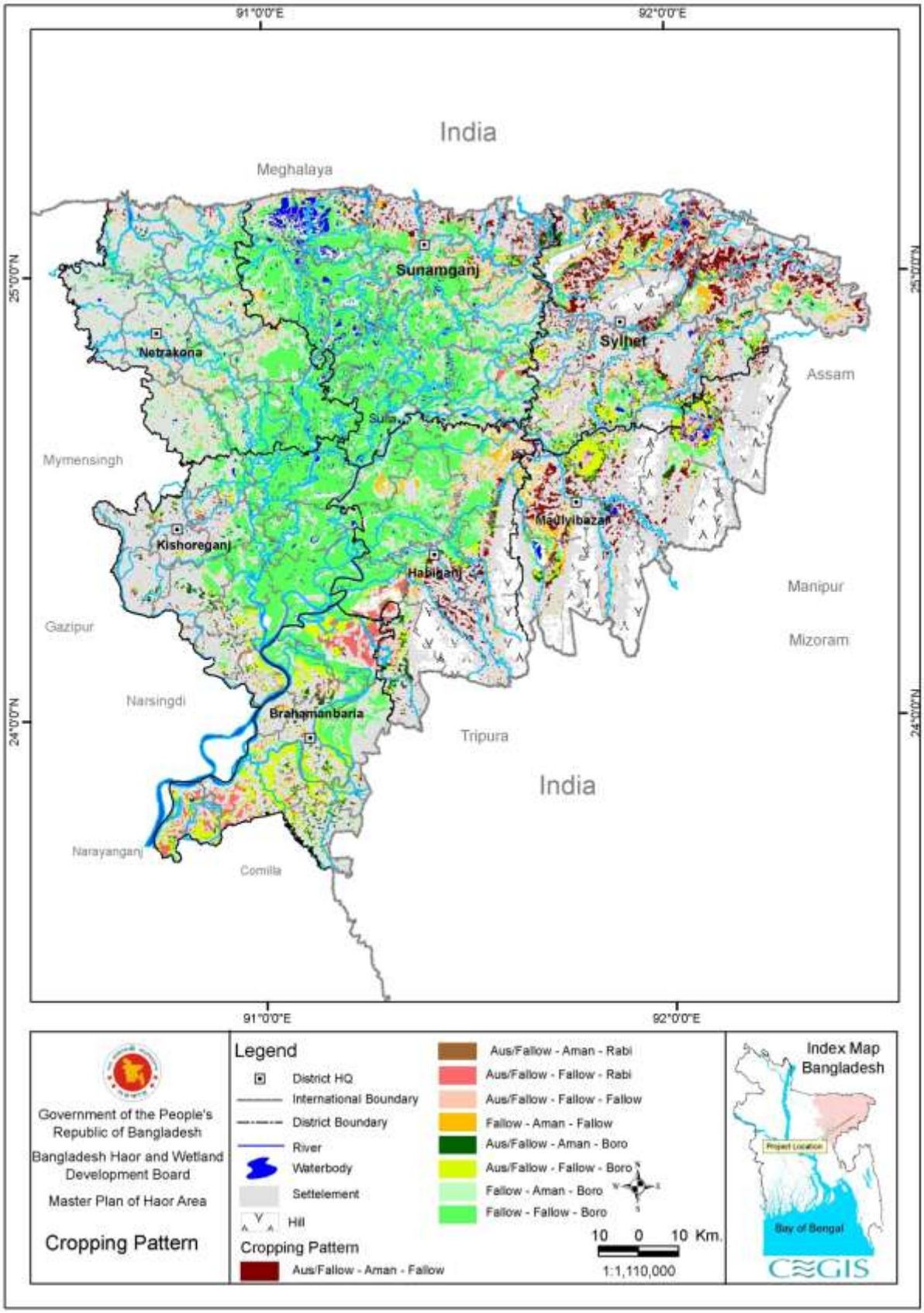


Figure 5.22: Cropping pattern in the haor area

Fisheries

The haor region comprises a wide variety of fin fish including 143 indigenous and 12 exotic species along with several species of freshwater prawns. Fish species are broadly grouped into two categories, large fish (major carp, large catfish, chital, Gangetic stingray, gazar and shol) and small fish. The estimated fish habitat area in the haor region is about 967,000 ha.

The fish habitats altogether produce about 4.32 lakh tons of fish where 73.7% is contributed by capture fishery and the rest is shared by culture fishery (Table 5.15). Among the haor districts, Sunamganj contributes about 23.4% in the total fish production followed by Netrakona (16.9%), Kishoreganj (16.2%), Sylhet (14.8%), Brahmanbaria (12.7%), Habiganj (8.1%) and Maulvibazar (7.9%). Of the capture fish production, floodplain contributes the bulk portion which is about 77.9% followed by beels (15.6%), river streams (3.5%), channels/khals (1.8%) and ditches/borrow pits (1.2%). Wetlands are breeding, nursing and feeding grounds along with over wintering refuge areas of residential as well as of most of the freshwater migratory fish species. Culture fish ponds in the haor area produce about 1.14 lakh ton which is 26.3% of the total production.

Table 5.15: Capture and Culture fisheries of Haor region

District	Total Habitat Area (ha)	Production Capture (lakh Ton)	Production Culture (lakh, Ton)	Total Production (lakh, Ton)	No of Species
Sunamganj	228,734	0.894	0.120	1.014	48+
Kishoreganj	145,134	0.522	0.176	0.698	56+
Netrakona	149,129	0.519	0.212	0.731	54+
Sylhet	180,490	0.503	0.138	0.641	63+
Habiganj	97,057	0.256	0.092	0.348	51+
Maulvibazar	66,949	0.228	0.113	0.341	46+
Brahmanbaria	99,352	0.265	0.285	0.550	37+
	966,845	3.187	1.136	4.323	

Nearly 20% of the total inland fish production of Bangladesh comes from the haor basin and this sector plays a vital role in the national economy in general and the local economy in particular especially for the poor. The contribution of the fisheries sector in the agricultural GDP of Bangladesh accounts for roughly 22.2% (DoF, 2011). Overall, the contribution of the fisheries sector accounts for 3.74% (DoF, 2011) of the GDP, 2.7% of foreign exchange earnings and 58% of animal protein intake (DoF, 2011). Of the fisheries contribution to the GDP, the haor basin alone contributes around 0.6% and 3.14% is contributed by the rest of the country. Over 452 tons of fish were exported from the haor basin in the 2009-10 fiscal year (DoF, 2011).

Depending on the life cycle of fish and their breeding behavior and habitats, fisheries are mainly divided into two parts. They are: River breeders: e.g. rui, catla, kalibaus, mrigel, chital, ghagot, ayre, rani, pabda, pangas, bacha, garua, shilon, baspata, kajoli, etc. and Floodplain and beel breeders: e.g. boal, ghonia, singhi, sarpunti, magur, koi, bheda, punti, icha, chanda, mola, golsha, tengra, khalisa, etc.

The yearly average riverine fish production rate of the area is 267 kg/ha (national 162 kg/ha). For the floodplain it is 305 kg/ha (national 310 kg/ha), for beels 1,025 kg/ha (national 694 kg/ha), for ditches/borrow pits 1,476 kg/ha (national 1,510 kg/ha) and for fish ponds 3,304 kg/ha (national 3,141 kg/ha).

The contribution of haor capture fisheries to the livelihoods of the rural poor of the area is very significant. Although 2.59% of the area population is full-time fishermen, over 65% of the households are engaged in fishing activities as part-time or subsistence fishermen.

Apparently, fishermen report that haor capture fishery has been depleted though the catch data of the FRSS showed the increasing trend of fish production. Depletion and declination of haor fisheries have been occurring due to over and indiscriminate fishing and degradation of habitats respectively. The physical habitat is altered by channelisation, construction of embankments and diversions, siltation and degradation of wetlands. The nearly extinct enlisted species comprise of nandina (*Labeonandina*), angrot (*Labeoangra*), pangus (*Pangasiuspangasius*), tor mohasol (*Tor tor*), baghayer (*Bagariusyarrelli*) and sarpunti (*Puntiussarana*) and catla (*Catlacatla*) and mrigel (*Cirrhinusmrigala*) become rare (Tsai, 1997). The fish species piplashol (*Channabarca*), which was once abundant, is reported to be extinct. Some fish species which are at risk of extinction include chital (*Notopteruschitala*), raik/lasu (*Cirrhinusreba*), ghonia (*Labeogonius*), rani (*Botiadario*), kanipabda (*Ompokbimaculatus*), madhupabda (*O. pabda*), kajuli/banshpata (*Ailychthyspunctata*), kuchia (*Monopteruskuchia*) and telotaki (*Channaorientalis*), etc. Figure 5.23, Figure 5.24 and Figure 5.25 show locations of Fish Sanctuary and mother Fisheries, Flood Plan Fish Habitats and Duar Fish Habitat respectively.

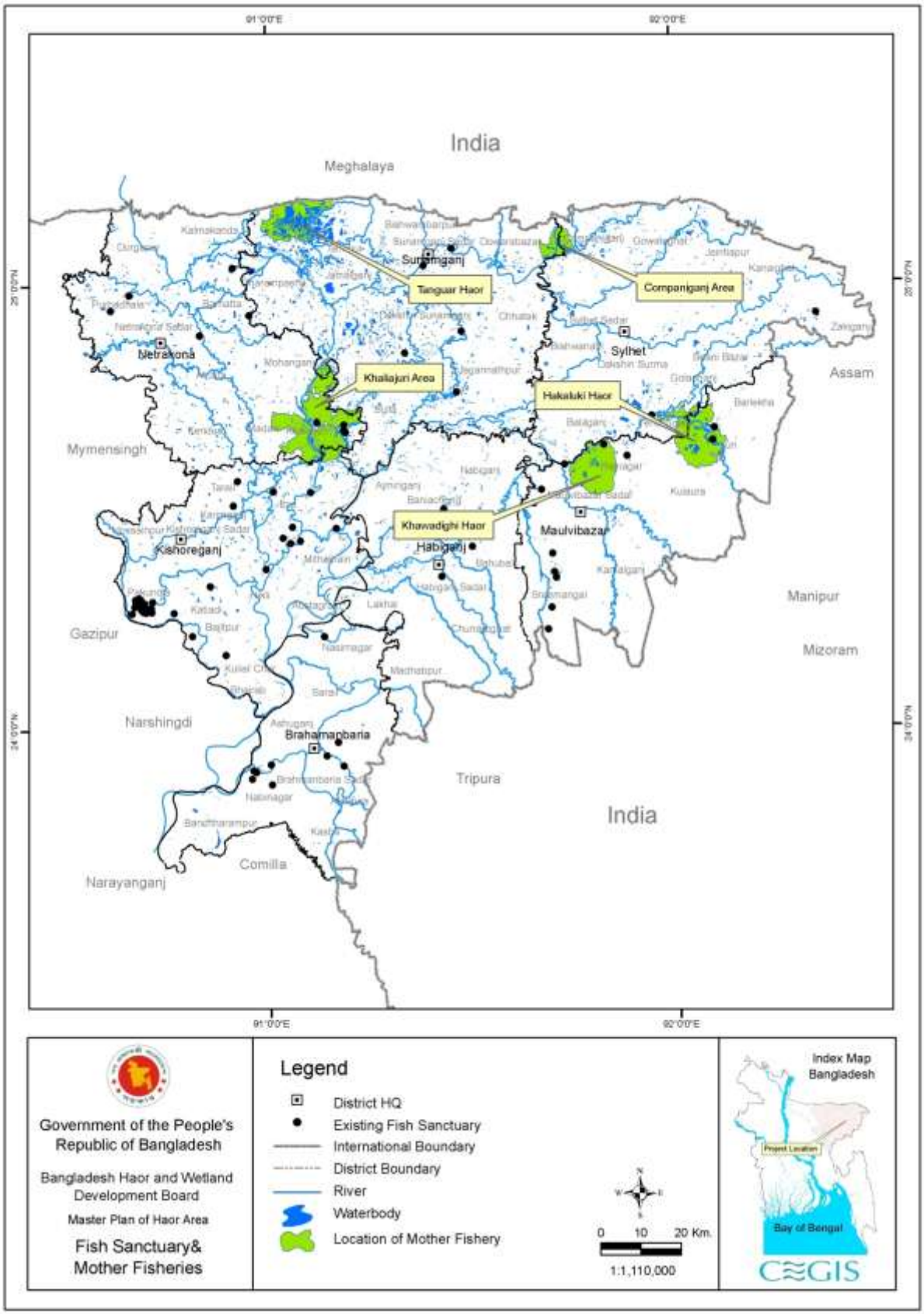


Figure 5.23: Fish sanctuary and mother fisheries of the haor area

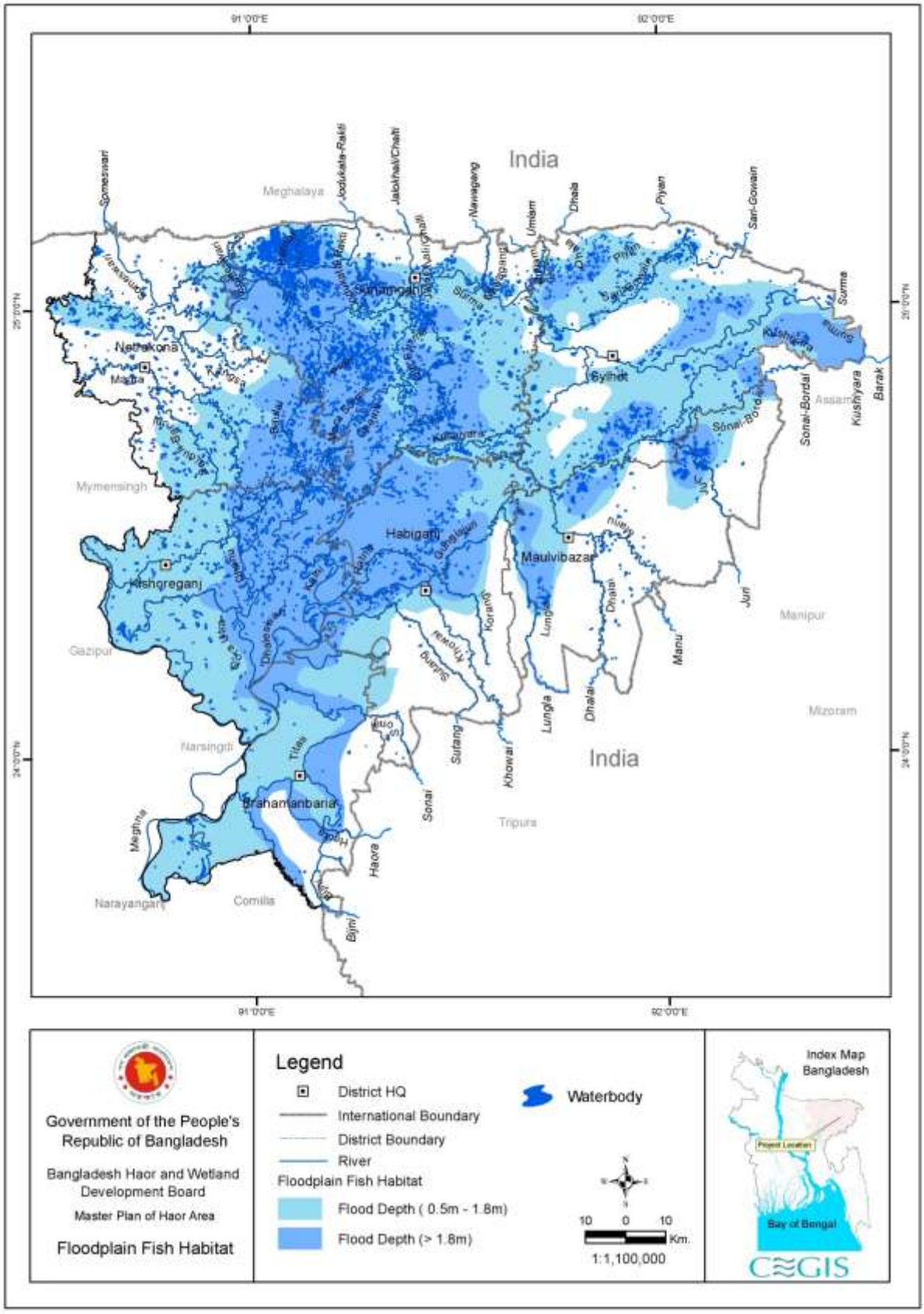


Figure 5.24: Floodplain fish habitat of the haor area

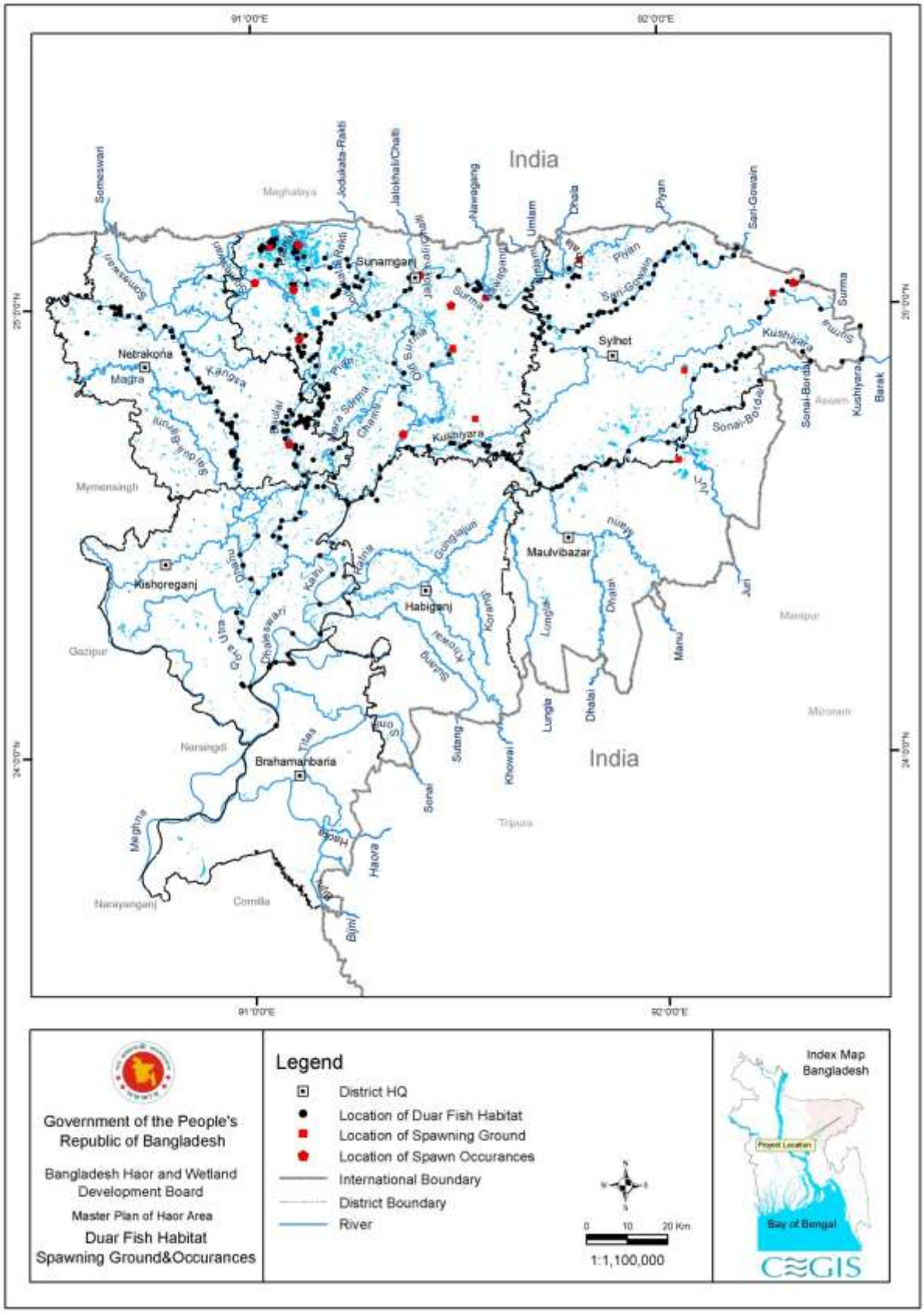


Figure 5.25: Duar fish habitat of the haor area

Livestock

Livestock is a major component of the agricultural economy of Bangladesh, performing multifarious functions such as food nutrition, income, draft power, manure, fuel, transport and saving foreign exchange. About 44% of the animal protein comes from livestock sources. Livestock resources also play an important role in the sustenance of the landless poor.

The livestock resources of the haor region are mainly cattle, buffaloes, goats, sheep, chickens and ducks (Table 5.16). Generally people of the haor area rear cattle, ducks and chickens. Livestock are raised at household and farm levels where having 1-2 cattle or goats and 5-6 chickens is common for the average family. The commercial farms mainly have about 10-50 cattle per farm and 100-1000 chicken per poultry farm.

Table 5.16**:** Livestock Population (2010-11) in Million

District	Cattle	Buffalo	Goat	Sheep	Duck	Poultry
Sunamganj	1.35	0.03	0.21	0.04	1.97	1.17
Habiganj	0.52	0.01	0.14	0.03	1.17	0.98
Netrakona	0.60	0.01	0.23	0.01	2.81	2.32
Kishoreganj	0.67	0.03	0.30	0.03	1.63	3.83
Sylhet	0.86	0.06	0.16	0.05	0.95	3.94
Maulvibazar	0.53	0.15	0.13	0.01	0.44	1.81
Brahmanbaria	0.48	0.01	0.11	0.02	0.78	2.11
Total in haor Region	5.01	0.28	1.29	0.21	9.75	16.15
National Total	22.9	1.26	21.56	2.78	39.84	212.47
% of Total in Country	22	22	6	7	24	8

There are around 32.68 million head of livestock (cattle, goats, sheep, ducks and poultry) in the haor farms. They constitute approximately 22% of the total cattle population in the country. The cattle populations are high in Sunamganj and Sylhet districts and are mainly of indigenous origin. Their productivity in terms of meat and milk is low.

Ducks and poultry are the major types of livestock population here with more than 24% of the country's total duck population found in the haor region. The highest number of duck population is found in Netrakona and Sunamganj districts. The majority of the people have the advantage of rearing ducks in the area specially the landless and marginal farmers. In Sunamganj, Netrakona, Kishoreganj and Habiganj districts, the duck population is higher than in the other districts. Poultry population is higher than other livestock in Sylhet, Maulvibazar, Kishoreganj and Brahmanbaria districts. Figure 5.26 shows livestock density of the haor area.

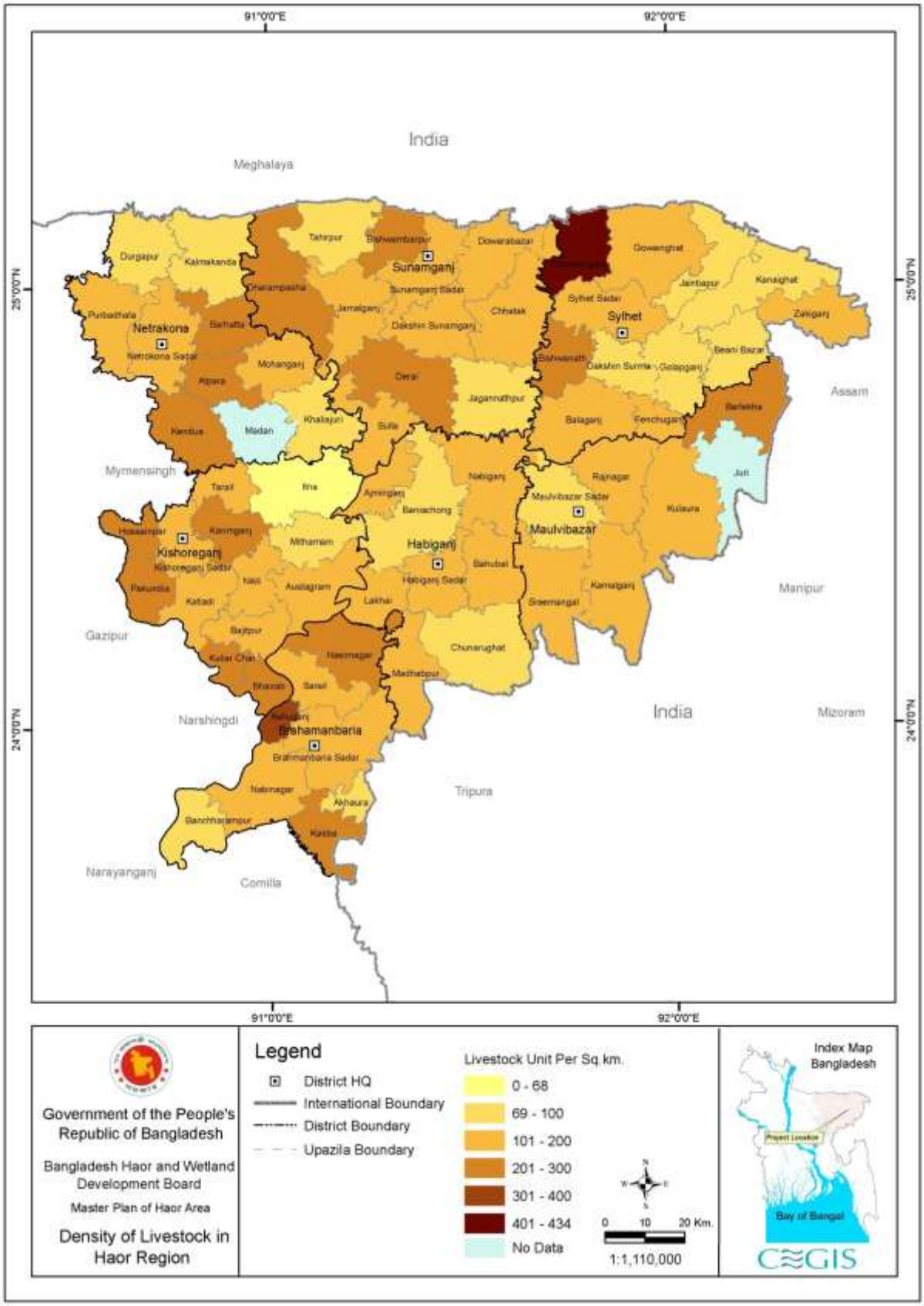


Figure 5.26: Livestock density in the haor area

The major potential areas of the livestock sub-sector in the haor region are to:

- increase the adaptive capacity of small and marginal farmers and marketing systems in order to reduce vulnerability to environmental risks;
- develop cattle farming through community participation and poultry through establishment of poultry model evolved by the DLS;
- improve the traditional livestock and livestock rearing system to increase productivity;
- initiate the integrated crop-livestock farming systems and establish linkage with smallholders up to the market;
- increase the income of the poor and marginal farmers and enhance food security through implementing the one-house one-farm model;
- create direct job opportunities through livestock and poultry development and marketing;
- take livestock production into account in the various rural development policies;
- explore the possibilities of investment priorities to create employment opportunities;
- create the scope of ensuring food security through enhanced production of milk, meat & egg including employment opportunity and poverty reduction through livestock rearing as well as developing infrastructure facilities and farmers' capacity through training.

Pearl

There is potential of Pearl culture at the bottom of water bodies and pockets of water bodies which can provide an additional source of income to the farmers and landless people.

Since the year round water availability of 0.5-1.0 m is a requirement for pearl culture practice, the hydrological regime in the haor basin is favorable for growing mussels year round, especially in perennial water bodies. The haor basin is a comparatively less industrialised area and less polluted than the other areas of the country. Moreover, pearl-mussels are also available in the natural environment of the area. *Lamellidensmarginalis* is very common here and could be selected for culturing due to its size and suitability. The culturing of pearls involves no fertilizer, feed, herbicide, drug, chemical, or antibiotic. There are no threats of corrosive leak into surrounding areas and no chemical leaching from pearl culture farms.

Pearl farming is labour-intensive and provides employment for both farm workers and in spin-off secondary support industries such as jewelry making. The business of pearl based jewelry making could be an ideal opportunity for the women and youth for income generation during their idle time or off farm period. Given the demand and prices of pearl, if pearl culture could be introduced in the haor region it would save some of the foreign currency spent every year on pearl import.

Power and Energy

Energy is one of the factors that support and accelerate growth of the country, but it is in poor condition in the haor area. The Rural Electrification Board (REB), which is entrusted with the distribution of electricity in the rural areas of Bangladesh, sponsors all programmes of electrification in the haor districts of Sylhet and Mymensingh through electric cooperatives called Palli Bidyut Samities (PBS). Although the principle of REB is to cover rural area under electrification, but the PBS follows certain revenue criteria for electrification that deprives the poor villagers from electricity. The status of electrification in the haor area has thus remained low. The electricity distribution system comprises of 46 substations along with 15775 km (Table 5.17) long 11Kv/6.35 Kv distribution lines and 9750 km long 0.4 Kv/0.23 Kv transmission distribution lines. Table 5.18 shows the electrification used in different purposes in the rural areas of Bangladesh.

Table 5.17: Transmission distribution

Name of the PBS	33/11 KV Sub-station (nos)	Transmission distribution line (km)	
		HT (11 KV, 6.35 KV)	LT (0.4KV, 0.23KV)
Sunamganj	3	1206	517
Habiganj	4	2287	980
Netrakona	6	2390	1049
Kishoreganj	6	1977	1186
Sylhet-1 &2	14	3518	2714
Maulvibazar	6	1865	1773
Brahmanbaria	6	2532	1531
Total	45	15775	9750

Source: REB Master Plan

Table 5.18: Electrification used in different purposes

Name of the PBS zone	Domestic In KWH	Commercial In KWH	Irrigation In KWH	Industry In KWH	Street light In KWH	Total In KWH
Sunamganj	43,850	7,149	71	765	47	51,882
Habiganj	108,255	12,982	977	1,726	431	124,371
Netrakona	62,229	11,872	3,933	1,550	59	79,643
Kishoreganj	88,053	13,807	1,946	1,762	254	105,822
Sylhet-1	135,138	22,424	25	1,952	294	159,833
Sylhet-2	38,177	5,393	103	769	51	44,493
Maulvibazar	109,289	18,828	217	1,559	1,115	131,008
Brahmanbaria	146,704	12,145	1,025	1,649	314	161,837
Total	731,695	104,600	8,297	11,732	2,565	858,889
National	7066,750	807,463	165,260	132,233	13,937	8185,643

Table 5.19 : Village electrification

Name of the PBS zone	No. of villages electrification till Dec 2010	Total no. of villages	% of villages electrification
Sunamganj	371	2,785	13
Habiganj	1,113	2,059	54
Netrakona	1,123	2,274	49
Kishoreganj	686	1,743	39
Sylhet -1,2	1,758	3,174	55
Maulvibazar	948	2,005	47
Brahmanbaria	741	1,334	56
Total	6,740	15,374	44
National	48,699	87,362	56

The total number of villages receiving electricity by 2010 was 6,740 out of 15,374 (Table 5.19) accounting for about 44% as compared to about 72% nationwide. As compared to the nationwide average consumption of about 200 kWh per capita, the haor area showed only 47 kWh in 2010. Sunamganj had the lowest use of electricity consumption with only about 17 kWh per capita followed by Kishoreganj and Netrakona. Table 5.20 Shows the annual and per capita consumption.

Although Bangladesh has acute shortage of electricity, there is no dearth of generating capacity in this area. As of September 2011, the total generating capacity of Sylhet division was 630 MW with capability of 597 MW, compared to which demand was only about 157 MW in the haor area. However, as the generation area in Sylhet is inter-connected with the power area beyond, available surplus power always flows out of the area. Sylhet is however, assured to be a “load-shedding” free area.

Power generation is the responsibility of the Bangladesh Power Development Board (BPDB). The generation capacity in terms of addition and expansion of the grid system is a centrally planned function carried out by the BPDB and the PGCB respectively.

The BPDB has a definite programme underway up to 2015 to augment generation capacity nationwide including Sylhet division to meet the projected demand. Therefore, in order to cater to the demand for necessary power in the haor area it would be necessary to only expand the distribution network in rural areas and extend consumer service connections.

Table 5.20: Annual and per capita consumption

Name of the PBS	Annual Consumption (m KWH)	Per capita consumption (KWH)
Sunamganj	45.12	17.04
Habiganj	147.95	64.89
Netrakona	62.82	24.19
Kishoreganj	81.60	24.64
Sylhet-1 &2	248.61	73.99
Maulvibazar	166.42	79.26
Brahmanbaria	151.00	49.19
Total	903.51	46.66
National	9952.55	200.00

The Power Grid Company of Bangladesh, a company under the BPDB, is responsible for developing transmission lines also known as a grid system for evacuating bulk power from power stations to substations. This is performed by high voltage transmission lines and substations of 132kV and 230kV. In order to meet the requirement of the short range generation programme, the PGCB is expanding the grid system including 400kV transmission lines.

The Power Development Board is understood to be updating a Master Plan for power system development (PSMP 2010). That Master Plan is concerned only with generation and transmission addition programmes. Area-based distribution programmes are developed such as for cities, towns and rural areas under rural co-operatives (PBSs). Long range programmes are based on load forecast that includes short and mid-range forecast as well. Load forecast has been finalized which is learnt to be based on 7% growth in GDP. Growth of per capita income will be dampened by population growth that will take place. However, the projected GDP growth requires that depressed areas be given priority for public sector investment to share the dream of a better life. Higher growth is a normal phenomenon on a low economic base; and low efficiency, i.e., high energy/GDP elasticity will prevail for quite a while in such areas.

All the same, the haor area demand is included in the nation-wide forecast of demand for the purpose of power generation and grid expansion. However, the forecast at field level has to be done for planning and developing the distribution system. These are being done routinely by the Palli Bidyut Samities. Recently they have developed a Master Plan up to 2020, which has been reviewed for facilitating the Master Plan of Haor Area. A plan has been developed consequently in the macro perspective taking into consideration GDP growth, Vision 2020 targets etc. and verified to see if the Master Plan of the PBSs is sufficient to provide electricity for supporting the national objectives.

Industry

Industrialisation has not taken place to a great extent in the area and consequently the number of industries and people engaged is comparatively low (1.33% of the total population only). However, most of the tea estates are in the Sylhet region (Table 5.21). Sylhet is also known for its cane products. The industrial product of the Sylhet region includes fertilizer, cement and liquefied petroleum (propane) gas. Other industries include food and beverage, textiles and leather, chemical and plastic, non-metallic mineral product and metal equipments. There are also several handicraft and cottage industries, including mat weaving and bamboo work.

Table 5.21: Status of type of Industries in haor, 2010

District	Type of Industry			
	LI	MI	SI	CI
Sunamganj	4	1	100	4,371
Habiganj	8	13	129	4,643
Netrakona			329	4,854
Kishoreganj	1	5	307	3,330
Sylhet	7	3	1,605	10,805
Maulvibazar	51	7	120	1,289
Brahmanbaria	2	5	10,983	3,079
Total	73	34	13,573	32,371

Note: LI: Large Industry; MI: Medium Industry; SI: Small Industry; CI: Cottage Industry

The industrial economy of the haor area is based on cottage and tea processing industries. The area is endowed with ample natural resources to develop cottage industries, including shitol pati factories, bamboo and cane furniture factories, herbal medicine factories and others. Tea processing is a potential sector in the northeast region of Bangladesh. Presently there are number of tea estates located in the eastern belt of the Master Plan area. There is also scope for establishing new tea estates and tea processing industries in Maulvibazar, Habiganj and Brahmanbaria districts.

There is ample scope for developing the tourism industry. Women (particularly tribal women) entrepreneurs may be given preference in service industries such as ICT, tourism and service, advertising and handicrafts etc. There are further opportunities for development of livestock and food production industries. Against the backdrop of arsenic contamination of groundwater in the north-eastern zone of Bangladesh and availability of surface water, there exist the scope and opportunity for establishing water purification plants for supply of safe drinking water

5.6.2 Major Service Areas

Water Supply

Most of the households of the haor area are found using tube-well water (groundwater) for drinking purposes. About 50% of the households are dependent on surrounding river/pond water for domestic use. As a result, in spite of having safe water collection sources, the haor people are affected by many water borne diseases. About 10% of the total population surveyed in haor localities had no idea about safe water (13% from severely flood prone and 7% and 10% from moderate and normal flood prone areas), 42% mentioned tube-well water and 25% mentioned arsenic free tube-well water as safe water. The rest of the people said that safe water meant water free from dust, disease and microorganism. The people of about 80% of the households were found

Table 5.22: District-wise water supply coverage

District	No. of Water source/ Technology	No of Population/Water Source/Technology
Sunamganj	16,446	152
Habiganj	20,485	93
Netrakona	24,848	98
Kishoreganj	30,420	93
Sylhet	26,235	107
Maulvibazar	18,828	99
Brahmanbaria	26,158	126
Total	163,420	105

suffering from diarrheal diseases. Dysentery, cholera, typhoid and skin diseases were also common water-borne diseases in 43%, 42%, 17% and 28% households, respectively.

The major drinking sources of water are the Shallow Tube Well (STW), Deep Tube Well (DTW), ring wells, Shallow Tara Pump, Deep Tara Pump, piped water supply, VSST, SST and pond sand filter (PSF), rainwater harvesting system (RWH) etc. The district-wise water supply coverage is presented in the Table 5.22 presented in this section. From the present situation analysis it has been observed that number people /water sources is about 100 to more than 150 whereas the minimum standard is 50 people/water sources and recommended number is 25 people/water sources. Further, out of 7 districts, 3 have a very low coverage of drinking water sources of more than 100 people/water sources. Sunamganj district has the lowest coverage of more than 150 people/water source. Figure 5.27 shows safe drinking water used by households in the haor area.

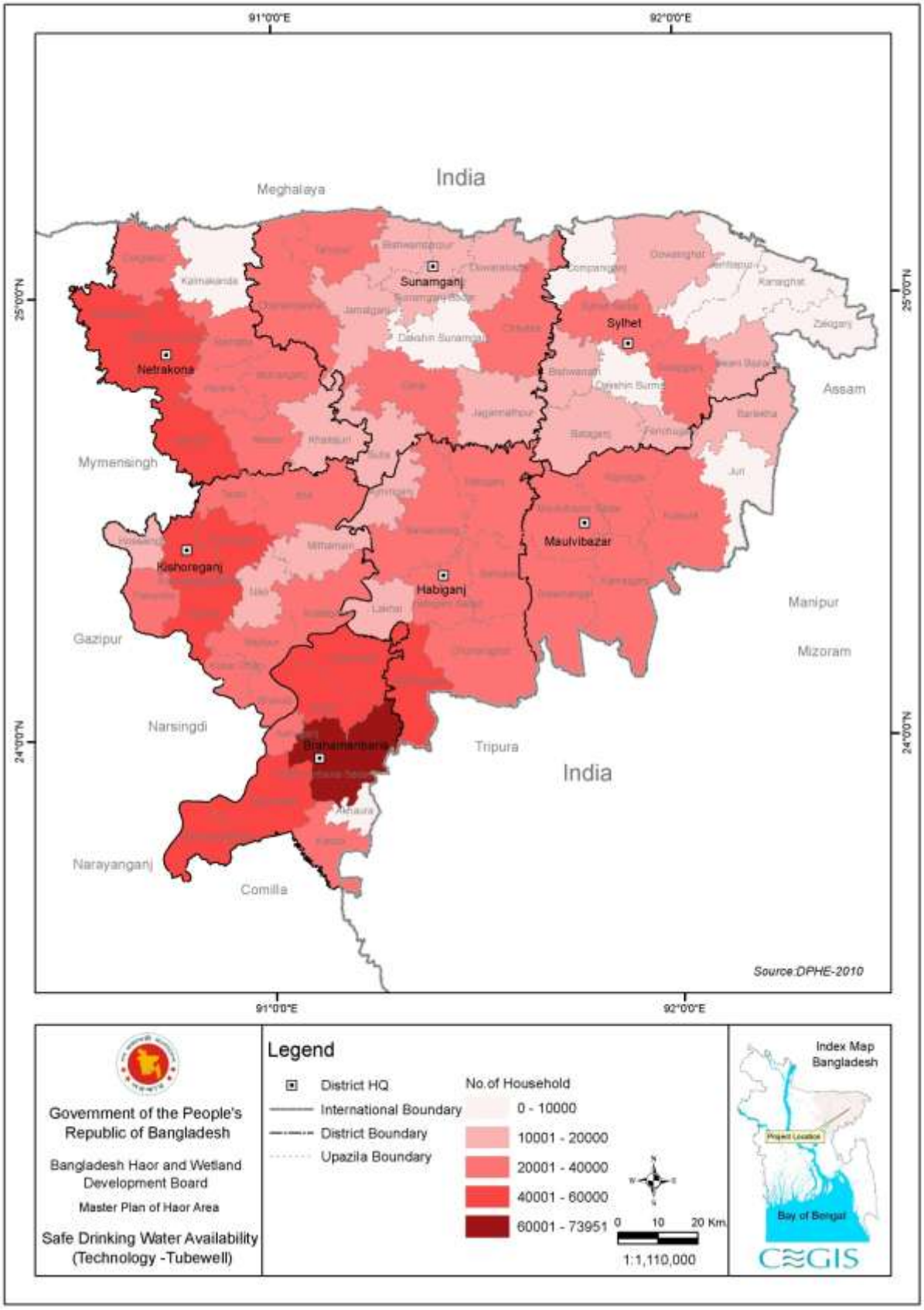


Figure 5.27: Tube well used by households in the haor area

Sanitation System

The sanitation facilities of the haor area (Table 5.23) are poor compared to other parts of the country. On average 11 persons are found to use one latrine in these areas. 49% of the households have latrines with inadequate capacity. 66% of the latrines are made by surki/khoa or only sand or brick. 28% of pits do not have any prepared base. Over 60% of the latrines are defective owing to bad quality construction materials and process. 99% of latrines were constructed without any skilled supervision. Flooding, high water table, excessive rainfall and loose soil formation are the causes of overflow and collapse of pit latrines. Every year most of the areas remain under water for about 4 to 7 months and almost all existing sanitation systems are severely damaged or washed away. It is almost impossible for the hardcore poor to reconstruct toilets on a regular basis. In fact, the main reasons for poor sanitation coverage in the haor area are lack of proper awareness and financial constraints. Only 44.25% of people on average use sanitary latrines in the haor region with Netrakona having the poorest coverage of 35%.

Table 5.23: Sanitation facilities

District	Use of Sanitary Latrine in %
Sunamganj	40
Habiganj	41
Netrakona	35
Kishoreganj	49
Maulvibazar	55
Sylhet	57
Brahmanbaria	46
Total (Average)	44

From the present situation analysis it has been observed that around fifty (50%) percent of the households have latrines with inadequate capacity. Based on the data analysis of the core haor area it has been found that around 50% people has no access to sanitary latrine and at some places the situation is worse especially in Dharmapasha upazila of Sunamganj district where less than 30% of the people have access to sanitary latrine.

The provision of physical sanitation facilities alone is not enough for the haor inhabitants to protect themselves from diseases or the environment from further degradation. Specific and specialised hygienic sanitation systems are essential for the haor people. Different organizations, especially BUET, have conducted research on suitable sanitation technologies for flood prone areas. There are several sanitation technologies, such as the Earth Stabilised Raised Pit (ESRP) latrine, step latrine, mound latrine, Sand Enveloped Latrine (SEL) (suitable for high water areas near foothills) and high raised villages and Sand Enveloped Raised Pit (SERP) latrine etc. These technologies have potential for the development of hygienic sanitation facilities in the haor region. Figure 5.28 shows the household wise availability of toilet facilities in the haor area.

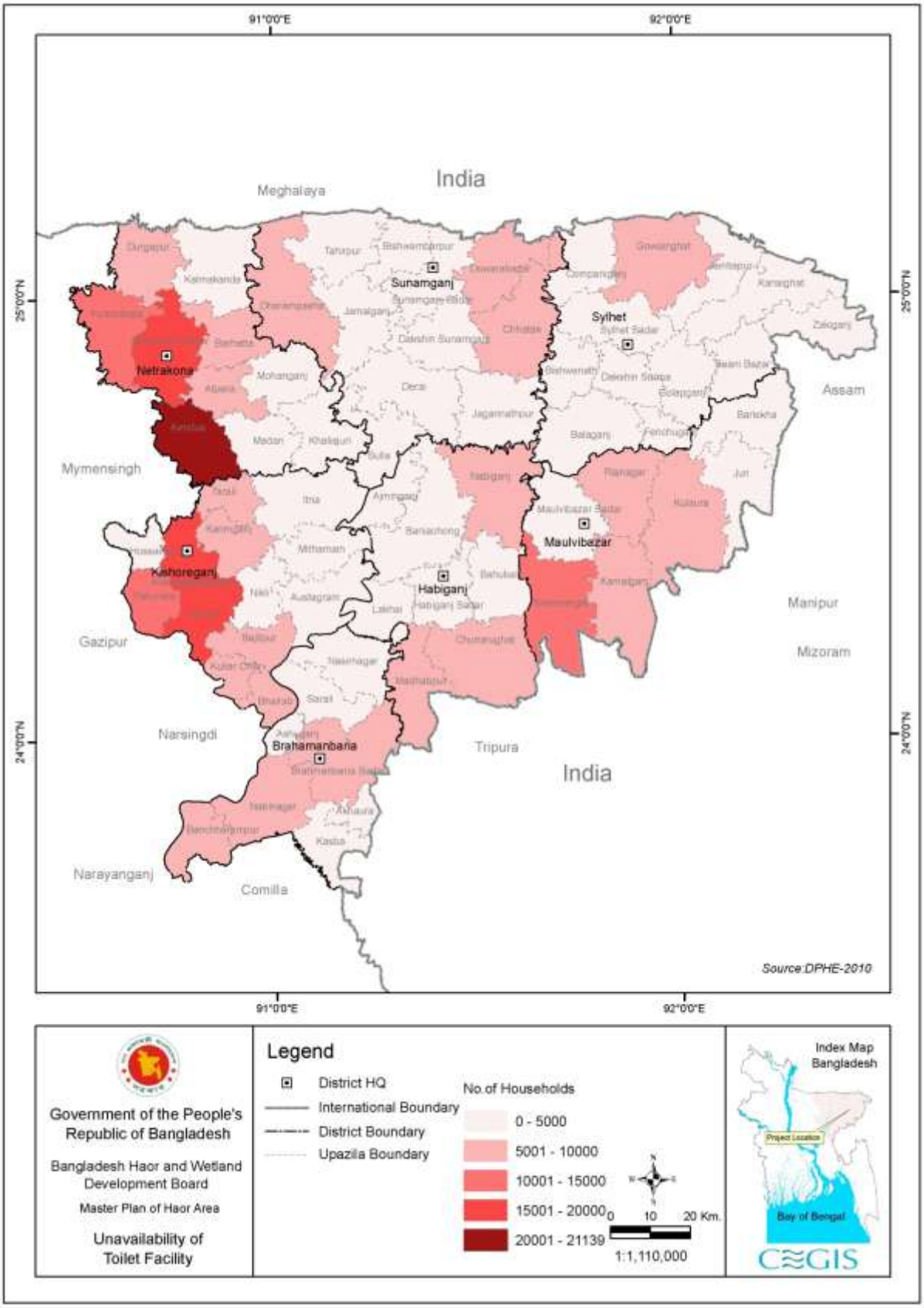


Figure 5.28: Unavailability of toilet facility in the haor area

Education

The drop-out rate of boys in primary school is higher than that of the girls in the seven Haor districts. In reverse the girls' drop-out rate is higher than that of boys in the secondary schools.

Currently, about half of the people of this country are literate (45.2%). The literacy rate of the haor districts is on average 38% (Figure 5.29). The country as well as the haor region has still to achieve the goal of 100% literacy of the MDG and the Outline Perspective Plan (OPP). In the haor region the male literacy rate is slightly higher than the female literacy rate. From among the haor districts Maulvibazar has the highest literate population (42%) followed by Sylhet (41%), Brahmanbaria (40%), Habiganj (37%) and Kishoreganj (37%), Netrakona (34%) and Sunamganj (33%). Upazila level literacy rates are very low except in Habiganj Sadar, Beani Bazaar, Dakshin Surma, and Sylhet Sadar where the rates are more than 50%. Most of the upazilas of Sylhet, Habiganj, Maulvibazar and Sunamganj districts have literacy rates of less than 40%. There are three upazilas (Companiganj, Gowainghat and Kanaighat) in Sylhet district having a literacy rate of less than 30%. On average, the literacy rate in the haor upazilas is slightly lower in the districts of Sunamganj, Kishoreganj, Netrakona and Brahmanbaria except for Sylhet which has a higher rate of literacy. Female education is as much important as for the male because of the vital role they play in the family and society. Maulvibazar district of Sylhet division has the highest percentage (72%) of literate women aged 15-24 years. Habiganj has the lowest percentage (56%) of literate women.

Children from poor families become engaged in different types of income earning activities to provide financial support to their families. Many parents also cannot afford to send their children to school because of inaccessibility and huge transport cost. Hence, school attendance of the children of the haor region, especially of remote areas, is very low. The rate of student attendance in primary school in the haor region is more or less similar to the national rate of 81.3% (Figure 5.30). About 60-80% percent of both male and female students attend school in the seven haor districts. The highest rate of attendance is observed in Maulvibazar with 81% and the lowest in Sunamganj with 67%. About 29.2% to 41.7% children attend (Figure 5.31) secondary school which is less primary school attendance. This also indicates that transition of students from primary school to secondary school is low. Similarly school dropout is very high in the haor region (44%) as a result of their poor socio-economic condition. Poor students are unable to stay the whole day in class on empty stomach.

Primary schools are predominant among the educational institutions available in the haor districts. However, many parts of the haor region are too remote and therefore beyond the reach of educational facilities. Other educational institutions such as high schools, colleges, universities and

Table 5.24: Number of Primary Schools by Type

Districts	GPS		RNGPS		Community Schools		Others		Total	
	Total	Haor	Total	Haor	Total	Haor	Total	Haor	Total	Haor
Sunamganj	856	856	464	464	94	94	33	33	1447	1447
Habiganj	732	732	245	245	54	54	22	22	1053	1053
Netrakona	630	403	464	266	57	30	15	9	1166	708
Kishoreganj	808	754	404	355	72	70	21	19	1305	1198
Sylhet	1,066	1,066	181	181	92	92	11	11	1350	1350
Maulvibazar	692	605	207	152	63	56	65	48	1027	861
Brahmanbaria	690	340	230	143	82	33	31	15	1033	531
Total	5,474	4,756	2,195	1806	514	429	198	157	8381	7148

Source: MoE, 2010

vocational institutes are low in number (Figure 5.32). The details of the number of educational institutions are presented in the Table 5.24 and Table 5.25.

The proposed infrastructural development should include establishment of at least one school or learning center per haor area, management of floating educational institutions, arrangement of school boats with support from local institutions, establishment of educational institutions for each neighborhood, repairing of infrastructures, establishment of one laboratory for every school in haor area, introduction of a separate holiday calendar, installation of computer training facilities at school level, construction of government high school at upazila level, supply of text book among students on time, more monetary allocation for educational institutions and arrangement of haor allowances for teachers. Adequate, experienced, highly qualified, skilled teachers should be recruited in proportionate numbers to ensure quality education. In order to reduce drop-out rate, emphasis should be given to activities such as stipends for all students, compulsory education at primary and secondary levels, free education for all students, extended allocation for social safety net programmes and introduction of meals at all the primary schools. For higher study, establishment of specialised university (e.g. Engineering, Agriculture, etc.) might be considered.

Table 5.25: Number of educational institutions

Districts	Secondary School		College		Madrasa		Vocational Institutes*		University
	Total	Haor	Total	Haor	Total	Haor	Total	Haor	
Sunamganj	149	149	27	27	76	31	2	2	
Habiganj	108	108	22	22	57	7	2	2	
Netrakona	186	106	30	19	89	10	6	6	
Kishoreganj	202	183	30	28	140	30	9	9	1
Sylhet	256	256	60	60	121	4	4	4	1
Maulvibazar	141	122	27	24	62	7			
Brahmanbaria	182	85	36	15	80	4	7	4	
Total	1224	1009	232	195	625	93	30	26	2

*Source: MoE, 2010 and *BBS 2010*

The environmental condition in the haor region makes it more difficult to gain access to educational institutions. Therefore arrangement of boat transportation facilities for school-going children, facilitation of transportation and communication development programmes and construction of submersible road networks to facilitate communication with educational institutions will be required to adapt to the environment. For providing protection from flood damage, the infrastructures should be built on highly elevated lands or above the existing flood level.

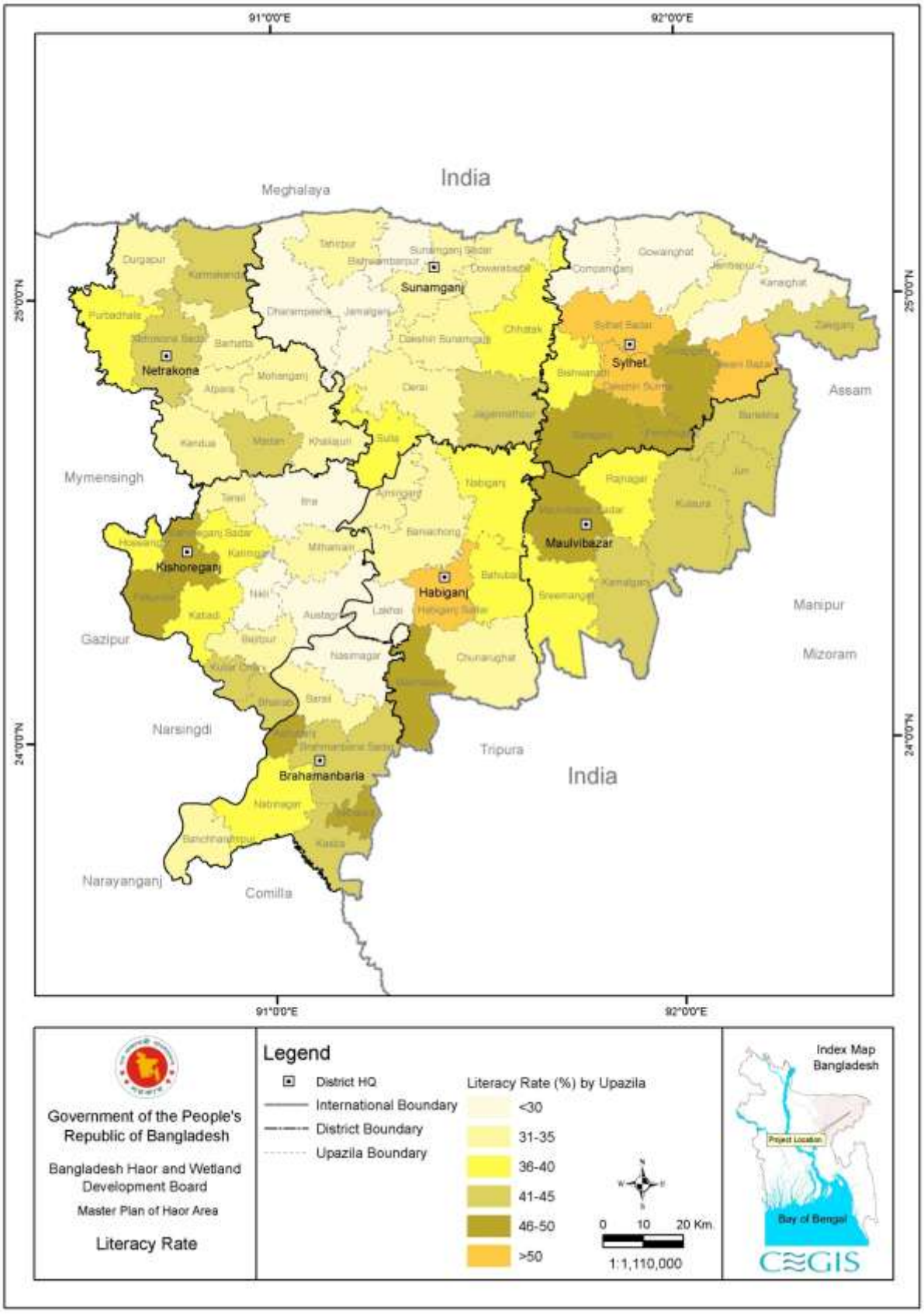


Figure 5.29: Literacy rate in the haor area

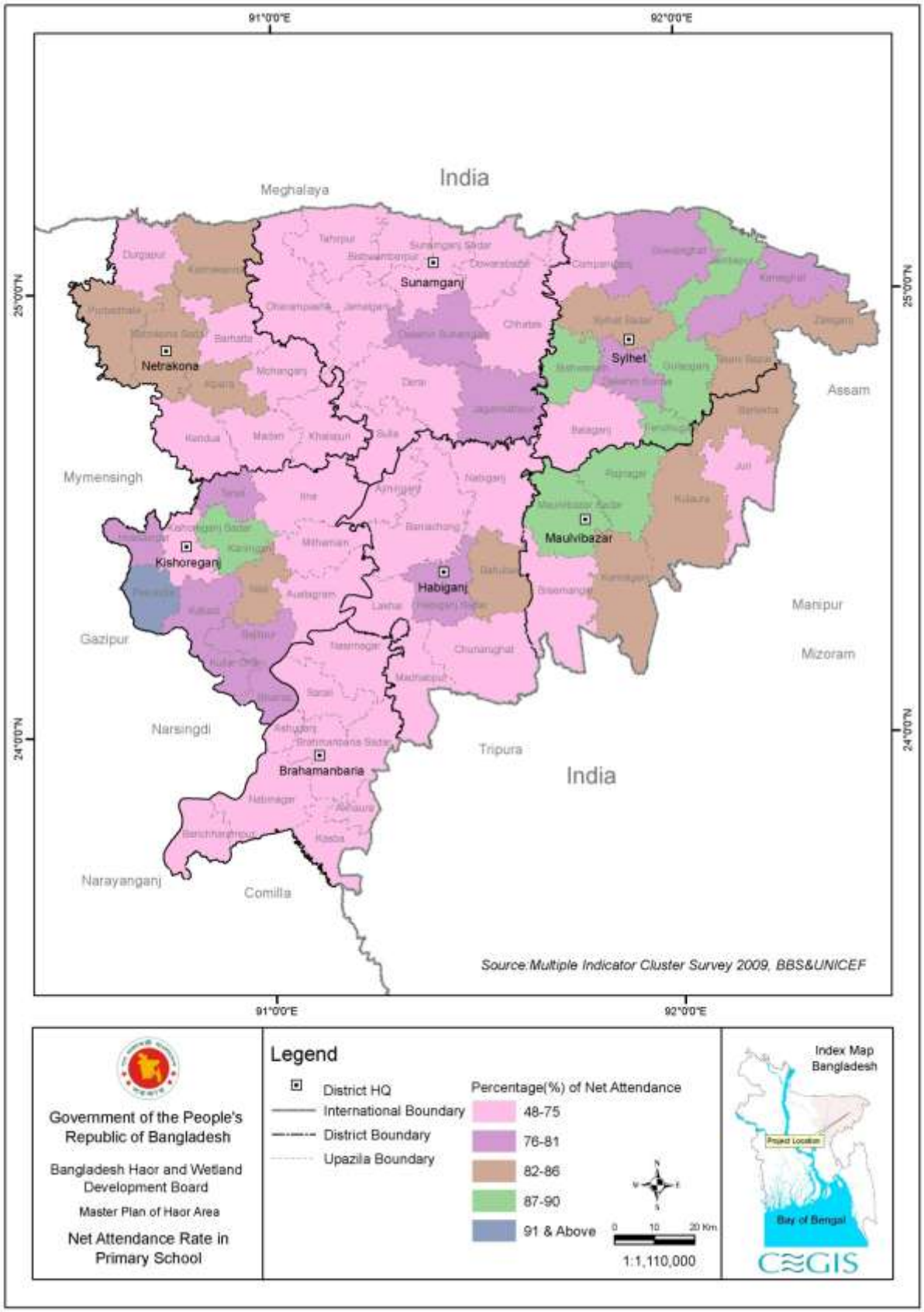


Figure 5.30: Attendance rate in primary school

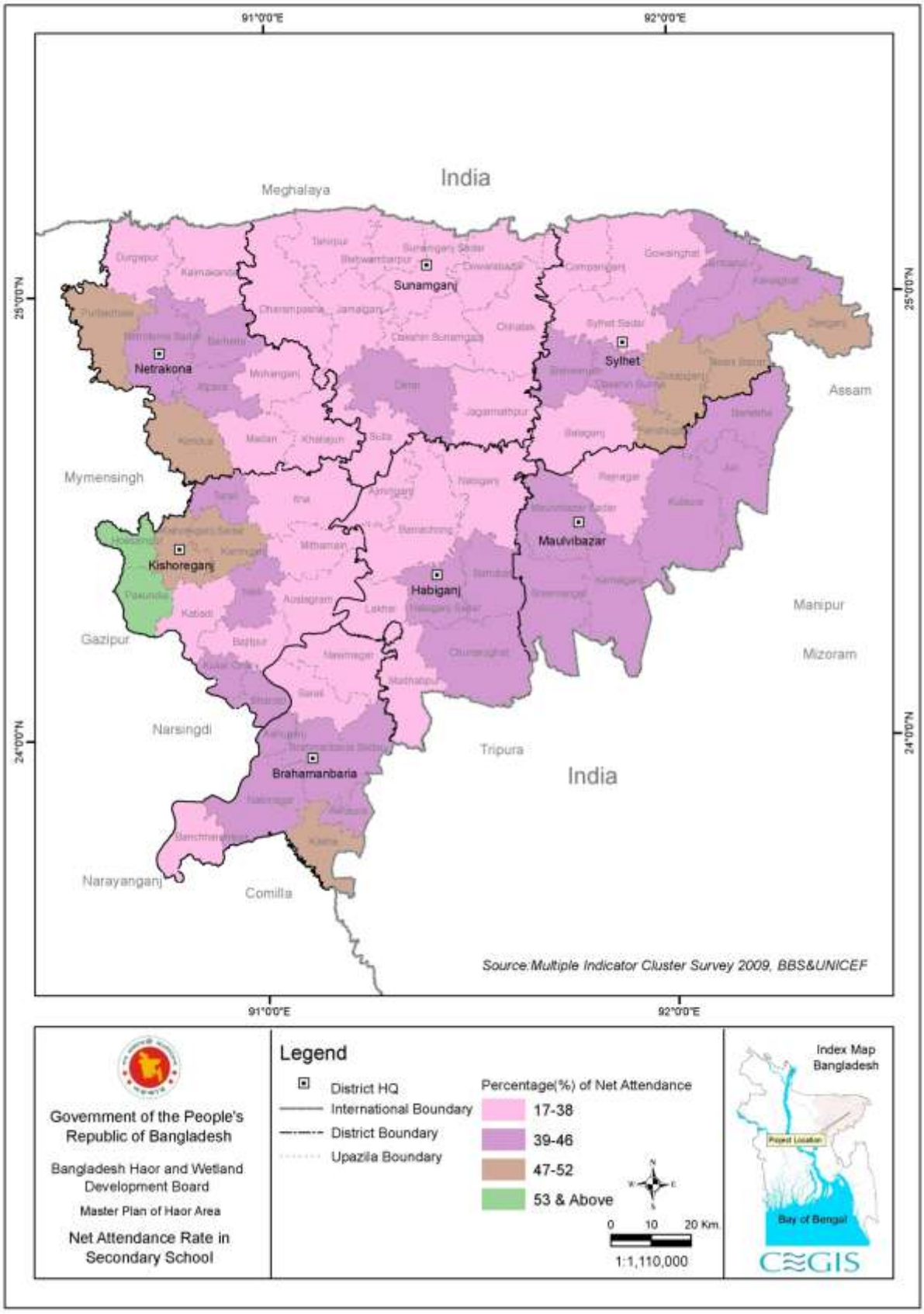


Figure 5.31: Attendance rate in secondary school

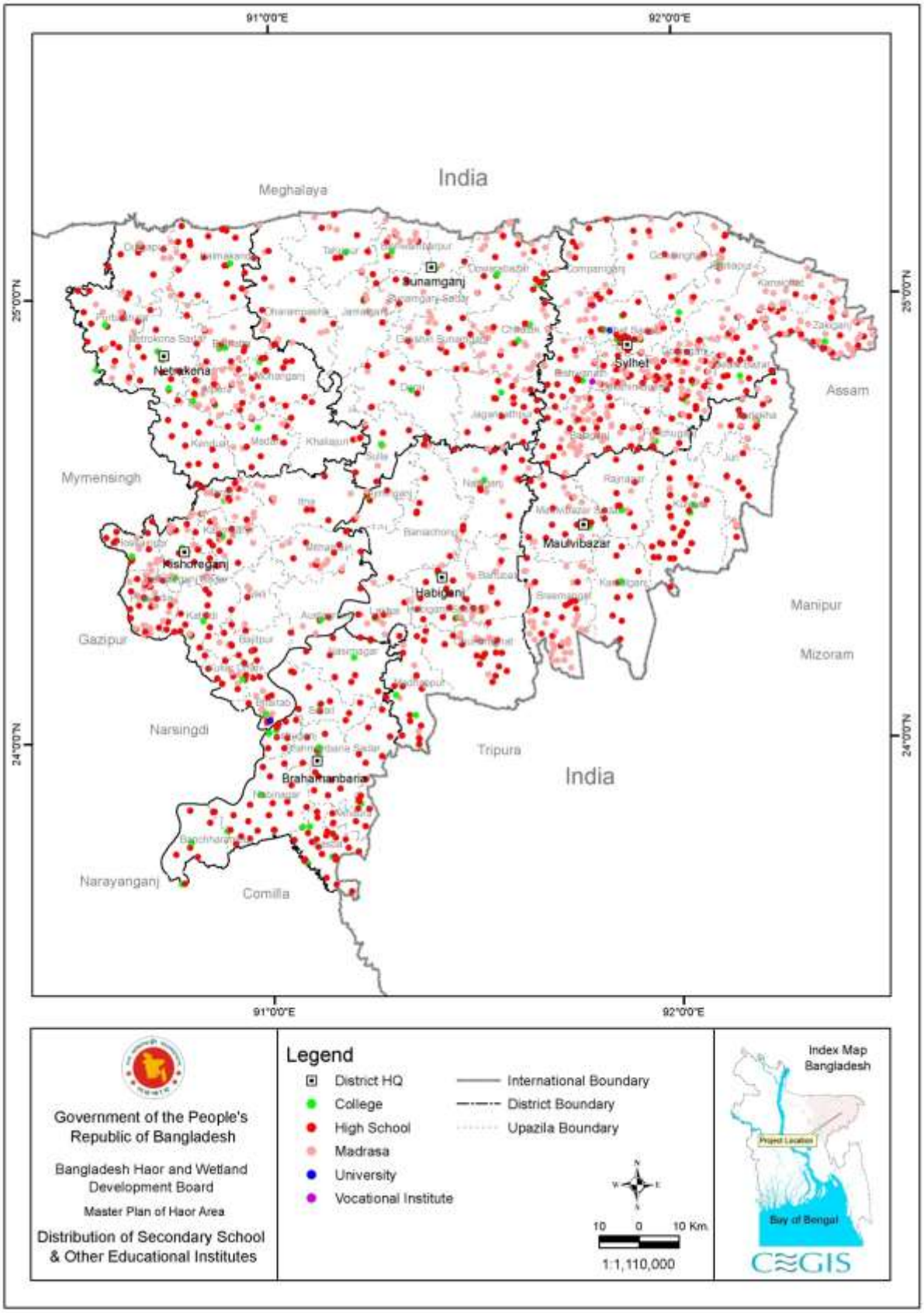


Figure 5.32: Locations of educational institutions

Health

For ensuring national development, health is one of the foremost prerogative in the national policies and plans namely the MDG, the OPP, the National Health Programme (NHP) etc. Reducing child mortality rates; Improving maternal health; and combating HIV/AIDS, malaria and other diseases are the three main goals identified in the MDGs. The country is on its way to achieving the MDG targets, attesting to marked progress compared to other developing countries. However, burdened with poverty and stressed with infrastructure inadequacy, the overall health status in the haor region continues to lag behind the national benchmark with the prevalance of both communicable and non-communicable diseases.

Table 5.26: The number of health organizations

Districts	Upazila Health Complex (UHC)	Community Clinic (CC)	Upazila Health & Family Welfare Center (UH&FWC)
Sunamganj	9	164	59
Habiganj	7	171	60
Netrakona	9	196	74
Kishoreganj	12	233	86
Sylhet	10	187	80
Maulvibazar	5	148	53
Brahmanbaria	6	192	88
Grand Total	58	1291	500

Source: HED, 2010

The communicable and non-communicable diseases prevalent in haor area are: asthma, peptic ulcer, anaemia, Acute Respiratory Infection (ARI), worm infection, hypertension, diarrhoea, malnutrition, skin diseases, dysentry, malaria, pneumonia and fever (influenza). Among these diseases the incidence of peptic ulcer, diarrhoea, anaemia, ARI, asthma, worm infection, skin diseases and hypertension are the most common. The malaria endemic districts of Habiganj, Maulvibazar, Netrakona, Sunamganj and Sylhet had 5345 number of case loads in 2009 (DGHS 2010). More than 1600 cases of malaria was found in Sunamganj and Maulvibazar with the death of 6 in Netrakona in the last year (DGHS 2010). The emerging non-communicable diseases are ischaemic heart disease, Diabetes Mellitus, cancer, Chronic Obstructive Pulmonary disease, mental health problems and injury. The incidence of HIV/AIDS is also observed in the haor districts with only 6-15% (MICS 2009) of women having comprehensive knowledge on HIV prevetion methods and awareness about the misconceptions.

Maternal mortality is of major concern which occurs due to poor health condition, unsafe delivery by unskilled birth attendants and delay in delivery process. In Bangladesh, Maternal Mortality Rate (MMR) per 1000 live births was 3.2 in 2001 (BMMS). The majority of the women (62% to 85%) in the haor region are assisted by the Traditional Birth Attendant (TBA). Delivery conducted by skilled health personnel or Community-based Skilled Birth Attendant (CSBA) on average is only 13.4% for all the haor districts lower than the MDG target of 15% and national average of 18% (BDHS, 2007). Without proper assistance many infants and even their mothers succumb to death. The average Infant Mortality Rate (IMR) and Child Mortality Rate (U5MR) in the haor area, except for Brahmanbaria district, are 57 (per 1000 infants) and 76 (per 1000 children) which are much higher than the national IMR of 49 and U5MR of 64 and also way beyond the MDG target of IMR of 32 and U5MR of 48. The high infant and child mortlaity is also due to malnutrion. The average of under-5 child malnutrition for haor districts is approximately 46% which is again higher than the national rate of 43% (BDHS, 2007).

Health services and facilities in the haor region are available in four tiers: 7 hospitals at district level, 58 Upazila Health Complex (UHC) at upazila level, 500 Upazial Health and Family Welfare Center

(UH&FWC) or Rural Dispensary (RD) at union level and 1291 Community Clinic (CC) at community level. Only in the haor upazilas, there are 51 Upazila Health Complex and 1009 Community Clinic. Considering the total number of health centers in Brahmanbaria there are 287 number of health facilities with a population coverage of 10696, in Habiganj 239 health facilities with a population coverage of 9540, in Kishoreganj 332 health facilities with a population coverage of 9974, in Maulvibazar 207 health facilities with a population coverage of 10143, in Netrakona 280 health facilities with a population coverage of 9272, in Sunamganj 233 health facilities with a population coverage of 11367 and in Sylhet 278 health facilities with a population coverage of 12086 per facility (Table 5.26).

The paucity of human resources in health facilities is reflected in the low coverage of population per doctor and nurse. In the haor region, population coverage per doctor is 23304, which is about ten times higher than the national value of 2785. The lowest coverage is observed in Habiganj (44,000) followed by Sunamganj (37,000) district. The number of population per nurse is 11729 in the haor region compared to the ratio of 5782 at national level. This ratio is the highest in Kishoreganj (15,920) followed by Maulvibazar (15,553) and Sunamganj (13,000) districts. The nurse-doctor ratio in the haor districts is 1.83:1 on average compared to the national ratio of 2.07:1.

PCM participants comprising local leaders, elites and general people suggested planned community clinics to be established in the haor area with necessary resources. They also recommended the introduction of a community based health care model with training and involvement of the community health care providers (village doctors and TBAs), community leaders and other sectoral people. The haor region also has urgent need for community based transportation and mobile clinics. Water transport facilities are needed to facilitate government health and family planning workers in their field visits and to conduct the mobile clinic. Emergency medical teams would be invaluable in ensuring service during disasters while improved sanitation and safe water supply during disasters and effective referral systems for emergency cases in health facilities at all levels could greatly help to improve the situation.

Demand side financing (DSF) and the National Nutrition Programme (NNP) should be scaled up in all haor districts and union health and family welfare center and community clinic should be established if not already existing. The PCM participants expressed the belief that building awareness about health among the common people; access to primary health care services; multi-sectoral cooperation and coordination in the implementation of health care programmes, particularly during disasters and improvement of nutrition as well as strengthening of the existing health system to provide health care and emergency obstetric care, would all contribute to a stronger and more responsive health care system in the haor region. Figure 5.33 shows the locations of health care facilities of the haor area.

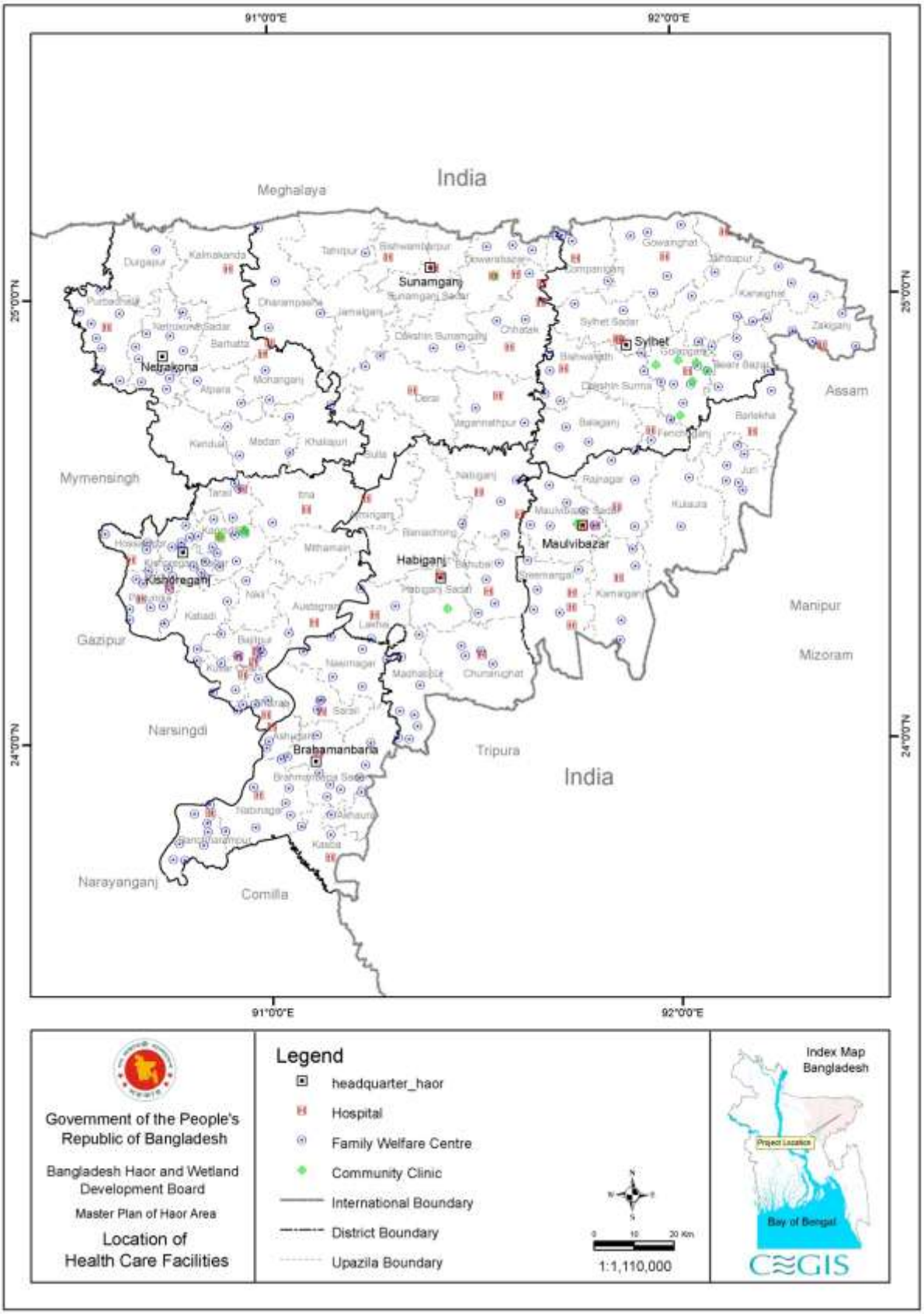


Figure 5.33: Locations of health facilities in the haor area

Tourism

Tourism is a source of socio-economic benefit for a region or community. It is the growth of an industry with some combination of natural, historical, archeological, scenic and cultural attractions. Haor are unique wetlands that have potentials for attracting tourists. The haor and beels receive thousands of migratory birds during winter. Winter is the ideal season for bird-watchers, but it is also a time when the haor are reduced in size and loss much of their watery grandeur. There are a number of locations in the haor districts which can be developed for tourism. The government aims to increase the current GDP rate of the tourism sector from 0.70 to 2% by 2015 and then to 5% by 2021 (OPP, 2010) (Table 5.27).

Table 5.27: District wise tourist spots, 2010

District	Natural	Man-made
Sunamganj	2	8
Habiganj	10	22
Netrakona	4	15
Kishoreganj	1	14
Sylhet	6	18
Maulvibazar	13	13
Brahmanbaria	1	17
Total	37	107

This sector has been identified in the country's Industrial Policy as one of the thrust sectors. The Sixth Five Year Plan has kept provisions to set up facilities for eco-tourism and recreation. According to the Tourism Policy, the haor districts suitable for eco-tourism development are Tamabil, Jaflong, Madhabkunda, Sreemangal, Lawachara forest in Sylhet and the haor of Sylhet-Sunamganj (NTPo 2009). Facilities for education and research including eco-tourism have already been initiated which would be extended in the future. Analysis of statistics on tourism reveals that 42% of the arrivals in Bangladesh are mainly for tourism, 39.35% for business, 1.82% for official trips, 5% for study, 3.29 for religious activities and 1.82 for other purposes. The highest peak occurs in the months of April-July and November-December during the summer and winter holidays.

Table 5.28: Name of the important sites for tourists

District	Important Sites
Sunamganj	Tanguar haor, Hassan Reza museum, house of poet Durbin shah, Sukhair Zamindar palace, Maheshkhali Kalibari Mandirs, English Tilla, Pagla Mosque, Dalura War Cemetery.
Habiganj	Alia Sora Khashia Punji, war cemetery of 1971, temple of Sachion gondham, graves of Sipahsalar Hazrat Shah Syed Nasiruddin, Sankar Pasha Shahi mosque, Mazar of Bayezid Shah, mazar of Shah Fateh Gazi
Netrakona	historical places at Birishiri, Seven martyrs graveyard, Salki village, mazar of "Kella Shahid", Komolaranir dighee, Royal Bari Mosque, Jafarpur Khoja Mosque
Kishoreganj	Egarosindur Forte, Zamindars' House, Kutub Shahi Mosque, Pitalganj Nil Kuthi (Indigo Center, 1800), Kulishwari Kali Mandir
Sylhet	Shrine of Saint Hazrat Shah Jalal, house of Roy Bahadur Shaheb, Khan Bahadur Shaheb, Sri Choitenna, Majar of Akum Shah, temple of Gouranga Mohaprovu, Dreamland Park and Koilashtilla.
Maulvibazar	Madhabkunda Eco-Park, Lawachara National Park, Memorial complex of Birshesthra Hamidur Rahman, Madhabpur Lake, War cemetery of 1971, Barshijora Eco-park, Baikkar Beel and tea, gardens, Hummam waterfall.
Brahmanbaria	Mazar of Kella Shahid, Gangasagor, Nawab house of Gokarna, Zamindar house at Chatalpar, mosque & temple in Fandauk, Bidyakut

The beautiful hilly forest areas of the region, the picturesque tea gardens of Sreemangal in Sylhet and the scenic waterfall of Madhabkunda in Maulvibazar attract many tourists. The Bangladesh Parjatan Corporation (BPC) hotel in Sylhet recorded a total of 6000 tourists in the year 2009. The BPC has the responsibility of developing tourism facilities in potential spots as per the 'Tourism Policy 1992'. Since its formation in 1972, the BPC has renovated the existing facilities and developed many new ones. The tourist spots in the haor region include the *Shah Kutub Shahi* mosque, ethnic community temples, the shrine of Norgaon Pir and the shrine of Saint Hazrat Shah Jalal (which is a major historical site located in Sylhet town), houses of poets and zamindars (landlords), the

historical Sholakia grounds, the Ram Krishna Mission, the Shahi Eidgah, the Baikkar Beel, the Madhabpur Lake (Kishoreganj), the 1971 War Cemetery at Shamshernagar, an eco-park, the national botanical gardens at Lawachara, rubber gardens and pineapple gardens, fruit valleys and the recently discovered Hammam Jharna, etc. Table 5.28 shows the name of some important sites for the tourists .

Strategies for developing tourism in the area include training programmes on ecotourism at the designated tourism training institutes for selected people and construction of physical infrastructures like parks, sanctuary, bird watching tower, roads, hotels, motels etc. Long term strategies include construction of potential tourist spots and expansion or renovation of existing tourist spots. The BPC has already proposed to construct roads and some other facilities with assistance from the LGED in order to support the development of some tourist spots. Figure 5.34 shows the existing tourist spots of the haor area.

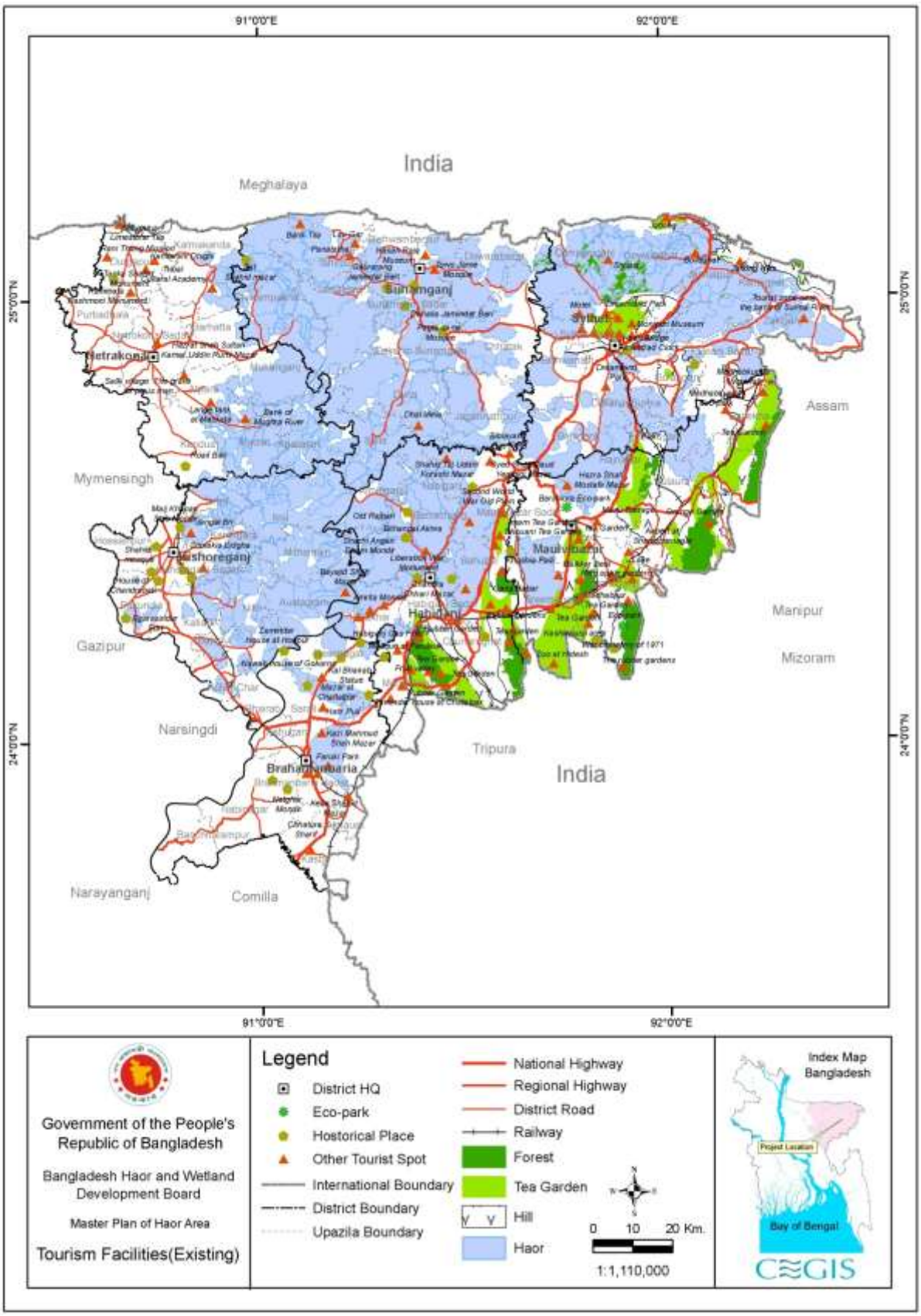


Figure 5.34: Existing tourist spots in the haor area

Road Transport

There is a famous saying in the haor area to describe the means of transportation "Borshakale nao aar shuknakale pao", which literally means "boats during monsoon and feet during dry season". Haor areas remain under water for 4-6 months during the pre-monsoon and monsoon season. The roads are submerged during this period making it impossible to travel from one place to other without using boats. The transportation network and the waterway and roadway have developed over the years in keeping with the unique characteristics of haor.

Table 5.29: Status of Road Transport by RHD in km

District	National Highway	Regional Highway	District Road
Sunamganj	-	72	106
Habiganj	132	88	45
Netrakona	-	51	230
Kishoreganj	4	91	169
Sylhet	126	147	172
Maulvibazar	89	74	150
Brahmanbaria	80	55	65
Grand Total	430	578	937

The road network of Bangladesh is comprised of national highways, regional highways, district roads and rural roads.

Table 5.30: Rural road network in the haor area by LGED in km

District	Upazila		Union		Village A		Village B	
	Unpaved	Paved	Unpaved	Paved	Unpaved	Paved	Unpaved	Paved
Sunamganj	64	102	630	97	1883	25	1044	6
Habiganj	217	126	406	112	1270	66	806	2
Netrakona	271	224	591	100	1764	31	710	1
Kishoreganj	208	217	526	119	1388	60	1377	21
Sylhet	135	120	608	161	2329	199	1300	33
Maulvibazar	64	172	356	161	1596	195	639	18
Brahmanbaria	130	174	285	153	830	110	659	58
Grand Total	1091	1134	3403	902	11061	685	6536	138

The Bangladesh Roads and Highways Department (RHD) are responsible for constructing roads at national, regional and district levels (Table 5.29).

The rural roads consisting of upazila, union and village roads are constructed by the Local Government Engineering Department (LGED) (Table 5.30). Eleven upazilas out of the total 69 upazilas in the haor districts are not connected with the RHD network. The upazilas are: Austagram, Itna and Mithamain upazilas in Kishoreganj district, Kalmakanda and Khaliajuri upazila in Netrakona, Dowarabazaar, Jamalganj, Sulla and Tahirpur upazila in Sunamganj district. There are 1055 bridges and 2074 culverts in the RHD road network of the haor region (RHD 2010). Sunamganj district has the lowest number of roads in terms of density while Sylhet has the highest road coverage. The 1,761 km long Bangladesh national highways are included in the Asian Highway network. Two major routes of the Asian Highway, AH-1 and AH-2 cross Bangladesh. Route AH-1 enters Bangladesh at Tamabil in the east and passes through the Sylhet-Dhaka-Padma Bridge-Narail-Jessore –Benapole. Route. AH-2 also enters Bangladesh through Tamabil and follows the same route as that of AH-1 up to Dhaka and then takes a turn towards Tangail in the North-West direction. AH-2 then passes through the Jamuna Bridge-Bogra-Rangpur-Dinajpur-Banglabandh route. The other Asian Highway route AH-41 connects the two sea ports of Bangladesh with AH-1 and AH-2. Railway network of 430 km length connects all the districts and 54 upazilas of the haor region with 88 number of railway stations. Only 14 km railway line lies within the Sunamganj district. Bulk of the

Table 5.31: Density in m/sq km

District	RHD road	Rural Road
Sunamganj	49	1049
Habiganj	100	1140
Netrakona	102	1345
Kishoreganj	97	1434
Sylhet	128	1400
Maulvibazar	112	1144
Brahmanbaria	104	1245

passenger traffic and cargo enters the haor region through Kasba station in Brahmanbaria District and ends at the Shahbazpur station of the border district of Maulvibazar (Table 5.31).

On an average in the haor region, daily traffic is 4434 of which 66% is motorized and 34% is non-motorised traffic. The average numbers of passengers travelling daily are 33756 of which 89% travel in non-motorized vehicles and the rest in motorized vehicles. Annually, a more than one crore person passes through the haor region. Figure 5.35 and Figure 5.36 show Roads and Highway (RH) network and road Accessibility of growth centers and rural markets to roads respectively.

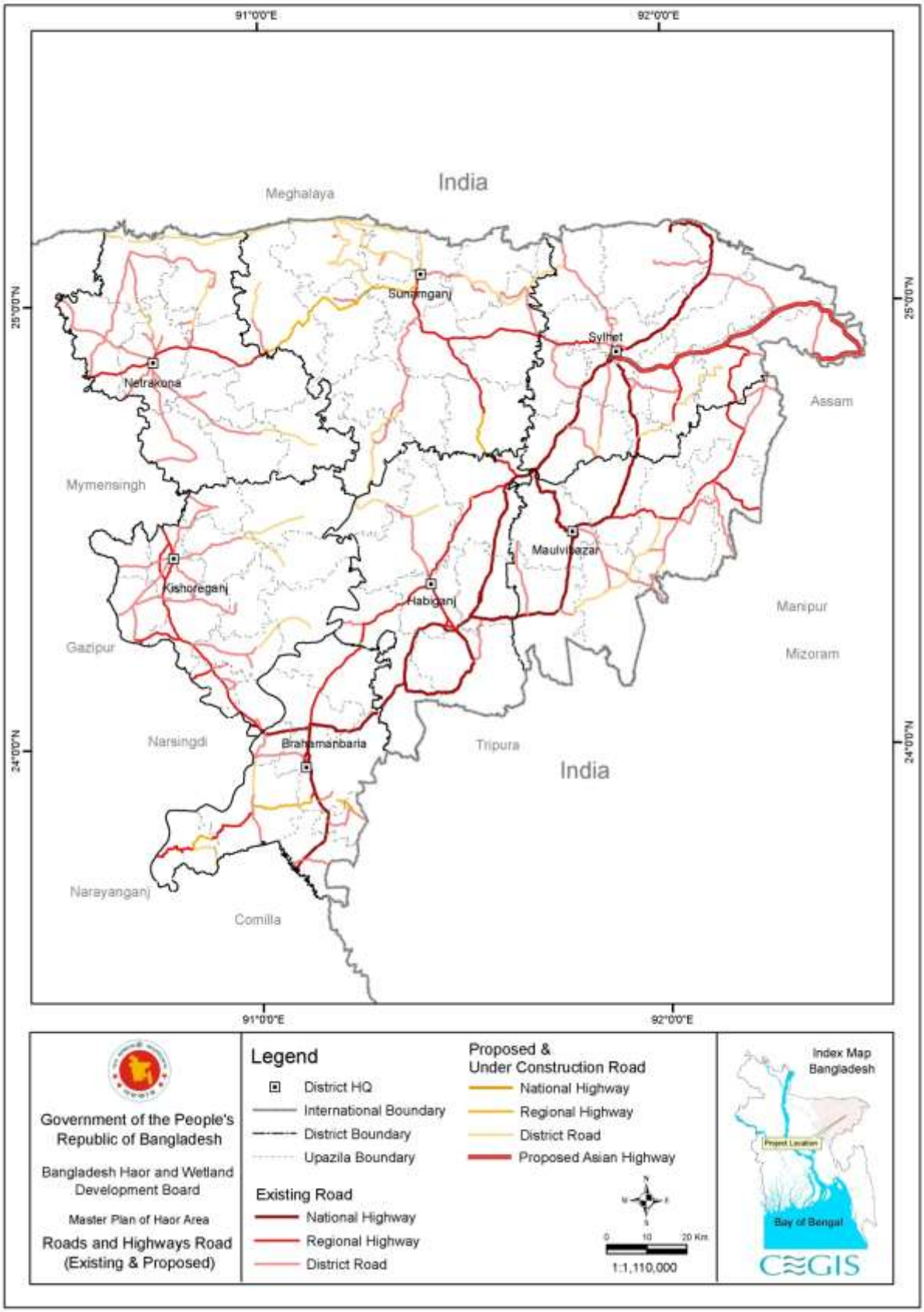


Figure 5.35: (RH) road network

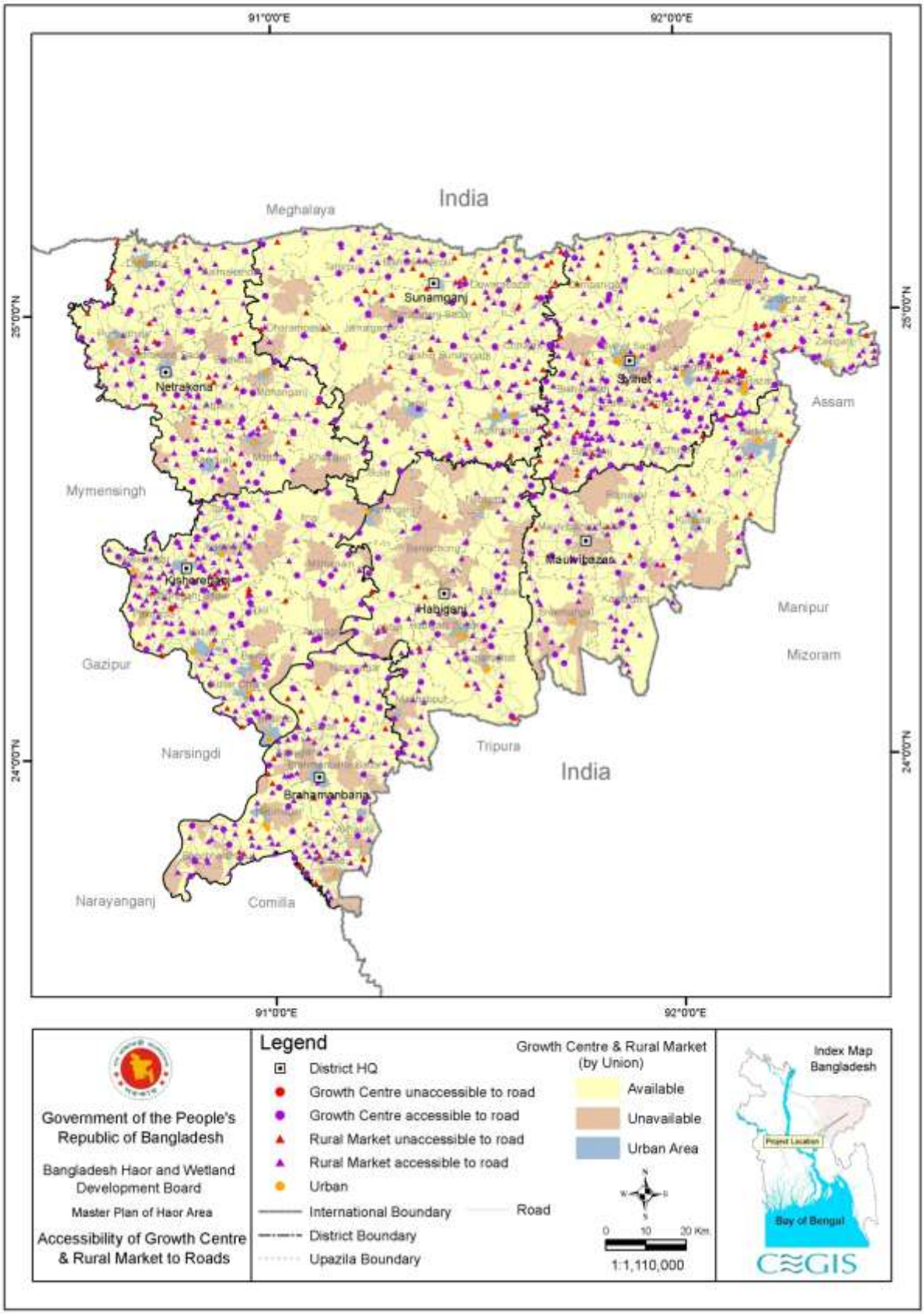


Figure 5.36: Accessibility of growth centers and rural markets to roads

Inland Navigation

Inland waterway is the mainstay of transporting cargo and passengers in the haor area. There are 25 Inland Water Transport (IWT) routes covering a length of 1828.8 km of inland waterways which remain navigable during monsoon (May-September). However, during the lean period (October-April) inland vessels cannot navigate in about 1000 km of the waterways. The major navigation routes are shown in Table 5.32.

Table 5.32: Navigation route with length

Sl No	Route	Rivers	Length in km
1	Bhairab Bazar-Rajapur-Itna-Sunamganj-Chhatak-Sylhet	Baulai, Dhanu, Nawa, Pandia, Surma	286
2	Bhairab Bazar-Ghoradigha-Madan-Netrakona	Dhanu, Mogra	179
3	Bhairab Bazar-Ghoradigha-Simla-Fatehpur-Tambulipara-Netrakona	Dhalai, Saiduli	168
4	Bhairab Bazar-Rajapur-Gaglajor-Mohanganj-Thakur Kona		193
5	Bhairab Bazar-Lalpur-Maqsudpur-Fazilpur	Baulai	197
6	Bhairab Bazar-Sunamganj-Sylhet-Golapganj-Atgram	Surma	369
7	Bhairab Bazar-Rajapur-Madna-Ajmiriganj-Fenchuganj-Zakiganj	Meghna, Dhaleshwari, Kalni, Nagdara nala, Kalakhal nala, Bibiyana, Kushiyara	296
8	Bhairab Bazar-Rajapur-Fediarkandi-Austagram-Ikardia	Dhaleshwari	52
9	Bhairab Bazar-Madna-Adampur-Habiganj-Shaistaganj	Dhaleshwari, Barak	116
10	Bhairab Bazar-Madna-Adampur-Ajmiriganj-Dhanpur	Old Surma	126
11	Bhairab Bazar-Madna-Ajmiriganj-Markuli-Talalpur	Bibiyana	176
12	Bhairab Bazar-Chitri-Marichakandi-Narsingdi	Meghna, Pagli	51
13	Bhairab Bazar-Raipura-Natunchar-Jayakalipur-Salimganj	Meghna	33

There are as many as 205 landing stations along the routes used by inland vessels and mechanised country boats. Of these places four major consolidation and distribution centers namely: Narsingdi, Bhairab Bazaar, Ashuganj and Chhatak have been declared as inland river port under the Port Act, 1908. Under the existing Protocol on Inland Water Transit and Trade between Bangladesh and India the route between Ashuganj and Zakiganj (296 km) is determined as one of the Protocol routes for transporting transit cargo of India through the territory of Bangladesh. Recently, Ashuganj was declared as a Port of Call under the Protocol and 137 transhipment between vessel and truck was allowed at Ashuganj. So the inland waterway in the haor area is also being used for transporting export-import cargo and Indian transit cargo as well.

From the data gathered from primary sources at 73 major and secondary landing stations it was estimated that these landing stations handle 7,05,000 tons of cargo and 1,05,650 passengers daily. About 500 inland vessels, 117 passenger launches and as many as 75,000 bulk head and mechanised boats in the haor area contribute more than one-third of the total IWT output in the country. The major commodities transporting from the haor area to other parts of the country are sand, stone, food grain and fish while fertilizer and liquid fuel are transported from other parts of the country to the haor area. IWT in the haor area is the second largest employment sector next to agriculture. More than 800,000 people of the area are directly employed in inland navigation.

According to the classification made in the IWT Master Plan prepared by the Dutch DHV consultants, IWT routes in the haor area are categorised in class-III and class-IV routes. Based only on the Least Available Depth (LAD), this classification indicates that class-III and class-IV are routes where

navigation is not possible in the lean period. These routes are not included in the programmes of BIWTA maintenance dredging.

Dredging: Capital dredging and regular maintenance dredging of the inland waterways may further enhance the traffic output. It may be mentioned that involvement of maintenance dredging in the haor area are less than that in the downstream areas.

Landing Stations: Landing stations should be provided with appropriate facilities for safe embarkation and disembarkation of cargo and passengers. Storage, transit, passenger sheds and shelters should also be developed where required. Approach roads should be developed between the landing stations and growth centers. Connectivity with other modes should also be established.

Aids to Navigation: To avoid any accident, grounding or other eventualities, appropriate aids to navigation are required in all IWT routes in the haor area. To enhance the turn-round of the vessels and to reduce transportation time, night navigation facilities should be installed.

Safety: Financial and motivational assistance should be extended to all mechanised boat operators to install reversible gears on board. This will enhance safety and facilitate efficiency.

Figure 5.37 and Figure 5.38 show Existing navigational routes and Accessibility of growth centers and rural markets to water way respectively.

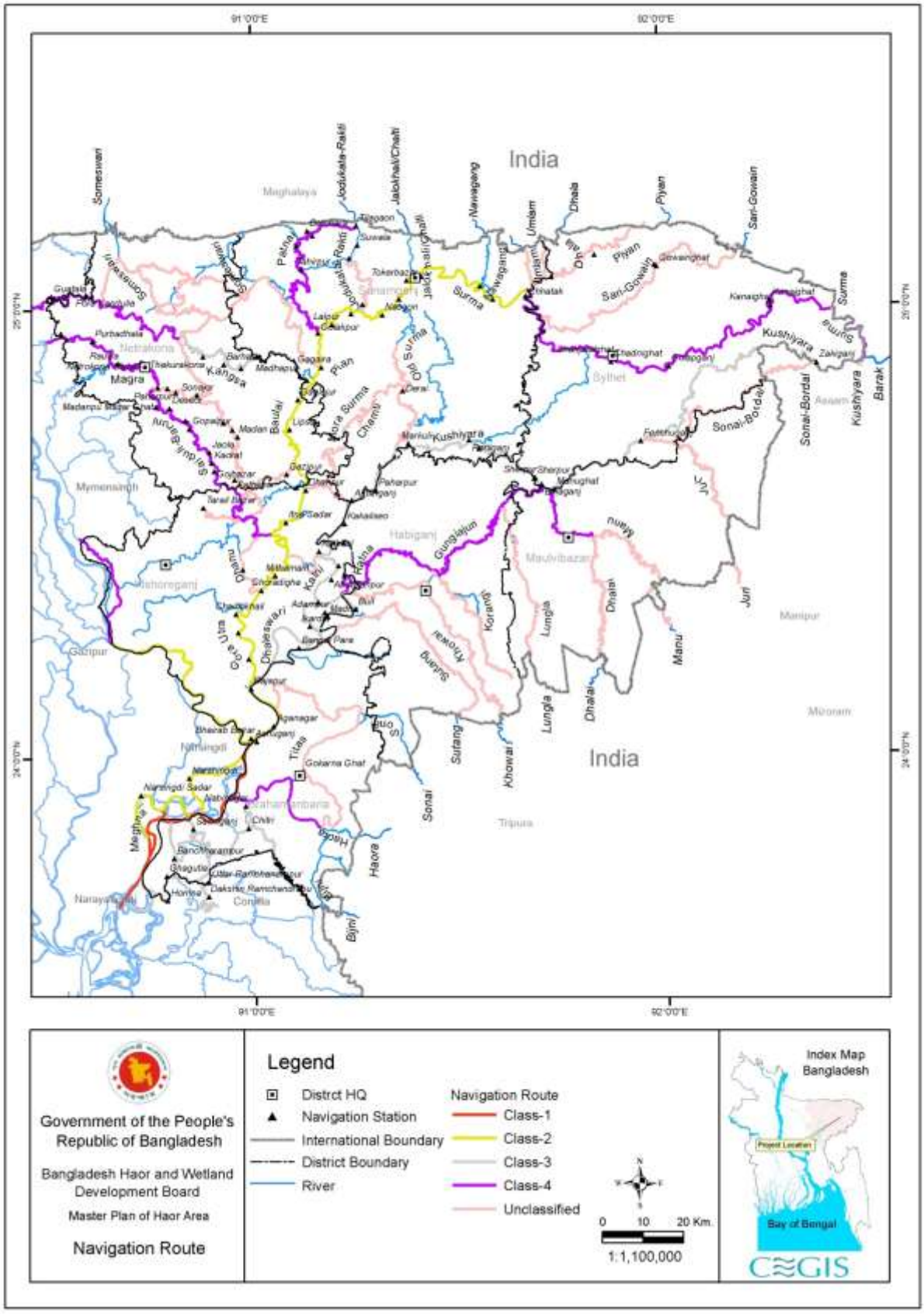


Figure 5.37: Existing navigation routes of the haor area

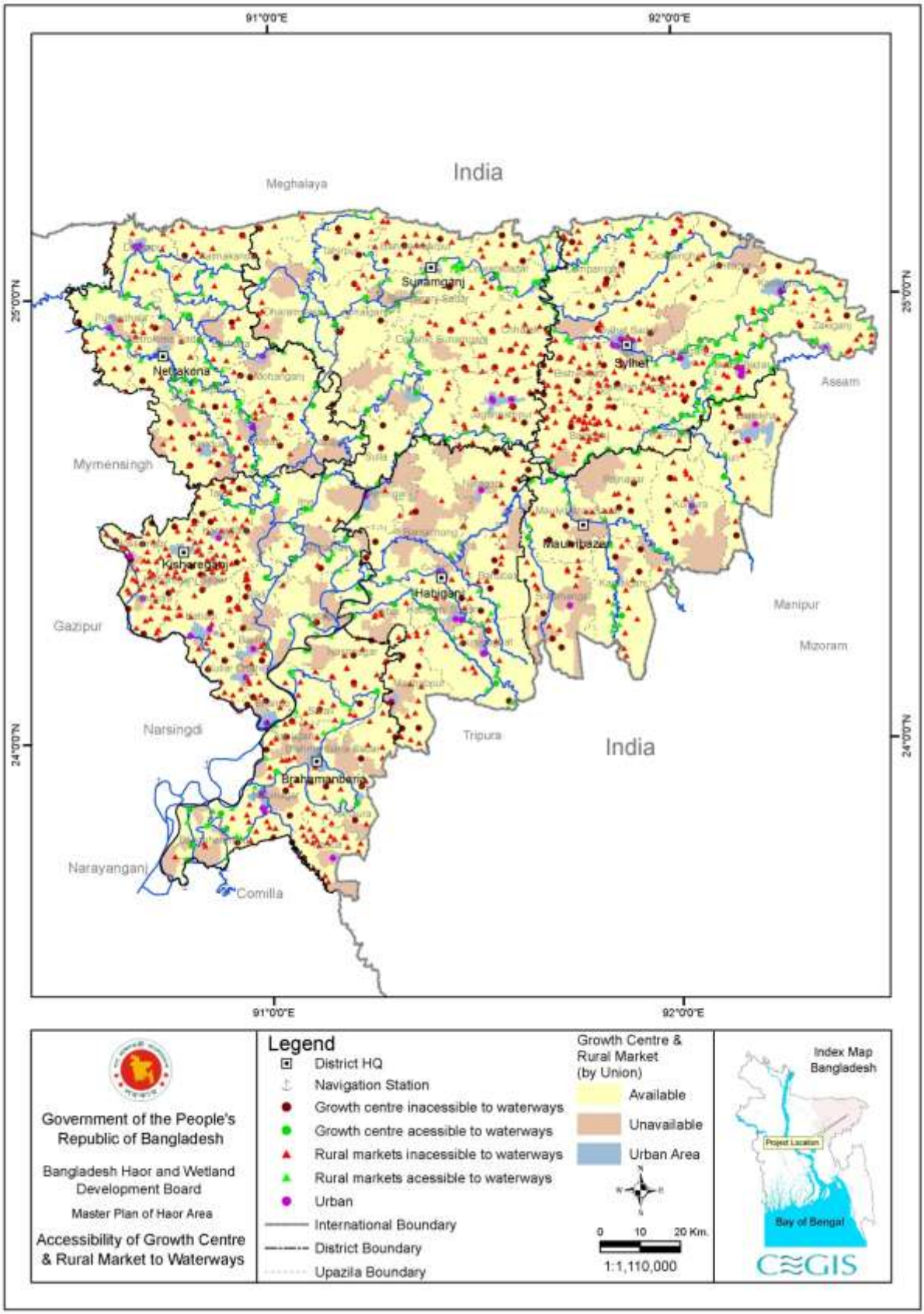


Figure 5.38: Accessibility of growth centers and rural markets to waterways

Housing and Settlement

The housing and settlement patterns of the haor area are not similar to the other parts of Bangladesh due to its geographical setting. Mainly three type of settlement patterns are found in the haor area which can be defined as the *linear settlement pattern,* the *cluster settlement pattern* and the *scattered settlement pattern.* The total settlement area and the number of houses were 303,120 ha and 3244,380 respectively in 2010. The settlement area comprises 12% of the total haor area (Table 5.33).

Table 5.33: Housing and settlement patterns of the haor area

Flood zone	Percentage of district	Settlement area in ha	Number of Households	Density of the Households
Deeply flooded area	Sunamganj (65%), Netrakona (10%), Sylhet (5%), Maulvibazar (5%), Habiganj (45%), Kishoreganj (45%), Brahmanbaria (10%)	26,820	454,383	5.1
Medium flooded area	Sunamganj (25%), Netrakona (35%), Sylhet (65%), Maulvibazar (15%), Habiganj (25%), Kishoreganj (15%), Brahmanbaria (60%)	88,426	860,775	4.9
Low flooded area	Sunamganj (10%), Netrakona (55%), Sylhet (30%), Maulvibazar (35%), Habiganj (15%), Kishoreganj (40%), Brahmanbaria (30%)	187,874	1,264,451	5.7
	Total	303120	2579609	15.7

The deeply flooded zone consists of 48 upazilas which contains 29 major haor with settlements scattered in the surroundings. The elevation of the settlements from ground level is on average 12 to 15 feet. Six main landform units are found in the deeply flooded zone, which include uplands, terraces, alluvial fans, piedmont floodplains, lowland floodplains and the flood basin. Seven physiographic units are found under this landform. About 50% of the total settlements are in the deeply flooded Eastern Surma-Kushiyara Floodplain with most of them linear and some scattered. Only dispersed settlements are located in the main haor basin.

Two or three villages together seem to function as a single entity. In the middle of the community is the landlords' enclave. The rest of the socio-economic groups are scattered in different *para*s, which are separate linear clusters, surrounded by orchards and periphery-land of the total settlement. The density of canopy in the rural area is less compared to the other districts of Bangladesh. There are 454383 households in the deeply flooded zone. Distribution of households by type shows that 99.51% are dwelling units, 0.39% institutions and 0.86% other types of households. The average household size (dwelling) for the deeply flooded zone is 5.01 persons. Rural and urban sizes are respectively 5.0 and 5.1. In the deeply flooded zone the houses are predominantly of the Kutcha[1]type. It has been found that 10% of the dwelling households live in jhupris, 76% live in Kutcha houses, 10% live in semi-Pucca[2] houses and the remaining 5% in Pucca[3] houses. The housing condition in urban areas is slightly better than the rural areas. In urban areas 0.93% households live in Pucca houses, 2.23% in semi-Pucca houses, 81.07% in Kutcha houses and 15.77% in jhupris as

[1]Kutcha house (Earthen floor a thatched house)
[2] Semi-Pucca (Tin shed masonry building, floor covered with cement concrete)
[3] Pucca (Masonry building, floor & roof of cement concrete)
[4] Jhupn (Poor quality Kutcha house)

against 0.27% in Pucca, 0.82% in semi-Pucca, 81.67% in Kutcha and the remaining 17.24% in jhupris[4] respectively in rural areas. Figure 5.39 shows the settlements in the haor area.

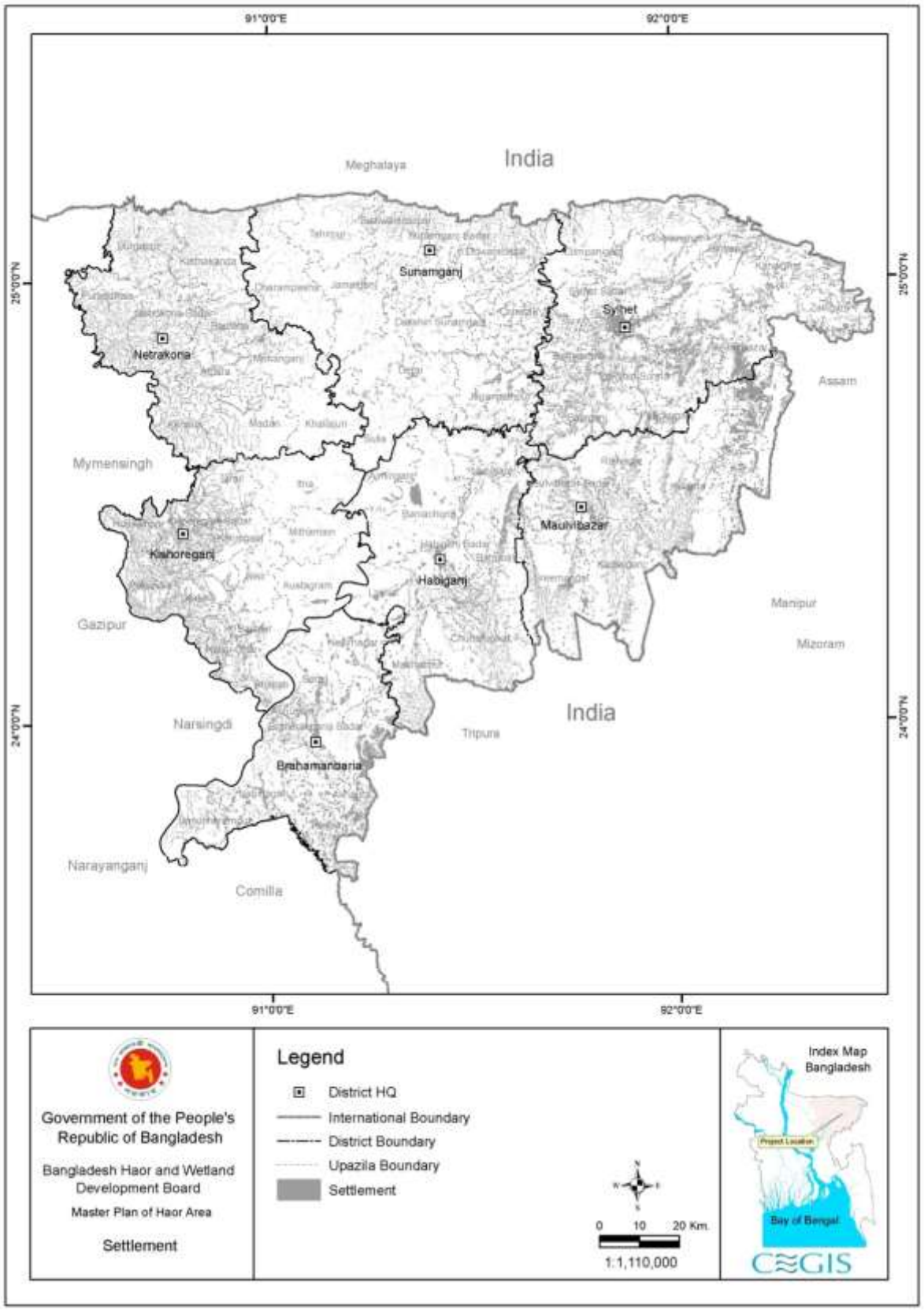


Figure 5.39: Settlements in the haor area

The medium flooded zone, which covers 59 upazilas, has six main landform units. About 56% of the settlements in the medium flooded zone are in the Eastern Surma-Kushiyara Floodplain. The settlement pattern here is similar to that of the deeply flooded zone. However, only dispersed settlements are located near the haor basin and the density of canopy in rural areas is higher compared to that of the deeply flooded zone. In the medium flooded zone, there are 860775 households. Distribution of households by type shows that 99.51% are dwelling units, 0.13% are institutions and 0.36% are other types. The average dwelling household sizes in rural and urban areas are respectively 4.9 and 4.8. Houses in the medium flooded zone are predominantly Kutcha. Only 1% of dwelling households in the medium flooded zone live in jhupris, 83% live in Kutcha houses, 10% live in semi-Pucca houses and the remaining 5% live in Pucca houses. The housing condition in urban areas is slightly better than urban areas. 2.98% households live in Pucca houses, 5.02% live in semi-Pucca houses, 84.23% live in Kutcha houses and 7.77% live in jhupris as against 0.15% in Pucca, 1.65% in semi-Pucca, 94.09% in Kutcha and the remaining 4.11% in jhupris respectively in rural areas.

The low flooded zone consists of 47 upazilas. Three major haor i.e. Hakaluki haor, Hail haor and Kauea Dighi haor are situated in this zone. The elevation of settlements from ground level is about 5 to 6 feet. Six main landform units and five physiographic units are found in the low flooded zone. About 35% of the settlements in the district are in the Eastern Surma-Kushiyara Floodplain. In this zone, most of the settlements are nucleated (clustered). Only dispersed settlements are located in the low land area. The settlement pattern of different socio-economic groups is similar to that of the deeply and medium flooded zones. However, the density of canopy in the zone is high compared to the other districts of Sylhet division. The socio-economic status of this zone is better than that of the other zones. There are 1264451 households in this zone. Distribution of households by type shows that there are 97.29% dwelling units, of which 1.26% are institutions and 1.45% are other types. The average dwelling household size for the zone is 5.7 persons. For rural areas the size is 5.7 and for the urban areas the size is slightly smaller, i.e., 5.3. Housing in the low flooded zone is dominated by Kutcha houses as 10% of the main dwelling households live in houses that are jhupris, 76% in houses that are Kutcha, 10% in houses that are semi-Pucca and the remaining 5% in houses that are Pucca. In urban areas the condition is better as 40.15% of the main dwelling households live in houses that are Pucca, 27.45% in houses that are semi-Pucca, 28.33% in houses that are Kutcha and the remaining 4.07% in jhupris as against 9.62%, 19.11%, 66.00% and 5.27% Pucca, semi-Pucca, Kutcha houses and jhupris respectively in rural areas.

The existing villages of the haor are developed near the rivers and are in the deeply flooded area of the Northeast Region. The villages are developed over manmade platforms to keep them above the water level during the monsoon season. The platforms formed are threatened by erosion from wave action. Bamboo and tarja fencing is used as edge of platform protection but often proves ineffective. The *hijal*, *koroach* tree in front of the villages is all that remains of the past lowland forest that protect the earthen village platform. But day by day this low land forest is being reduced due to human interventions to fulfill their homestead fuel purpose. The Master Plan of Haor Area through the development of Housing and Settlement sector aims to improve the quality of life of vulnerable haor people. Development of 38 eco-villages and protection of the earthen village platform from the wave erosion have been proposed.

Social Services

Markets and growth centers

There are not enough markets to meet the needs of the haor population and due to the severe scarcity of land the few existing markets are very congested. The people also have to travel a long distance to buy and sell local goods at the big weekly market, which is locally referred to as "Haat". Otherwise, markets and growth centers in the haor area are commonly situated at upazila headquarters. Only one growth center is usually found in each upazila, situated linearly on embankments and upazila platforms.

Table 5.34: Markets and growth centers

District	Growth Center		Rural Market	
	All Upazila	Haor Upazila	All Upazila	Haor Upazila
Sunamganj	46	46	147	147
Habiganj	33	33	79	79
Netrakona	40	27	133	85
Kishoreganj	50	46	155	140
Sylhet	51	51	269	269
Maulvibazar	31	26	86	69
Brahmanbaria	31	14	123	59
Total	282	243	992	848

There are a total of 282 growth centers and 992 rural markets in the seven districts of which 243 growth centers and 848 rural markets are located within the haor upazilas. Although Kishoreganj, Sylhet and Sunamganj districts have the highest number of growth centers or rural markets, in terms of population coverage, Sylhet and Sunamganj have the highest coverage of 10,000-15,000, Kishoreganj and Maulvibazar have the coverage of 16,000-18,000 while Brahmanbaria and Habiganj have the lowest coverage of around 20,000 (Table 5.34).

Of the total number of growth centers (1274) in the haor districts, 136 (48%) are situated within a kilometer from the upazila headquarters. In the rural areas, 93 unions (out of 628 unions) have no growth centers or rural markets.

The strengths of establishing growth centers and rural markets are that they facilitate marketing of agricultural products; provide agriculture inputs like seeds, fertilizers etc.; allow knowledge sharing on farming, technology, HYV crops, use of insecticide-pesticides etc.; and facilitate earning of local revenue as well as generation of rural employment. Commodities are available for developing the marketing system which could be further enhanced through increase in agricultural produce and productivity and extension of marketing facilities. However, what is needed for developing the system are factors like utilisation of available kanda for building market infrastructure, establishment of markets above flood level, flood and erosion protection of the existing markets, establishment of necessary sheds and drainage system and construction of public sanitation system at the haat/bazaar. Figure 5.40 shows the location of growth centers and rural markets.

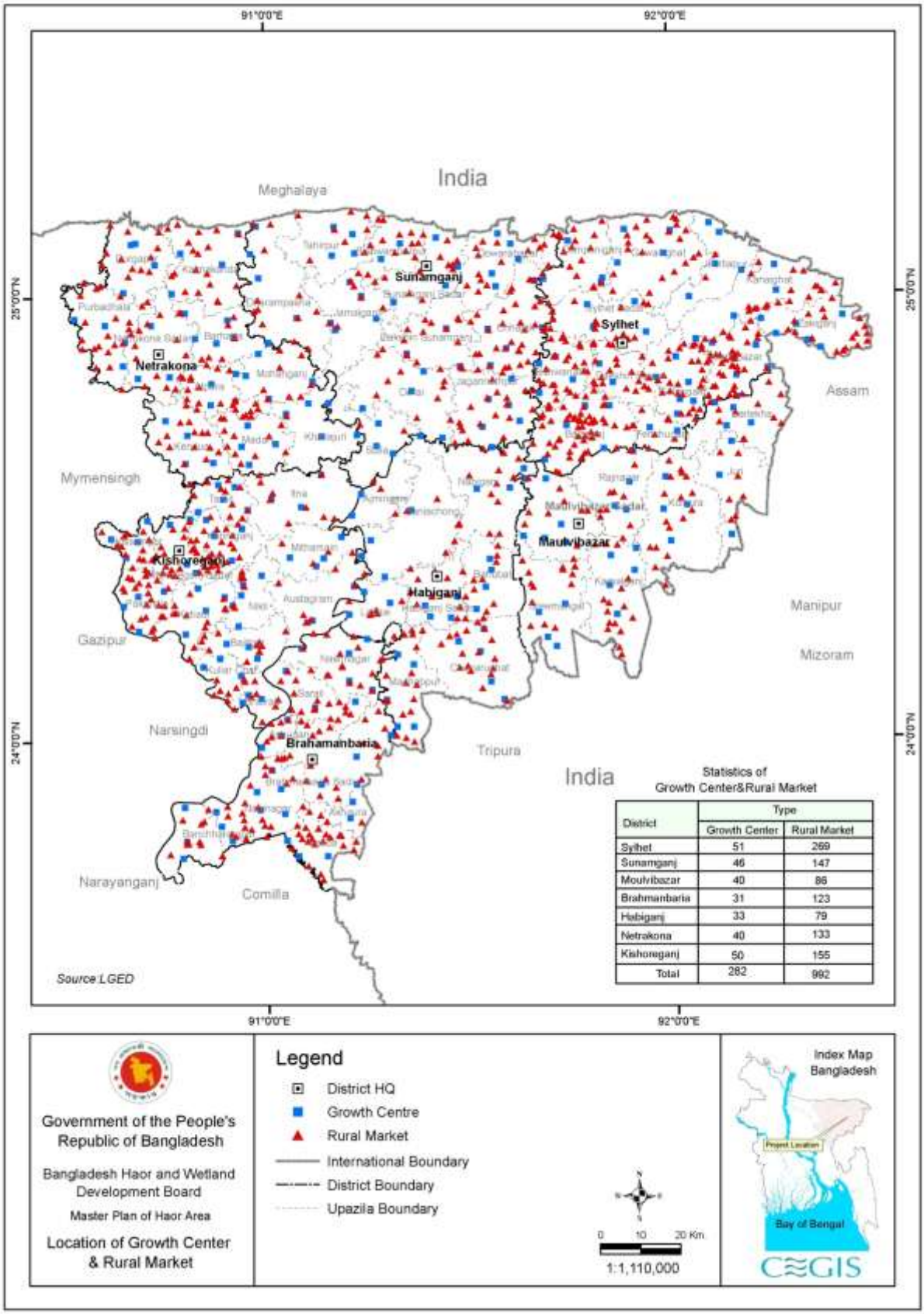


Figure 5.40: Locations of growth centers and rural markets

Godowns for food, fertilizer and seeds

There are mainly three types of food godowns available in the haor districts with a capacity of 500 metric ton, 750 metric ton and 1000 metric ton (Figure 5.41). More than 85% of the food godowns have 500 metric ton storage capacity. Most of the food godowns (40) are located in Habiganj district. Kishoreganj has 6 godowns with a maximum storage capacity of 1000 M.ton. Habiganj and Kishoreganj have the most number of godowns for seeds followed by Sylhet. The highest number of godowns for storing fertilizers is available in Kishoreganj and Netrakona. Unavailability of data for Maulvibazar makes it impossible to determine the availability of seed godowns in that district (Table 5.35).

Table 5.35 : Existing no. of godowns for seeds and fertilizer

District	Seed		Fertilizer	
	No	Capacity (M.ton)	No	Capacity (M.ton)
Sunamganj	8	450	6	600
Habiganj	19	2200	5	2400
Netrakona	2	No info	57	6060
Kishoreganj	19	8750	42	21550
Sylhet	12	750	3	No info
Maulvibazar		No info		
Brahmanbaria	2	5060	4	21500

Table 5.36**:** Existing number of food godowns by districts

District	Capacity 500 (in MT)	Capacity 750(in MT)	Capacity 1000 (in MT)	Others	Total
Sunamganj	26		6	6	38
Habiganj	32			15	47
Netrakona	29		2	3	34
Kishoreganj	30	1	6	13	50
Sylhet	26		4	7	37
Maulvibazar	22			1	23
Brahmanbaria	29		2	7	38
Grand Total	194	1	20	54	267

*Source: Department of Food, *BBS*

Only 32 godowns are located near the growth centers or rural markets. It should be noted that 92% of the growth centers (235 out of 256) and 99% of rural markets (963 out of 974) do not have any food godowns in their vicinity. Nearly 50% of the food godowns (40) are located in the moderate (0.5 – 1.8m) flood zone. Food godowns (20) that are located within the deep flood zone of more than 1.8m depth are highly vulnerable.

Construction of new godowns or cold storage and repair of the existing godowns to preserve perishable goods are necessary to combat food crisis. The godowns should be constructed near growth centers or rural markets if space is available or an available kanda may be utilized for building the infrastructures (Table 5.36).

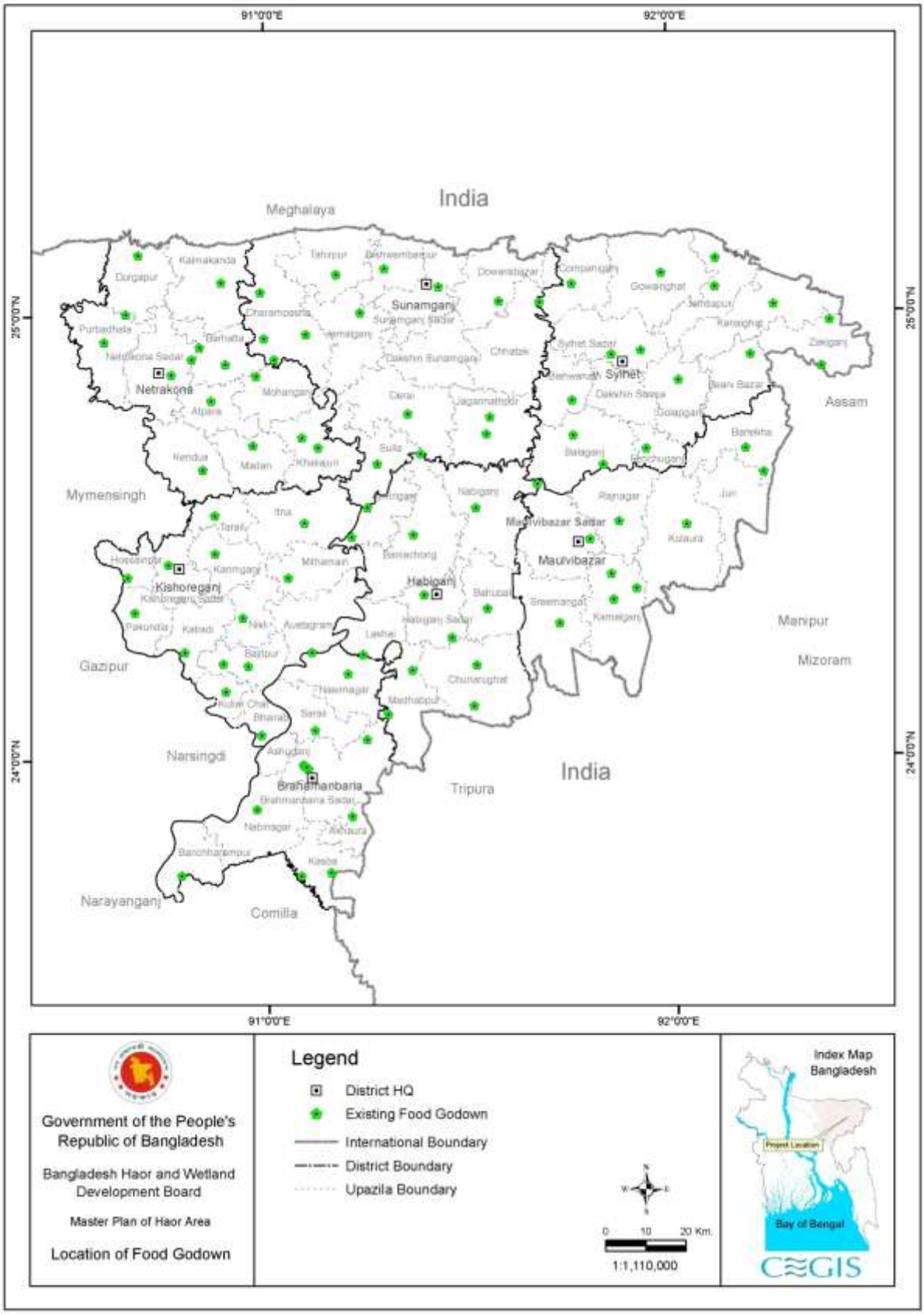


Figure 5.41: Locations of existing food godowns

Religious institutions

The existing number of religious institutions like mosques, temples, churches and pagodas is given in the Table 5.37.

Common property resources

Religious institutions are comprised of 19,696 mosques, 2,317 temples and 76 church/pagodas adding up to a total of 22,089. Most of the crematoriums and graveyards in the haor area are located on low land. As a result, problems often arise in burying and burning the deceased during the monsoon period. Many of the existing graveyards are in a dilapidated state requiring repair. A many as 407 graveyards, most of which (more than 70) is in Kishoreganj and Habiganj, need to be repaired. The other haor districts have around 50 graveyards.

Table 5.37: Existing religious institutions

District	Religious institutions			
	Mosque	Temple	Church & Pagoda	Total
Sunamganj	2,633	239	9	2,881
Habiganj	2,581	372	7	2,960
Netrakona	3,480	802	30	4,312
Kishoreganj	3,356	233	20	3,609
Sylhet	4,314	285	10	4,609
Maulvibazar	883	140	-	1,023
Brahmanbaria	2,449	246	-	2,695
Grand Total	19,696	2,317	76	22,089

The number of police stations as well as other social services and facilities is also inadequate. There are 80 police stations in the seven haor districts with 10 in Brahmanbaria, 9 in Habiganj, 19 in Kishoreganj, 7 in Maulvibazar, 10 in Netrakona, 12 in Sunamganj and 13 in Sylhet.

There is still requirement and opportunity to establish new religious institutions, cremation grounds and graveyards, playgrounds or sports complexes and police stations through raising ground height above flood level in the kandas by earthwork. The existing facilities also need extensive repair.

Chapter 6 Future Development Scenario

6.1 Introduction

The future characteristics of the region have been briefly outlined in this chapter focusing on the important trends that have bearing on the haor region over a period of twenty years between 2010 and 2030. The future scenario reflects the present trend of different resources (without the proposed Master Plan projects). This chapter also includes the demand scenario of resources and the important driving forces considered in the development of the Plan.

6.2 Resources

In order to make strategic decisions, it has been important to comprehend the future development context of the haor region. The objective has been to develop several plausible pictures that describe how the haor area may, in fact, develop under certain future events, trends and developments.

6.2.1 Human Resources

As people's well-being is the central focus, it is necessary to know at the onset about its size, composition, current resource endowment and their growth potential in the foreseeable future.

Population

As per 2010 data, the total population of the seven haor districts is about 19.37 million and the average household size is 5.3. By the years 2020 and 2030 the population may increase to 21.38 million and 22.92 million respectively. The population growth rate per annum for the overall haor area is lower than the national trend. It might decrease further from 1.09% to 0.63% by the year 2030, while the overall national growth rate might also decrease from 1.31% to 0.84% over the same period.

Table 6.1: Population Scenarios in haor area

District	2010	2015	2020	2025	2030
Sunamganj	2.65	2.81	2.96	3.09	3.20
Habiganj	2.28	2.40	2.51	2.61	2.69
Netrakona	2.60	2.74	2.88	2.99	3.09
Kishoreganj	3.31	3.47	3.61	3.73	3.83
Sylhet	3.36	3.56	3.74	3.90	4.04
Maulvibazar	2.10	2.22	2.32	2.41	2.49
Brahmanbaria	3.07	3.22	3.36	3.48	3.58
Total	19.37	20.42	21.38	22.22	22.92

Out of the seven haor districts, the population growth rate in Netrakona, Maulvibazar, Sunamganj and Sylhet districts are above-average. The size of the population pyramid shows a great transformation between the years 2010 and 2050 when the proportion of elderly people will increase due to a decrease in adult and child death rates. The proportion of middle aged and elderly people will increase by the years 2020 and 2030. Table 6.1 shows population

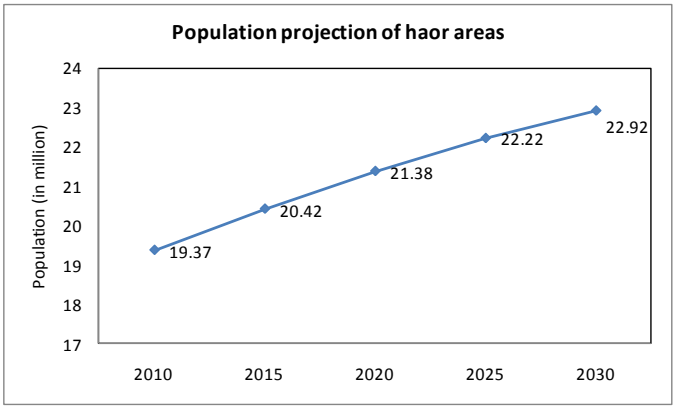


Figure 6.1: Future population trend in haor areas

trend from 2010 to 2030. Figure 6.1 and Figure 6.2 gives future population trend and distribution by age groups for 2010, 2020 and 2030.

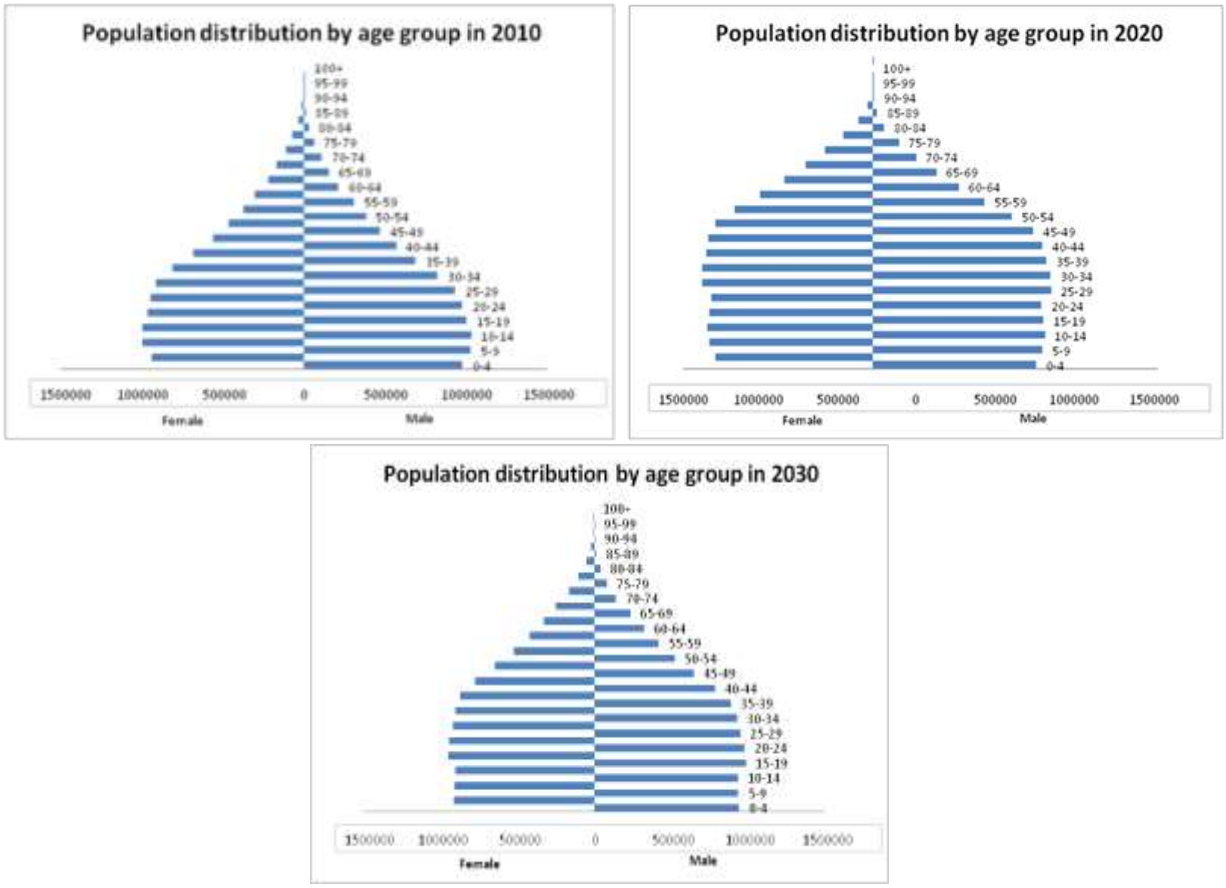


Figure 6.2: Population distribution by age group for 2010, 2020 and 2030

Population by Sex

On average, the sex (Female:Male) ratio in the haor districts is 100:99.27, which indicates that the male population is lower than the female population. This scenario is similar for all the haor districts except Sylhet and Sunamganj. In these two districts the sex ratio indicates that the male population is more than the female population. The national ratio (Female:Male) is 100:105. The population distribution by district is shown in the Table 6.2.

Table 6.2: Male-Female population projection

District	Sex Ratio		
	2011	2020	2030
Sunamganj	102.06	101.02	100.22
Habiganj	98.18	96.74	95.62
Netrakona	100.87	99.79	98.95
Kishoreganj	98.43	96.81	95.55
Sylhet	102.53	101.76	101.15
Maulvibazar	98.55	96.84	95.51
Brahmanbaria	94.25	91.54	89.44
Haor	99.27	97.79	96.64

Urban and Rural Population

The proportion of urban people in the haor region is expected to follow an increasing trend and reach 12.62% in 2020 and 13.72% in 2030. The population in the rural haor areas will follow a steady growth and eventually be stabilised after 2020.Figure 6.3 gives urban and rural population trend up to 2030.

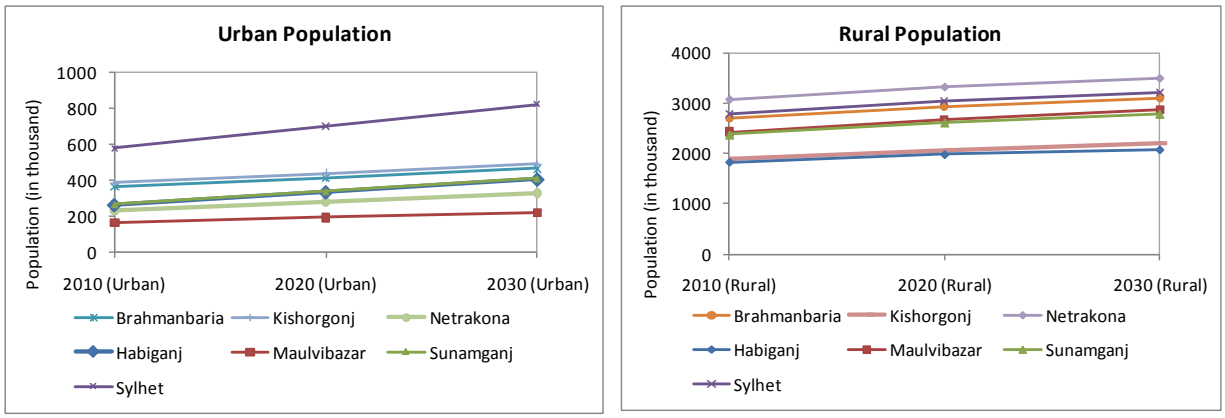


Figure 6.3: Urban and rural population in haor area

Landless and Farm Population

The conversion of farm holdings to non-farm holdings is clearly seen from the increasing trend in all the haor districts. This trend is also visible for the entire country with about 50% coverage of both types of holdings by the year 2030. Non-farm holdings will increase from 50% to 63% in Sylhet district and 47% to 55% in Kishoreganj district by 2030. Table 6.3 gives distribution of non-farm and farmland holdings in haor districts.

Table 6.3: Population distributions by age group for 2010, 2020 and 2030

Districts	2010		2020		2030	
	Non FH	FH	Non FH	FH	Non FH	FH
Sunamganj	47	53	50	50	52	48
Habiganj	42	58	44	56	45	55
Netrakona	38	62	39	61	39	61
Kishoreganj	48	52	51	49	53	47
Sylhet	50	50	57	43	63	37
Maulvibazar	42	58	44	56	45	55
Brahmanbaria	45	55	48	52	50	50
National	39	61	46	54	50	50
FH: farm holding						

Literacy Rate

Human resource development is almost certainly the most important factor to be addressed and financially supported if development is to occur in the haor region.

The current average rate of literacy of 51% will reach 63% and 75% by the year 2020 and 2030 if the literacy rate continues to increase following the existing trend. Figure 6.4 gives the trend of literacy growth in the haor region.

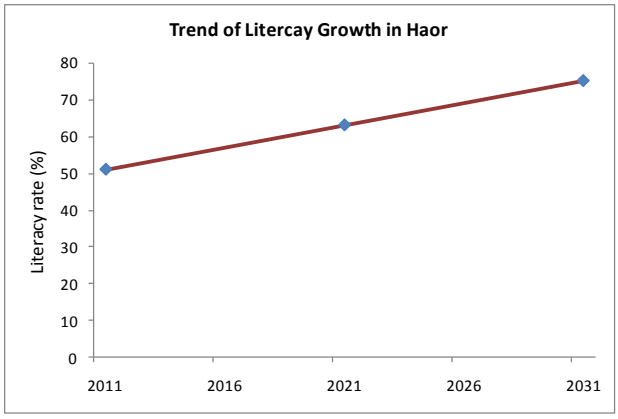


Figure 6.4: Literacy growth trend in haor

6.2.2 Economic resources

Gross Domestic Product (GDP)

Over the last decade, the haor area has contributed on average around 2% of the national GDP with the average worth of BDT 37,740 million. Of this, 25% has been contributed from the agriculture sector, 31% by the Industrial sector and the remaining by the service sector. According to the OPP, the Government has targeted to achieve double digits by the year 2015-2016. If this trend persists over the period of 2015-16, the GDP from the haor area might increase up to ten times with the net worth of BDT 3,62,574 million (Figure 6.5) and a significant shift from the service sector to the agriculture and industrial sectors might be evident.

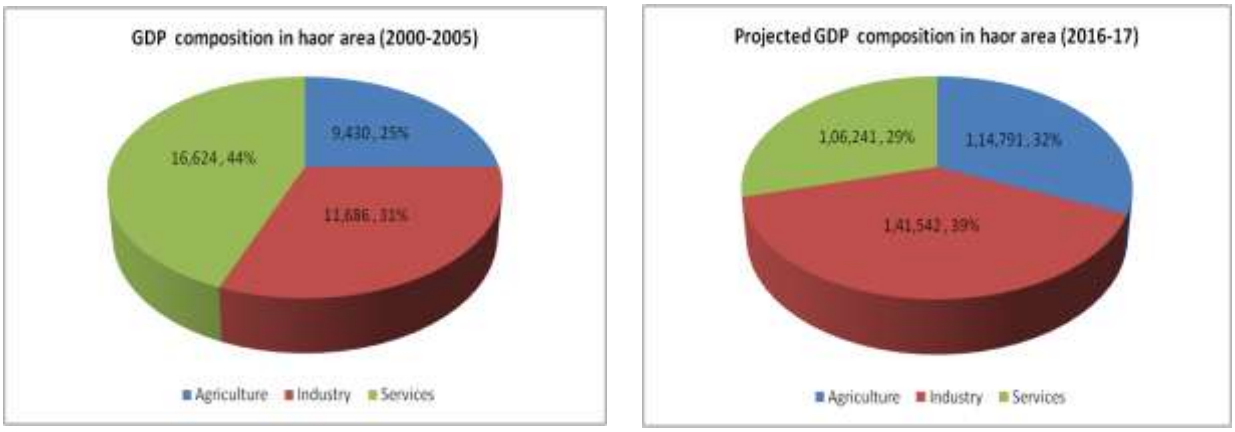


Figure 6.5: GDP composition and projected GDP in haor areas

Primary Productive Area

Agriculture

Agricultural crop production has been projected for the business-as-usual scenario for the period of 2011-2030. This describes the likely future characteristics of crop production in the haor region based on past trends. The total cultivated land is expected to decrease by about 94,400 ha in 2030 due to urbanisation and development of infrastructure.

The crop suitability and projected land use data have been used as well for making the future crop area projection. In future, the total rice crop areas will increase by about 1,90,000 ha of which Aus, T Aman and Boro will be 70,000 ha, 70,000 ha and 50,000 ha respectively. The area of B Aman will remain unchanged. It is observed that a significant rice area and cropping intensity will be increased in Sylhet, Habiganj and Maulvibazar districts due to utilization of seasonal fallow lands mostly in Kharif-I and Rabi season. The crop suitability analysis indicates that a significant area is suitable for jute in Kharif-I season and different Rabi crops like oilseeds, pulses, vegetables, spices, potato, maize and wheat in Rabi season. Improving cropping pattern will also help to boost up non-rice crop area. In future, total area of non-rice crop is expected to increase by about 2,45,000 ha. The main causes of this seasonal fallow are absentee land ownership; scarcity of surface water for irrigation, very high cost of ground water abstraction, unavailability of labors force during peak period etc.

In future, 6.55 million metric tons of rice will be produced which is about 25% higher than the existing total rice production. Total production of rice will be increased by about 1.3 million tons of which Aus, T Aman and Boro will be about 14.6%, 30.0% and 55.4% respectively. Total production of

non-rice crops will be about 2.49 million metric tons which is about 63% higher than the existing total non-rice production.

Fisheries

Fish production has been estimated under the future-with-Master Plan scenario for different years and clustered as 2015-16, 2020-21, 2025-26 and 2030-31. Assumptions considered in projecting the production include: (1) Continuation of existing fisheries development projects of the DoF and reinforcement of fisheries laws and regulations in different ways, such as fishing ban on certain waterbodies/haor, restricting fishing gear and appliances, etc. as well as extension of improved fish culture technology for enhancing culture fisheries; (2) Restoration of wetlands and management under the co-management approach for sustaining fisheries resources; and (3) Establishment of fish sanctuary, beel nursery along with campaigns and motivation drives under NGO programmes to prevent the harvest of undersized fish, use of pernicious gear, training on improved fish culture technology, etc. Having diversified activities of the DoF and other agencies, considered under future-without-Master Plan, for boosting fisheries production in the haor basin as per the business as usual cannot intensify and magnify the production compared to the needs and potentials.

Considering the above assumptions and given 12 production oriented programmes along with other 10 programmes which have indirect influence on fish production, productions have been projected as 4.52, 4.56, 4.62 and 4.68 lakh tons for said years respectively. Figure 6.6 shows the fish production trends from 1983-84 to 2009-10 and the projection from 2010-11 to 2030-31.

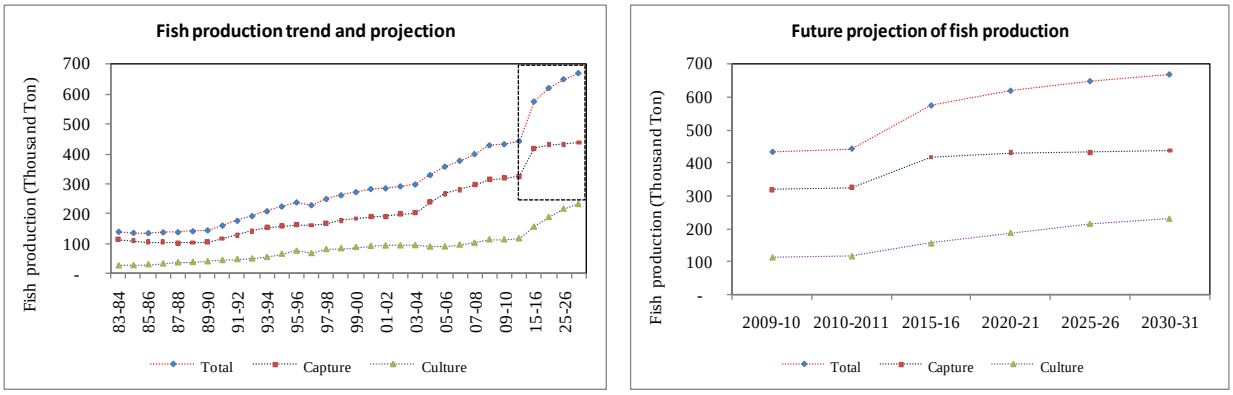


Figure 6.6: Fish production trend and projection

Livestock

Bangladesh has one of the highest densities of livestock in the world. It has 145 large ruminants/km^2 compared with 90 for India, 30 for Ethiopia and 20 for Brazil. Despite the highest density of cattle population in Bangladesh the productivity of all the species is far below the world average. Milk yield per head per lactation is 206 kg against the Asia average of 1220kg, India-1014 kg and Pakistan 1179kg (FAO-2005). The average weight of local cows ranges from 125-150kg and bulls from 200-250kg that falls from 25-35 kg short of the average weight of all purpose cattle in India. The average body weight of goats is 8 kg, sheep 10 kg and buffalo 150kg (DLS-2009).

In the year 2010, milk production of all the haor districts was estimated to about 0.62 million M. ton. This production will gradually increase to about 0.93 million M. ton by the year 2015, 1.32million M. ton by the year 2021 and 1.74 million M. ton by the year 2030.

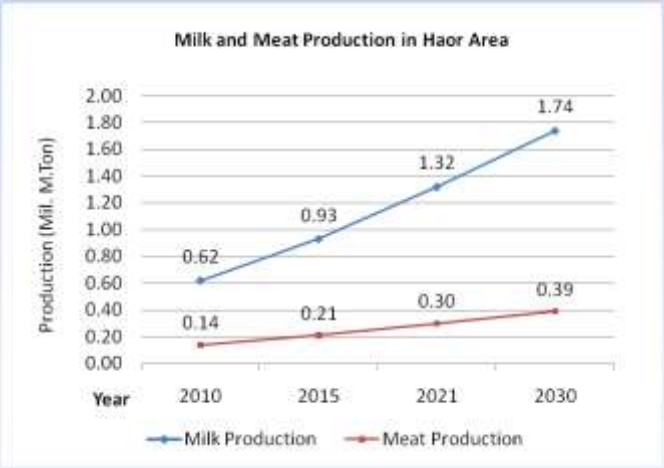


Figure 6.7: Trend of milk and meat production in haor areas

Meat production in the haor area was about 0.14 million M.ton in the year 2010, which will increase up to 0.39 million M.ton by the year 2030. In 2015 and 2021, meat production in the haor area is predicted to reach about 0.21 and 0.30 million M.ton respectively.

About 989 million pcs of eggs were produced in all haor districts. This production will generally increase up to 1483,2096 and 2771 million pcs by the year 2015, 2021 and 2030 respectively. Figure 6.7 shows the trend of milk and meat production in haor areas up to 2030.

6.2.3 Natural Resources

Water Resources

Changing of water resources during the period of 2012-2030 will depend on some key driving forces such as climate change, sediment budget and future land and water use in the region. Several assessments have been carried out to estimate the impact of climate change on rainfall trend and pattern as well as morphological change. Table 6.4 shows the historical mean annual rainfall in the haor region. The effect of upstream intervention and climate change will have an impact on discharge as well as water level of the rivers of the region. Any change in water regime, either of quality or quantity due to intervention in the upstream is likely to cause impact in the aquatic environment. There is likely to be significant change in rainfall pattern and quantity which has been projected from analysis of past data. Similarly, the cumulative impact on discharge and water level has been assessed.

Table 6.4: Mean annual rainfall (mm)

Period	Mean Annual Rainfall (mm)
1901-30	2871
1931-60	2987
1960-90	3180
1960-09	3230

Decadal temporal variation over the haor region has been assessed for the period of 1901-2009. There is an overall increasing trend of mean annual rainfall from 1901 to 2009. This trend has been analysed based on past observed data (without climate change). The decadal trend of rainfall shows that it has an increasing trend for most of the months for most of the stations. The district wise mean annual rainfall has been assessed and shown in the Table 6.5.

Table 6.5: District wise mean annual rainfall in mm

District	1961-70	1971-80	1981-90	1991-00	2001-10
Sunamganj	5242	5183	6224	6387	5371
Habiganj	2255	2682	2561	2521	2426
Netrakona	2647	2969	2906	3311	3003
Maulvibazar	2509	2590	2526	2309	2383
Sylhet	3899	4259	4644	4001	4157
Kishoreganj	2086	2339	2387	2404	1921
Brahmanbaria	1629	2179	2201	2099	2013

Forest

Plantation data have been obtained from the Forest Division in Sylhet from 2001 to 2011. Analysis of the data shows that on average 1308 ha of land afforestation and 145 km of strip area are planted each year in the haor area. The average trend is that about 1% of land is planted each year. The following Table 6.6 presents the last ten year trend of plantation (including strip plantation) in five districts of the haor area. The types of strip plantation include Bamboo, Bet, Murta, Sagun, Agar, Hill area, etc. The Table 6.6 shows year-wise plantation area and plantation length in Sunamganj, Habiganj, Netrakona, Sylhet and Maulvibazar districts.

Table 6.6: Year wise plantation area and length

Year	01 - 02	02 - 03	03 - 04	04 - 05	05 - 06	06 - 07	07 - 08	08 - 09	09 - 10	10 - 11
Plantation area in ha	201	805	1101	1387	2370	1313	1010	1058	1416	2420
Plantation length in Km	334	259	190	115	65	59	54	65	50	254

Mineral Resources

A projection has been made based on the daily gas production (source: Petrobangla) and total remaining reserve of different wells in of the haor districts. Till date (2010) the total extraction of gas from haor wells is 8,095.60 BCF and the remaining reserve is 8,717.30 BCF. As per the projection for the year 2015 the remaining reserve will be 6,139.04 BCF, while it will be 2,967.08 BCF in 2020 and 1,321.39 BCF in 2030. In 2019 the Jalalabad gas field, in 2020 the Bibiyana gas field, in 2026 the Titas gas field and in 2029 the Maulvibazar gas field will be emptied. The line diagram (Figure 6.8) shows the projection of gas reserve in the haor area.

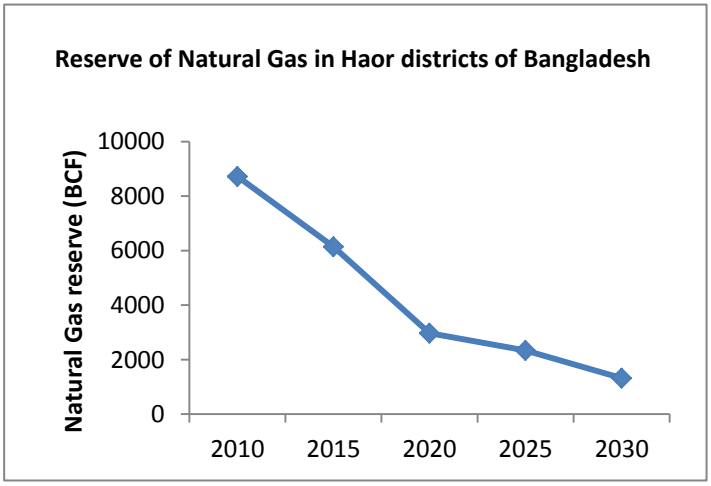


Figure 6.8: Natural gas reserves in Bangladesh

Climate Change

Bangladesh is one of the most climate change vulnerable countries of the world and the impact of climate change may be even worse than that anticipated (MoEF, 2008). Floods, tropical cyclones, storm surges and droughts are likely to become more frequent and severe in the coming years. The 4th Inter-Governmental Panel on Climate Change (IPCC) Report predicts that seasonal (pre-monsoon) rainfall will increase up to 31% in 2099, resulting in higher river flow during the monsoon season. Global warming will cause sea level to rise between 0.18 and 0.79 meters in 2099. In response to this, the Bangladesh has recently developed the Bangladesh Climate Change Strategy and Action Plan (BCCSAP, 2009) for building a climate resilient development framework through adaptation and mitigation. Adaptation for physical infrastructure is one of the six pillars in the BCCSAP, which stresses the need to deal with the likely impacts of climate change.

The projected global average surface warming and sea level rise at the end of the year 2100 based on AOGCMs is presented in the Table 6.7.

Table 6.7: Projected global average surface warming and sea level rise under different scenarios

Item	Scenarios					
	B1	A1T	B2	A1B	A2	A1FI
Temperature(^{0}c)	1.1 – 2.9	1.4 – 3.8	1.4 – 3.8	1.7 – 4.4	2.0 – 5.4	2.4 – 6.4
Sea Level Rise(m)	0.18 – 0.38	0.20 – 0.45	0.20 – 0.43	0.21 – 0.48	0.23 – 0.51	0.26 – 0.59

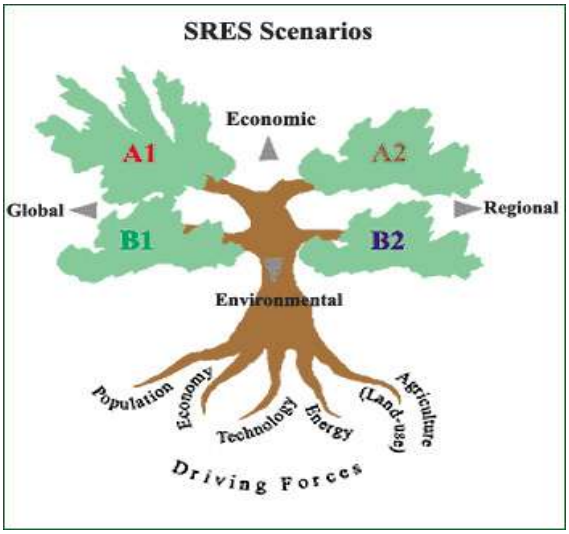
The projected precipitation change in Southeast Asia during the 21st century based on AOGCMs is presented in the Table 6.8.

Table 6.8: Projected precipitation change in Southeast Asia during the 21st century

Sub-region	Season	2010 – 2039		2040 – 2069		2070 - 2099	
		A1FI	B1	A1FI	B1	A1FI	B1
South Asia	DJF	-3	4	0	0	-16	-6
	MAM	7	8	26	24	31	20
	JJA	5	7	13	11	26	15
	SON	1	3	8	6	26	10

Note: DJF: December, January & February; MAM: March. April & May; JJA: June, July & August; SON: September, October &November (-ve : decrease)

Emission Scenarios



- A1 - a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter and the rapid introduction of new and more efficient technologies. Three sub groups: fossil intensive (A1FI), non-fossil energy sources (A1T), or a balance across all sources (A1B).
- A2 - A very heterogeneous world. The underlying theme is that of strengthening regional cultural identities, with an emphasis on family values and local traditions, high population growth and less concern for rapid economic development.
- B1 - a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A1 storyline.
- B2 - a world in which the emphasis is on local solutions to economic, social and environmental sustainability

There is no specific or comprehensive study on climate change impact on the haor area. However, projections made by the IPCC (4th Assessment) for south Asia as well as other projections could be considered for the haor region for insight into climate change impact, adaptation and mitigation.

6.3 Driving Forces

Driving forces at different levels shape the future development of the haor region. Many parallels and linkages between forces at different levels contribute in shaping its development policies and future economy. Following are the major driving forces controlling future development of the haor region:

6.3.1 Stress on Agricultural Land

Increasing population is the major concern and driving force in this region. Increasing population also exerts tremendous pressure on rural lands. Farms are becoming smaller (fragmented) through inheritance and other processes. Depending on soil fertility and other factors, farms below 0.4 ha are not economically sustainable even with the technology presently available. Functional landlessness in the region amongst the rural population already exceeds 50% and will further increase rapidly due to the lack of new land for agricultural use as well as small size of existing farms, existing land ownership patterns and rapid population growth.

6.3.2 Pressure on fragile Ecosystems

Wetlands are increasingly being encroached upon and drained for the purpose of agricultural activities. Alluvial fans or desilting areas in the north of the region are being disturbed by agricultural activity resulting in increased silt deposition to the south.

6.3.3 Urbanisation and Migration

The haor region is lagging much behind from the rest of the country in terms of urbanisation partly due to cultural reasons in the sense that the inhabitants appear to prefer rural life and partly because of relatively poor accessibility to urban areas and modern facilities like education, industrialisation etc. However, given the rapidly growing rural population in the northeast, increased landlessness and population pressure on the fragile haor ecosystem, it is likely that the region will experience rapid urbanisation and moreover there will be increased migration from the region to other major urban areas such as Dhaka city. At present, cyclical migration does occur, particularly from central wetland (Haor) areas to urban areas. Some migrants have settled in northeast urban centers on a permanent basis but they usually retain ties, frequently through land ownership, to their rural homesteads or communities. Given the enormous pressures on rural land, urbanisation in the region can represent a positive force, particularly if well-managed. Inevitably, a much higher percentage of the Gross Regional Product (GRP) will be contributed by urban areas. Since all urban centers in the region are still relatively small, they could be shaped to improve future human well-being, in terms of being environmentally balanced and economically effective.

6.3.4 Improvement of Transportation

Transportation improvements are among the most significant driving forces that will shape the future economy and sustainability of the haor region. Use of mechanised country boats and improved road networks are contributing factors in improving accessibility. Based on ongoing, committed and planned road programmes and projects, road network improvements are more likely to reflect initiatives in rehabilitation and maintenance rather than network extension. Existing new embankments will be paved in a phased manner considering the communication needs of the area.

Improved physical linkage between rural areas and larger settlements will increase access of outsiders to local rural resources while at the same time improve the economic bargaining positions of rural residents. If not planned carefully, highways can alter drainage patterns, impede navigation and create other negative environmental or economic impacts. Similarly, efforts to improve navigation such as straightening of river courses could cause unexpected hydrological impacts with negative environmental and / or agricultural consequences.

6.3.5 Economic Diversification

The region is lagging slightly behind the nation in this regard but will soon restructure more rapidly in terms of rural off-farm activity, urban manufacturing and formal and non-formal service activity. This restructuring process will be driven by both push factors such as lack of access to land and pull factors such as demand for non-agricultural products from the region, for example, natural gas.

6.3.6 Dependency on Local Resources

The growing rural population, including the landless, is increasingly harnessing wetland resources as their means of livelihood and creating increased demand on wetland resources. As pressure on local resources is increasing, over-exploitation is likely to occur. A better and coordinated management of natural resources has to be developed for sustainability of the ecosystem. For most of the region's residents, local surface and aquatic resources are the only source of biomass for fuel and building material. Pressure on local surface and aquatic environments will be relieved somewhat through increased rural electrification and increased local household use of available natural gas.

6.3.7 International demand for conservation of wetland

Wetlands in the haor region, as they become more known and accessible, may become subjected to increased international demand for preservation of specific wetland species that have national and international environmental and economic value. Tanguar haor has already been declared as a RAMSAR site for preservation of the wetlands in the haor region. There are more potential haor to be considered as RAMSAR sites in the near future.

6.3.8 Initiation of Agricultural Technologies

The rate of adoption of High Yielding Varieties (HYV) varies throughout the region. The fastest rate of adoption is in the western part of the region where extension of irrigated areas is due to use of groundwater. There can be negative impacts of HYV adoption, such as water pollution and encroachment of wetland areas. The planners need to consider and make arrangements to compensate for the effect of lowering of groundwater level. Currently, rice yields in the region are increasing at only about 2% a year which is close to the population growth. There is a need to diversify agriculture in the region for food production and economic reasons.

In Bangladesh society, there is an extremely strong preference for rice cultivation for obvious reasons. Creating areas suitable for rice cultivation sometimes leads to draining of marginal areas or management practices which inadvertently create secondary impacts such as the drying up of wetlands. Although much of the region is ideally suited for rice cultivation, sometimes rice is planted when other crops would probably yield higher nutritional and/or economic returns and/or be less environmentally damaging. Hence, this driving force of local psychology and tradition related to rice cultivation must be kept in mind while formulating regional plans and strategies.

6.3.9 Ownership of Wetland Areas

Wetland areas, originally defined as permanent water bodies and lowland forest and reed areas, were identified through various surveys prior to 1956. Tenurship over government-owned wetlands and other (government-owned) lands is vested in the Ministry of Land (MoL) which has a revenue collection mandate. The MoL generally leases out its holdings – be they fisheries, quarries, grazing lands, or swamp forests. The major beneficiaries of the current leasing system are the moneylenders, leases and musclemen who derive high profits from land lease. The system is not totally in conformity with the national development strategy as the system of rent and taxes stimulates resource depletion rather than sustainable development. Rents and taxes on wetlands transfer wealth from rural areas to the center and from poor resource gatherers to members of the elite. The tenure system promotes concentration of control over natural resources to rich and politically strong groups. There exist conflicts of interests, even among the governmental agencies such as between the DF & the MoL and the DoF & the MoL.

6.3.10 Recurrence of Water Related Risks and Hazards

The haor region is composed of depressions near hilly areas. The depressions are transformed to water bodies due to their connectivity with the river system and as a result of local rainfall. The geographical aspects extensively contribute to flash flooding and Afal (wind generated wave on vast water body in the depressions) which have a yearlong effect on the livelihoods of the haor people. These natural driving forces actually shape how the people live and how they can most effectively adapt themselves to the harsh natural events. These also shape their social economy in terms of whether to grow rice or capture fishes. Hence, policy making must consider these aspects.

6.3.11 Social Change

Social change is taking place in terms of women empowerment and appreciation of their role in the economy. The economic role of women in the household and the community is becoming more valued in the region. In part, this trend is a product of necessity as the labour of both men and women is required to earn livelihood in an increasingly competitive socio-economic environment. Modern communications technologies are contributing to social changes in the region. Since young people are more willing to change, it is likely that the youth will be influential in bringing about changes in the region. Given the age structure, employment avenues need to absorb a huge amount of population over the next two decades. This force is also required in the regional labour market.

6.3.12 Local Initiatives and Decentralisation of Power

Many BWDB initiatives and plans reflect project ideas or actions generated locally. There is increased involvement of local people in the identification of local needs for intervention by bodies such as the BWDB. Such intervention reflects the transfer of power to the general people.

6.3.13 Climate Change

Climate change and variability may impact the haor area more frequently than ever before. Extreme events like point rainfall may increase causing frequent and devastating flash floods. During monsoon, increase in the precipitation is anticipated and subsequently increase in the volume of surface runoff may occur to further aggravate the flooding condition in the area. Due to climate change induced inundation, a large portion of the area could face major challenges in terms of

displaced populations and their loss of income. Agriculture and human health will be strongly affected as well, while ecologically important areas will suffer from extreme flow and other effects.

Chapter 7 Formulation of Strategy

7.1 Introduction

The strategy of the Master Plan focuses on achieving the objectives of Development Areas based on certain key principles. The strategy has been formulated based on a blend of structural and non-structural measures to make optimal use of available natural resources with minimal disturbance to the haor wetland ecosystem. There are obvious limitations to the use of natural resources and exploitation/change of the natural and fragile ecosystem of haor wetlands. Therefore, it has been necessary to base the strategy on appropriate interventions on nature and the human system with understanding of the processes and impacts of the interventions on the ecosystem.

7.2 National Development Vision and Priorities

The vision of the GoB has been to achieve sustainable national development which encompasses all aspects of economic, social, cultural, political and other areas of development. Bangladesh has shown high resilience against natural disasters including recurrent floods and has proven to be a successful innovator with a turn for proactive action that brings beneficial outcomes. As mentioned earlier Bangladesh has six clearly defined national goals (National Water Policy, 1990):

- Economic development
- Poverty alleviation
- Food security
- Public health and safety
- Decent standard of living for the people and
- Protection of the natural environment

The development priorities of Bangladesh are to promote an equitable society as a basis for social and political stability. There will be poverty reduction, gender equity, balanced regional development and an inclusive society with workers' rights and responsibilities firmly established. The provision of universal socio-economic-cultural safety nets or social protection, including targeted programmes is part of the government policy to ensure an equitable society as the country climbs the ladder to higher economic growth. The development priorities of the government as set out in the Outline Perspective Plan (2010) are:

- Ensuring effective governance
- Developing a sound environment and innovative people for a modern digital Bangladesh
- Creating a caring society
- Addressing globalisation and the challenges of regional cooperation
- Ensuring broad-based growth and food security
- Providing energy security for development and welfare
- Building a sound infrastructure and
- Mitigating the impacts of climate change

7.3 Development Strategy

Formulation of the Master Plan strategy has involved analysis of different documents, plans, policies and strategies of the Government of Bangladesh. The strategy has been formulated to identify a set

of priority actions based on assumptions and constraints to achieve the objectives of the Master Plan. It is also based on the strategies formulated for different DA plans. The principles followed for developing the Master Plan strategy are:

- Compliance with declared development policies, strategies and plans
- Consideration of the national vision, goal, objectives and strategies
- Recognition of the recommendations and suggestions based on public participation and consultation process
- Pursuing the integrated policy directives of the government for sustainable development of the areas
- Maximisation of resource utilisation with minimum degradation of the haor wetlands and eco-system

Based on the above principles, the strategies have been formulated under the umbrella of six broad thematic areas, which are:

1. Improved water and disaster management
2. Agricultural development for food security
3. Biodiversity enhancement and wetland management
4. Social safety net and improved standard of living
5. Improved physical infrastructure and
6. Enterprise and technology development

The strategic thematic and (relevant) development areas are sown in Table 7.1.

Table 7.1: Strategic thematic areas and development areas

Sl no	Strategic Thematic Areas	Development Areas
1	Improved water and disaster management	Water Resources
2	Agricultural development for food security	Agriculture, Fisheries, Pearl culture and Livestock
3	Biodiversity enhancement and wetland management	Biodiversity & Wetland and Forest
4	Social safety net and improved standard of living	Education, Health, Water Supply & Sanitation, housing & settlement and Social Services
5	Improved physical infrastructure	Transportation and Tourism
6	Enterprise and technology development	Industry, Power& Energy and Mineral Resources

Descriptions of the strategies considered under each thematic area are given below:

7.3.1 Improved Water and Disaster Management

Water is central to the fragile ecosystem of the haor area. The haor Basin contains the last major remaining semi-natural and large-scale freshwater wetlands of the country and includes important mother-fish sites. The Basin is under threat from encroachment of agriculture, deforestation and over exportation of capture fisheries. The purpose of the programme is to safeguard the water resources and to preserve the natural characteristics of the whole Basin with special attention to ecologically important areas. This will be achieved by the development and implementation of a staged, environmentally sound and acceptable water management plan for the area.

Disaster management for the haor area is to protect lives and properties from any kind of hazards where particular emphasis is given on water related disasters (such as flash floods) with priority given to disaster risk management along with mitigation. The Disaster Management Act identifies a group of broad-based strategies, which focus on the management of risk and consequences, community involvement in protecting lives and properties with greater involvement of local government bodies and emphasis on non-structural mitigation. The government has taken a number of steps for building up institutional capacity from national to union levels for effective and systematic disaster management. This thematic area covers climate resilient improved water and disaster management initiatives in line with the national development goal and other relevant policy directives of the government.

The haor area is experiencing some crucial problems related to water resources management such as flash floods, wave erosion, drainage congestion, scarcity of irrigation water in dry season, inadequate institutional set-up, funding, etc. Compounding all these problems is the threat of climate induced changes. The strategic recommendations for water resources development and management are presented below:

- Areas unprotected from flash flood to be brought under protection with minimum disturbance to the haor ecosystem and areas already under protection to be brought under rehabilitation.
- Innovative and environmental friendly structural solutions to be implemented for fish pass to facilitate fish spawning, breeding and migration.
- Enough opening to be provided in the embankments to facilitate navigation (boat pass) and also for allowing water inside the haor during monsoon.
- Embankment and water control interventions to be designed considering 1:10 year pre-monsoon flashfloods.
- Regular O&M (re-sectioning) of submersible embankments under existing FCD/I projects on a priority basis for the protection of pre-monsoon flash floods.
- Drainage of distributaries and outlet channels to be improved for re-establishing the drainage connectivity of haor.
- Protection to be provided against erosion around the periphery of haor villages using hard materials and/or through green belt afforestation giving priority to deeply flooded areas.
- Improved monitoring system to be introduced for ground and surface water quality and quantity in support of sustainable irrigation and domestic water supply.
- Appropriate small-scale surface water conservation and irrigation facilities to be created in areas where groundwater use is approaching rechargeable limits.

- Transfer of FCD/I scheme management to the beneficiaries (stakeholders) according to the national policy and directives.
- Homestead mounds to be extended for creating better facility for cattle rearing in monsoon.
- Safe haven to be created for mother fish through further deepening of the deeper portions of haor.

7.3.2 Agricultural Development for Food Security

This thematic area encompasses crops, fisheries, pearl culture and livestock sub-sectors to ensure food security, economic development and poverty reduction of the haor people. Agriculture plays an important role in the overall economic development of Bangladesh which contributes about 21% of the GDP, sustains the livelihood of about 52% of the labour force and remains a major supplier of raw materials for agro-based industries. Social issues like food and nutritional security, income generation and poverty reduction are also related to agriculture. Besides, it is the biggest source of market for a variety of consumer goods, including consumer durables particularly in the rural areas. Hence, improvement in agricultural sector performance and acceleration in its growth are critical for reducing rural poverty. Pearl culture can open up a new-dimension of economic activity in the rural haor areas.

The agricultural strategy needs to be directed toward increased production of non-rice crops, livestock products, fodder, fuel and other commodities. Water control and management have an important role in ensuring maximum agricultural land use, diversified production and higher output per unit area in order to raise the level of well-being of the entire community of farmers, the rural landless who directly depend on them for employment and of the urban customers who rely on them for food. Advances in agriculture may also be accompanied by other programmes of the government including population control and poverty alleviation. Following are the specific thrust areas of the strategy.

Crop

Present and projected agricultural indicators for crop production are given in Table 7.2.
Intensive agriculture: Private and public initiatives and investment in agriculture should focus on areas where much higher returns on investment are possible e.g. through homestead gardening and intensive livestock production.

Development of irrigation system: Minor irrigation development needs to be promoted in the haor area. There is a huge demand for expanding the command areas of existing irrigation facilities with appropriate irrigation infrastructure and also for minimising loss from irrigation. Re-excavation of canals will serve the twin purposes of moisture retention and distribution for irrigation.

Construction of food godowns and seed stores: The Community Food Bank (CFB) may be introduced in the haor area. Buffer stock of food grains may be stored at community level to provide food during seasonal deficits in the lean months of the year or during disaster periods.

Development of quality seeds: Individuals, companies and other agencies are to be encouraged to undertake plant breeding programmes and to import breeder/ foundation seeds of notified crops for a variety of development and promotional purposes. The quality of seeds should be ensured by the

government at all stages of the seed system from production to marketing including seed import and export.

Promotion of technological development in agriculture: Mechanisation will be promoted in the haor area for quick land preparation, planting, weeding, harvesting, processing, seed drying etc. The government encourages production and manufacturing of agricultural machinery in the haor area by providing exemption of import duties on raw materials.

Table 7.2: Present and projected agricultural indicators

Target indicator	2010	2021	2030
Cropping intensity (%)	160	184	194
Total cropped area (million ha)	1.93	2.23	2.36
Rice area (million ha)	1.74	1.88	1.93
Non-rice area (million ha)	0.19	0.34	0.43
Rice production (million metric ton)	5.25	6.22	6.55
Non-rice production (million metric ton)	1.53	2.15	2.49
Irrigation area (Surface water), million ha	0.472	0.528	0.552
Irrigation area (Ground water), million ha	0.345	0.387	0.405
Rice seed requirement (thousand metric ton)	72.86	78.7	81.2
Labour use/demand[1] (million man-days/year)	306	308	309
Fertilizer use/demand[2] (thousand metric ton)	360	436	468
Pesticides use/demand[3] (mt or kl)	3277	3920	4195

[1] Agricultural mechanization through combined harvester, rice transplanter, grain dryer, power thresher, might help to reduce about 70% of additional future labour requirement of the study area.

[2] In future, the training on integrated crop management (ICM) and on-farm fertilizer management with optimum use of fertilizers will encourage the farmers to apply optimum level / balanced fertilizer for crop production. The impact of ICM training will reduce urea application by about 16-25%.

[3] Integrated pest management (IPM) and integrated crop management (ICM) training will be imparted to the beneficiaries through 'learning by doing' which will reduce use of pesticides by over 50%-70%.

Development of suitable crop variety: Short duration quick-maturing varieties with high yield potential are needed in the haor region. Cold tolerant Boro rice varieties need to be developed for early transplantation. Suitable varieties of non-rice crops are also needed which can grow in the winter season before modern Boro rice varieties are transplanted.

Platforms for intensive cultivation of non-rice crops: The raised platforms which are proposed to be built with dredged spoil may be utilized to increase cultivation of homestead vegetables, pulses, spices and fruits. This in turn will improve nutrition and increase household income.

Development of effective supply chain for agricultural marketing: Strong market infrastructure should be developed to bring efficiency in marketing services aiming at the development of an efficient agricultural marketing system.

Fish

The fisheries sector of the haor basin is an integral part of the wetland management which contributes to food and nutrition self-sufficiency, increase employment opportunities and human well-being and maintain the ecosystem. Table 7.3 shows the present and future fish indicators for haor areas. Therefore, the strategy for the fish sector focuses on:

Table 7.3: Present and future fish indicators

Target indicator	2010	2021	2030
Fish production (Lakh ton)	4.32	6.19	6.69
(a) Capture(Lakh ton)	3.19	4.31	4.37
(b) Culture(Lakh ton)	1.14	1.89	2.32
Fish wastage Thousand ton	17.3	12.4	6.7
Fish export Ton	452	830	905
Fish demand for human nutrition (Lakh ton)	3.93	4.34	4.65
Over all fish demand (Lakh ton)	4.13	4.49	4.75
Fish add to national grid (Lakh ton)	0.20	1.70	1.94
Fishers Lakh Nos.	3.17	3.59	3.73
(a) Fishermen Lakh Nos.	2.60	2.94	3.06
(b) Fisher women Lakh Nos.	0.57	0.65	0.67

- Different approaches for improving capture fishery, aquaculture practices and for assisting stakeholders in improving fisheries productivity and production;
- Ensuring rights/access of the poor to fisheries resources;

- Gender inclusiveness by encouraging involvement of women in fisheries to either support family income or make them self-reliant;
- Alternate income generating activities by identifying and providing fishermen with alternative income activities and seasonal safety nets;
- Environmental management by adopting an appropriate ecosystem management approach;
- Inland capture fisheries for local fishing and user communities through collaboration of all partners concerned for sustainable management;
-
- Aquaculture sub-strategy, which supports the continued development of aquaculture as a key supplier of animal protein and opportunity for resource development through the provision of a regulatory structure to ensure quality inputs and by the provision of services for enhancing knowledge to promote production;
- The shrimp sub-strategy is aimed at supporting stakeholders to ensure its development to full potential;
- The aquaculture extension sub-strategy includes provision by the Department of Fisheries and partners of an efficient, effective need based extension service to all categories of farmers for enabling them to increase production to an optimum sustainable level by using appropriate aquatic resources;
- The human resource development sub-strategy is to strengthen the human resource capacity of the Department of Fisheries, its partners and its primary stakeholders to ensure requisite knowledge, skills and techniques to enable them to make productive use of their potentials;
- The quality control sub-strategy calls for supporting the implementation of industry controls on quality to ensure that all fish and fishery products marketed for export or domestic consumption satisfy the requirements for quality as detailed under the HACCP (Hazard Analysis and Critical Control Points) and other regulations including traceability and social accountability;
- The monitoring and evaluation sub-strategy is to develop systems to monitor progress towards the National Fisheries Polices objectives and evaluate activities directed towards achieving those objectives.
- Biodiversity conservation, for example, through establishment of sanctuaries and restoration of fish migration routes where they have been blocked;
- Mitigation of the negative impacts of water management structures through community collaboration and scaling up of community based floodplain fisheries management to all floodplains;
- Supporting restoration of wetlands and associated aquatic life (especially fish populations) in a river floodplain ecosystem, thereby reversing declining fisheries and protecting nationally threatened species;
- Ensuring that poor fishermen gain rights to use water bodies on condition that they adopt sustainable practices that conserve aquatic resources;
- A long term pearl culture programme initiated as a pilot programme based on past experience including capacity building, community awareness, intensive training and establishment of micro enterprises with market chain.

Livestock

The livestock strategy addresses issues of traditional livestock rearing, low productivity, environmental adaptability and immunity to diseases. Animal feed scarcity, disease prevalence, inadequate input supply and lack of technological development are the basic issues/problems for future planning in the livestock sector. The strategy directive is that the planning should adopt a holistic approach for agricultural development (crop, livestock and fisheries) and productivity, as well as development of suitable breeds and varieties adaptable to the adverse situation in the haor region. The Vision 2021 of Bangladesh envisages narrowing the demand-supply gap of animal protein and ensuring that almost 85% of the human population gets 150 ml. of milk, 110 gm of meat and 104 eggs per day respectively by the year 2021. It also emphasises reduction of unemployment from 2.8 crore to 1.5 crore by creating employment opportunities for 1.3 crore people. Table 7.4 shows the present and future livestock indicators for haor areas. To reach the above goals, the following strategies could be adopted:

Table 7.4: Present and future livestock target indicators

Target Indicator	2011	2021	2030
Protein Production of milk (Million M Ton)	0.62	1.11	1.46
Protein Production of meat (Million M Ton)	0.14	0.25	0.33
Protein production of egg (Million number)	990	1,762	2,326

- Develop cattle and buffalo breed in the haor region through artificial insemination.
- Provide farmers with training and facilitate transfer of technology on cow rearing, goat rearing and broiler production.
- Import meat-type animal or facilitate expansion of hybridisation through artificial insemination.
- Improve management, ensure adequate feed supply and reduce mortality to develop traditional poultry and cattle.
- Increase egg production capacity of backyard poultry through improvement in variety, technology and management.
- Ensure availability of commercial chicks and feeds for improvement of commercial poultry farming.
- Provide training to farmers on better management and preventive measures and also reduce mortality.
- Ensure duck farming through availability of ducklings for improving duck rearing and variety development.
- Provide training to farmers on duck rearing technique and take necessary steps to reduce mortality.
- Introduce fodder cultivation in floating platform and village edge for multi-purpose use
- Ensure availability of improved bulls and bucks for breeding and avoid in-breeding
- Introduce multipurpose fodder crop (e.g. *Sesbaniasesban* and *Sesbaniagrandiflora*) as alley crop and analyse crop suitability.
- Establish mini duck hatcheries and husk incubation system.
- Form co-operative societies for farmers to facilitate marketing.
- Establish community grazing land maintained by CBOs, which should not be used for crop production.
- Establish a livestock service center in every haor village. A self-sustained health worker (preferably a woman) should be developed and trained from the same village to take charge of the service center.

- Extend artificial insemination services to all service centers at the Union Parishad level to develop better breeds.
- Develop capacity of government-owned input supply stations for supplying ducks/ducklings as per the demand of the region.
- Ensure government veterinary services for all livestock farmers.
- Establish milk procurement and processing plants in the region.
- Ensure easy credit delivery policy with provision for minimum interest rate for livestock farmers.
- Ensure implementation of community-based livestock and dairy development project of the government.

7.3.3 Biodiversity Enhancement and Wetland Management

This thematic area covers biodiversity and wetlands as well as development of forest resources in the haor area. The wetland biodiversity of the haor region makes it a unique wetland ecosystem. It plays an important role in the ecology, environment, economy and livelihood of the region. Apart from the scenic beauty of these wetlands, which have great economic and environmental value, its natural resources need to be protected and conserved to maintain ecological balance and to protect the environment and improve livelihoods of the poor people of the haor area.

Biodiversity and Wetland

Bangladesh has the obligation to conserve its national biodiversity and ensure wise-use of wetland resources as the country is signatory to a number international agreements/protocols related to biodiversity conservation and wetland management such as the Convention on Biological Diversity and the Ramsar Convention. Hence, strategic options on biodiversity conservation and sustainable wetland management are aimed to protect the country's wetlands and biodiversity. The following strategies will be followed:

- Zoning of the region based on distribution of the ecological attributes of biological resources and land use pattern. The strategy calls for the establishment of new land use zones considering historical changes and the present situation.
- Wise use of wetland resources and conservation of aquatic resource genomes, allowing natural regeneration of areas having swamps and reeds by protecting over exploitation trends, determining the sustainable harvest quota and plantation of indigenous species of aquatic and wetland plants.
- Development and implementation of a Management Plan for identified wetlands of global significance.
- Establishment of a recovery programme for threatened species of wild flora and fauna.
- Establishment of wetland protected area network.
- Establishment of a Global Wetland Center for research, education, conservation, awareness, networking, recreation, monitoring and evaluation.
- Strengthening of local institutions for wetland and biodiversity management.
- Formulation and implementation of a comprehensive Wetland/ haor Conservation and Development Policy, as development of a unique or "stand alone" wetland policy statement can be an important step in recognising wetland problems/issues and taking targeted action to deal with them.
- Identification of ecologically important areas within the region to protect biodiversity and mitigate conflicts over resource exploitation along with provision of legal arrangements.
- Monitoring of wetlands to recognise the changing ecology of wetlands, i.e. changes in flora and fauna, hydrology or chemistry, in response to climate change, pollution and other long-term impacts. Habitat/land use studies on a national or regional scale should help to evaluate the success of direct conservation initiatives and find out if wetland loss is still occurring and the reasons thereof.
- Promotion of effective wetland science through establishment of national priorities for scientific research on wetlands with regular review. A comprehensive national inventory is the basis for many activities necessary for achieving the wise use of wetlands, including

policy development, identification and designation of Ramsar sites, documentation of wetland losses and identification of wetlands with potential for restoration.

- Wetland data management through carrying out a comprehensive national inventory
- Coordination and rationalisation of government programmes to minimise their adverse effects on wetlands and encourage wetland conservation.

Forest

The community is the main beneficiary of social forestry. The strategy of this programme is to develop the forestry sector through implementation of different projects so that communities are benefitted. Table 7.5 gives the present and future forest indicators for haor areas. The following measures are to be taken under the strategy for improving forestry:

- Natural resources management is to be practised through active participation of the beneficiaries.
- Roadside and embankment plantations shall be in the "Strip Plantation" category.
- Ecosystem and forest oriented research on haor areas will be promoted.

Table 7.5: Present and future forest indicators

Target indicator	2010	2020	2030
Plantation of hill and agro forest (ha/yr)	1300	2000	2000
Strip Plantation on side of road, embankments, homesteads and institutions (km/yr)	150	350	350

7.3.4 Social Safety Net and Improved Standard of Living

The Government of Bangladesh aims to achieve poverty reduction which is directly targeted to benefit all kinds of poor people including the ultra-poor and the disabled. The Vision 2021 focuses on a strong and expanded social safety net programme, which will protect the poor from all sorts of social, economic and natural shocks. The PRSP 2, 2008 provides strategic guidelines for poverty reduction.

This strategic thematic area integrates the health, education, water supply & sanitation, housing & settlement and social services & facilities sectors to provide social safety net and improved standard of living for the haor people. Ensuring social security for lives and livelihoods, people's participation, employment generation and people's empowerment are the key components for providing social protection to the vulnerable group of people. Social Safety Nets or "socioeconomic safety nets" are non-contributory transfer programmes seeking to protect the poor and those who are vulnerable to shocks and poverty from falling below a certain poverty level.

Health

The key indicators to be improved in the haor area are maternal and child health by reducing mortality rate (infant under-5 and maternal) and also child delivery conducted by skilled health personnel. Table 7.6 shows present and future health indicators for haor areas. More specifically, the aim is to bring about:

Table 7.6: Present and future health indicators

Target Indicators	2010	2021
Reduction of Under-5 child malnutrition(per 100) in %	46	33
Delivery conducted by skilled health personnel in %	13.4	50
Maternal mortality rate (per 1000 live births) in %	3.2	1.2
Under-5 child mortality rate (per 1000 live births) in %	76	48
Infant mortality rate (per 1000 live births) in %	57	32
Population growth rate in %	2.0	1.2
Total fertility rate in %	3.5	2.1

- Improvement of the nutritional status of children by reducing Under-5 child malnutrition;
- Improvement of health through ensuring provision of general health care services and improved hospital services;
- Control of communicable, non-communicable, emerging and re-emerging diseases through prevention and control of communicable and non-communicable diseases;
- Development of human resources in the health sector through quality medical education and in-service training for different disciplines of health care providers
- Improvement in the availability of essential raw materials and machines to ensure production of essential drugs and other accessories and also for quality control of drugs.

Education

The following strategies have been adopted for developing education facilities in the haor region:

Table 7.7: Present and future education indicators

Target Indicator	2010	2020	2030
Literacy rate in %	38	75	100
Net enrollment rate in primary school in %	82	95	100
Attendance rate in primary school in %	74	100	
Students attending in secondary level in %	37	60	80
Decrease teacher student ratio	1:54	1:40	1:40
Attendance of female students in %	75	100	
Women Teachers		50	50
Survival rate in %	82	100	
Transition rate in %	60	80	100
Dropout Rates at primary level	44	20	5

- Improvement of the literacy situation, especially in remote haor areas by increasing literacy rate (Table 7.7);
- Increase in net enrolment rate at primary level;
- Increase in attendance rate in primary schools;
- Increase in percentage of students attending secondary level;
- Increase in primary education cycle completion rates of students from poor families and creation of friendly learning environment;
- Increase in opportunities for education for the ultra-poor and inhabitants of remote haor areas;
- Improvement of the quality of education and decrease in the teacher student ratio from 1:80 to 1:40 by recruitment of more teachers;
- Development of skills of teachers and introduction of financial incentives similar to that in the Chittagong Hill Tracts (CHT) to attract teachers to serve in remote areas;
- Ensuring equality and equity in education to increase the percentage of attendance of female students from 20% to 50% at all levels and percentage of women teachers to 50%;
- Fostering dynamism in post literacy activities through continued education programmes and skill development;
- Establishment of vocational institutions as per requirement in all haor upazilas;
- Teachers training as per requirement in all haor upazilas.

Water Supply and Sanitation

Table 7.8 provides present and future indicators for water supply and sanitation for haor areas. The strategy for improving drinking water supply and sanitation in the haor area has been formulated based on the following principles:

Table 7.8: Present and future water supply and sanitation indicators

Target Indicator	2010	2121	2030
Water Supply			
Provision of number of people per water source (PSF, RWH, TW etc.)	93 - 152	90	50
Provision of no. of household per water source (PSF, RWH, TW etc.)	13 - 18	10	5
Sanitation			
Access to general sanitary latrine per household (%)	67 - 88	100	100
Provision of no. of household per suitable sanitary latrine (ESRP, SEL, SERP etc.) (%)	5-20	55	100

- Development of the water supply and sanitation sector through local bodies, public-private sector, NGOs, CBOs and women groups involving local women, particularly elected members (of local bodies) in sector development activities;
- Gradual community cost-sharing and introduction of economic pricing for services;
- Assigning priority to under-served and un-served areas;

- Adoption of water supply and sanitation technology options appropriate to specific regions, geological setting/condition and social groups;
- Improvement of existing technologies and continuous research and development activities to develop new technologies;
- Provision of arsenic free water to mitigate arsenic toxicity and protect health and wellbeing of people living with acute arsenic problem in the haor area;
- Social mobilisation through publicity campaign and motivational activities using mass media, among other means, to ensure behavioral development and change in safe water through hygiene practice;
- Capacity building at local/community level to deal effectively with local water and sanitation problems;
- Regular qualitative and quantitative monitoring and evaluation to review progress of activities;
- Wherever feasible, safe water from surface water sources shall be given preference over other sources;
- With a view to controlling and preventing contamination of drinking water, regular and coordinated water quality surveillance and monitoring by the Department of Public Health Engineering (DPHE) and other government organizations;
- The local people and groups of people concerned including members of local authorities, Village Sanitation Center (VSC), NGOs and CBOs trained in technology of low cost sanitation options particularly for high-water table and flood-prone areas and transfer of technology;
- Provision of sanitation facilities to the poor free of charge and a tax concession to the well-to-do people;
- Community-type latrines built for high-water table and flood prone areas where individual households cannot afford latrines due to financial constrains;
- Community contribution in cash or kind ensuring ownership of facility;
- More local and mobile Village Sanitation Centers (VSC) established to motivate people;
- Awareness raising on health and hygiene through different methods;
- Community leaders and religious leaders play active roles in motivating people to change their habits and start using improved sanitation facilities;
- Rallies and communication techniques applied to intensify social mobilisation for changing existing sanitation practices;
- An integrated approach combining water, sanitation and hygiene education for achieving overall success in the improvement of general health, quality of life and environment;
- Sanitation facilities improved through formulating appropriate policies and undertaking programmes in this area;
- Capacity building of the local authority as well as CBOs towards sustainable development of the overall sanitation programmes;
- CBOs, NGOs and the private sector are to be involved effectively in sanitation programmes and they are promoted in the production and sale of sanitary latrines in terms of providing soft loans or grants;
- Private sectors encouraged and supported to establish sanitation production centers in critical areas (remote villages, high-water table and flood-prone areas) for effective coverage;

- Establishment of facilities for producing compost and bio-gas from human and animal excreta which will provide improved cultivation and supplemented energy as well as reduce environmental pollution.

Housing and Settlement

The physical setting of the haor region creates a variety of difficulties for its dwellers. Revetment works and green belt around villages and roads need to be taken up immediately to prevent damage of the village platform from recurring monsoon flash floods. The proposed village protection revetment and green belt plan will enhance the livelihood pattern of the people of haor villages and reduce their economic and social vulnerabilities. The following strategies have been considered to improve housing and settlement in the region:

- Importance is given to ensure development of housing for the poor and needy as well as for the majority of the rural population.
- Importance is given to community participation for development of housing and ensuring a healthy livable environment.
- The concept of eco-villages has been introduced for the expansion of planned infrastructure on a priority basis in the newly developed settlement platform and for reducing housing density in the existing settlement area.

Social Services

Due to remoteness of the haor area most of the service facilities are inadequate. Poverty, illiteracy, lack of self-awareness coupled with gender discrimination and crime have made a vicious cycle which are the main causes of backwardness of the area. The Master Plan has been prepared to achieve the goals of government policies, outlining strategies to fulfill gaps in social services and facilities such as growth center and rural market facilities, storage facilities, religious infrastructures, establishment of police stations and sports facilities, etc. The strategy focuses on:

- Ensuring balanced distribution of resources among people and marketing of products through construction of rural markets and growth centers in all haor unions;
- Ensuring supply of food grain during emergency periods as well as surplus food grain to other areas in need through construction of food godowns and cold storage at union level and near each growth center or rural markets and construction;
- Creating a congenial and secular atmosphere and providing options for practicing religion through construction of mosques/temples and churches as needed and awareness generation among spiritual leaders;
- Construction of graveyards/crematoriums etc.;
- Making provision for sports through construction or expansion of one large playground for each upazila and each secondary school and adequate sports equipment at schools; and
- Ensuring safety and security of people through establishment of police stations and out posts and improve the law and order situation in all the haor villages.

7.3.5 Improved Physical Infrastructure

This strategic theme deals with the building of physical infrastructures, transport and tourism. Infrastructure development in the haor area will contribute to regional economic growth in general and pro-poor growth in particular. Building infrastructures such as road, railway, inland waterway and tourism facilities will help economic development, enhance tourism, employment generation and help in poverty reduction.

Road Transportation

- Connecting the missing links on the national and regional highways and developing regional connectivity through construction of regional, national and Asian highways;
- Connecting villages with union HQ/s, local markets, farms and ghats or with each other through union roads;
- Ensuring an environmental friendly transport system by construction of submersible road-cum-embankments and roads with minimum obstruction to the drainage flow path;
- Integrating development of transport infrastructure by construction/reconstruction of bridges and culvert;
- Developing, expanding and maintaining railway infrastructure and providing grade separations in different locations; and
- Providing accessibility to all the services and facilities for ensuring access to most of the major services and facilities by waterway, road or railway by the shortest possible route.

Inland Water Transport

- Development and maintenance of waterways for smooth navigation through river training and dredging to facilitate passenger and freight movement.
- Development of landing stations with ancillary facilities such as passenger sheds, parking yards, storage yards etc. for easy and safe embarkation and disembarkation of goods and passengers with storage and transit facilities.
- Development of provisions for aids to navigation by channel marking, installation of night navigational equipment along the waterways.
- Development of Inland Container Terminal (ICT) with container jetty, container yard and workshop.
- Development of tourism with tourist boat facilities to navigate the inland waterways at different important tourist resorts.

Tourism

Strategies for the development of tourism industry are formulated to achieve the goals and targets of the government as delineated in the policies. The short- and long-term strategies in line with the Sixth Five Year Plan and the medium term budgetary framework and long-term strategies as per OPP, 2010 will be:

- Development of tourism industry compatible with the haor ecosystem and environment through identification of tourist spots in different locations;
- Development and promotion of ecotourism;
- Expansion/renovation and modernisation of the existing tourist spots;
- Development of potential tourist spots;

- Involving local government institutions with tourism activities;
- Construction of infrastructures and improvement of the management of tourism industries under Public Private Partnership (PPP);
- Promotion of the tourist attraction sites to both local and foreign tourists;
- Provision or expansion of tourism related service sectors such as through improved accommodation, security, markets, communication system etc.;
- Development of human resources for tourism and tourism related service sectors through conducting appropriate training programmes.

7.3.6 Enterprise and Technology Development

This strategic theme deals with the development of industry and Small and Medium Enterprise (SME), power and energy and sustainable extraction and use of mineral resources. Development of SME in the haor area will contribute to regional economic growth in general and pro-poor growth in particular. Development of agro-based industry and sustainable use of mineral resources will be carried out for economic development of the haor region as well as of the whole country. This thematic area covers industrial development, exploration and extraction of natural gas and oil and suitable harvesting of gravel, sand and stone with involvement of local entrepreneurs. This will create employment opportunities for the poor.

SME and Industrial Development

Some industrialisation took place in the haor region in the early 20th century with the installation of the Chhatak Cement Factory followed by the Fenchuganj Natural Gas Fertilizer Plant along with some gas exploration in the area. The number of big industries is still very limited. Recently, the government has established an EPZ in the Sylhet area to attract foreign investors. Following is the strategy for promoting Small and Medium Enterprises (SME) and industrial development in the area:

- Efforts to establish agro-based industries as well as to increase agricultural production
- Fostering industrialisation and economic development and generating employment opportunities in haor areas
- Ensuring participation of women in the field of industrial development
- Prioritising industries to be set up on highlands or lands suitable for farming
- Discouraging establishment of industries on land reserved for cattle pasture or in urban areas, as well as filling of marshland, canals or rivers or destroying hills
- Preference for use of abandoned industrial areas as location of new industry
- Preference for utilizing mono-crop farmland if no other option is available

Power and Energy

Energy means primary energy that is comprised of oil, gas, coal, biomass etc. of which the first three are internationally tradable. Biomass is locally available and meets the requirement of household cooking particularly in the countryside and many other heating requirements such as rice parboiling, brick manufacturing etc. which will

Table 7.9: Present and future power and energy indicators

Power and energy Target Indicator	2010	2021	2030
Percentage of villages electrified in %	44	70	100
Percentage of household electrified in %	20	100	100
Solar electricity in %		5	15
All energy supply per capita	133	176	230
Commercial energy per capita	37	80	134
Electricity consumption per capita in kWh	47	152	250

continue. Of the commercial energy resources gas and coal is indigenously available in Bangladesh, but oil is imported from abroad. Coal is domestically available but mining is not yet done as to meet the requirements. Some coal is imported from India particularly for Sylhet. Gas is abundantly available in the area and there is potential for finding further reserves as some has been discovered recently in the district of Netrakona. Currently gas is also being piped to different areas of Bangladesh. The energy need of the haor area can be met from the natural gas available in the area to a great extent. However, demand for liquid fuel i.e., diesel, petrol and High-density Fuel Oil (HFO) will continue to rise in the transport sector. To a considerable extent, compressed natural gas (CNG) has replaced liquid fuel during the last couple of years. Future demand is estimated to grow at the rate of 7.1% per annum from the per capita consumption of about 37 kg to 230 kg by 2030. Table 7.9 gives the present and future indicators for power and energy for haor areas. It is therefore necessary to adopt the following strategies for adequate and timely supply of energy:

- Supply of gas shall be maximised for gainful purposes in a most efficient way, such as for the production of electricity combined cycle power plants.
- Liquid fuel supply shall be ensured as far as possible from the condensate at gas extraction sites.
- Renewable power sources shall be explored and in order to pursue this objective:
    - Solar power may be used to supply electricity to individual homes where grid supply is costly and they do not qualify for electrification from the revenue point of view of the Rural Electrification Board (REB).
    - Hydropower potentials shall be explored.
    - Biomass production and supply through planned forestry shall be ensured.
- High efficiency devices, machines and household apparatus shall be used to conserve natural resources.
- Reserve of useable energy resources shall be increased to ensure energy security for exploration/ discovery of new gas/coal field.
- Skills of the human resources involved in the energy sector shall be developed for exploration/ discovery of new gas/coal field.

Mineral Resource

The energy sector of Bangladesh is virtually dependent on a single source, which is fuel i.e. gas. Inadequacy of this resource is the main constraint in the development of this sector as it is being depleted with new development initiatives that require more and more gas reserves. The other mineral resources available in haor areas include coal, peat, limestone, white clay, gravel, stone, sand, etc. The following initiatives are essential to fulfill the strategy for developing the mineral resource sector of the haor area:

- Exploration of new gas fields in the haor region to meet local and national requirements for generating power;
- Extraction of coal and peat in a planned way to meet local and national energy requirement;
- Extraction of other minerals like glass sand, limestone, white clay, gravel and ordinary sand in a planned way for meeting the local and national requirement;
- Strengthening the capacity of miners and mining labourers in haor districts which will contribute much in the development of this sector.

Chapter 8 Overview of the Plan

8.1 Introduction

The development initiatives taken so far in the haor region have been considered to be inadequate for achieving the national goals defined by the Government of Bangladesh. About 373 haor/wetlands dispersed in the region are yet to be brought to an integrated and intensive development process. The area has the most severe hydrological conditions, such as heavy rainfall and subsequent flash flooding which usually strike during the weeks prior to the monsoon season. Historically, floods of this type have created major catastrophes on the haor population in their day-to-day life. Although floods often cause damage to life, livelihood and infrastructure, they also ensure hydraulic connectivity between perennial water bodies and as such are essential for the sustainability of fisheries which represent the principal protein source for the region.

Despite the fact that the region has great economic significance, it is one of the most poverty stricken locations of the country. More than 28% of the total population in the haor area lives below the Lower Poverty Line (LPL). Agriculture is the principal livelihood of the farmers who mostly follow mono-agricultural practice.

Water is the main controlling function for economic growth/development of the haor region. Most of the development initiatives are mainly linked with water resources as well as the aquatic environment. Many of the wetlands in this region have the potential to be considered as Ramsar Sites, Tangua haor being already declared as one. However, the security of natural aquatic resources is being slowly but inevitably compromised by human interventions both within the haor area and across its borders.

The anticipated impact of climate change includes sea level rise, delayed surface drainage and unpredictable rainfall. The profound nexus between the national goals and Bangladesh's hydrological regime will become even more obvious with the changing climate.

It has been mentioned earlier that the Master Plan is a framework plan for developing the haor area through optimal utilisation of natural and human resources for the next 20 years. Policies, strategies and plans relevant to the haor have been extensively reviewed to identify the targeted achievable goal and to establish linkage with the Master Plan. The Plan is being formulated in an integrated manner envisioning mainly disaster management, environmental sustainability, production of crop, fisheries and livestock, expansion of education, settlement and health facilities, road communication, navigation, water supply and sanitation, industry, afforestation and generation of power and energy.

8.2 Goal of the Master Plan

The overall goal of the Master Plan is to achieve sustainable development of the area by integrated planning and implementation through multi-organizational involvement and community participation for optimum utilisation of resources and reduction of poverty. The idea is to create conditions in which the development of sustainable livelihoods and the integration of the area into the national development processes can take place.

8.3 Structure of the Plan

8.3.1 Strategies

The strategy of the Master Plan focuses on achieving the objectives of Development Areas based on certain key principles. This strategy has been formulated for optimal use of available natural resources with least interruption to the haor eco-system. The formulated strategies have been grouped in six thematic areas. They are:

1. Improved water and disaster management
2. Agricultural development for food security
3. Biodiversity enhancement and wetland management
4. Social safety net and improved standard of living
5. Improved physical infrastructure
6. Enterprise and Technology Development

The details of the formulation strategies have been discussed in chapter 7.

8.3.2 Framework of the Plan

The development of the Master Plan has been an interactive process. The Plan has been prepared ensuring the participation of stakeholders from all levels to identify the major problems and issues. The PAPD process has been followed up to upazila level (69 upazilas) to prepare the Plan with active participation of community level stakeholders including men and women of different occupations and social hierarchy. In this process, the participants have identified problems and issues, reasons, solutions and possible impacts of the solutions. The stakeholders have also considered the technical, social, environmental and economic aspects of the problems and solutions. The findings from the planning activities carried out at all upazilas have been compiled to formulate the Master Plan.

As stated earlier, this Plan is in the form of a framework plan with a set of development activities proposed for specific areas or issues for the next 20 years (up to 2032). It has been prepared for the periods of short term (5 years), medium term (5 to 10 years) and long term (beyond 10 years). It presents the distribution of investments and other resources as well as the priorities to be attached to the projects for holistic development.

The projects may involve development of new projects, rehabilitation of existing projects, improvement of projects, or a combination of these activities which may be undertaken by public or private agencies individually or jointly. The Plan looks into coordination of activities of the local authority, other public agencies and NGOs.

8.3.3 Project Portfolio

The planned investment portfolios have been prepared considering the strategic thematic area and presented according to Development Areas.

Each DA consists of a number of individual projects. A total of 154 projects have been identified and presented in Chapter 10 on investment portfolios. The projects included in the portfolio are of Umbrella Type. Several sub-projects may be formulated from one project. The situation is comparable with the Programmes of NWMP.

8.3.4 Haor Information System

A web-enabled and GIS-based Haor Resources Information System has been developed using space technology, in particular GIS and Remote Sensing techniques. The aim of the development of this comprehensive and integrated database is to assist and guide planners in the preparation of the Master Plan and in the coordination of activities for haor management by line agencies. The Integrated Haor and Water Resources Database (IHWRD) contains 100 layers of data on different sectors such as hydrology, morphology, water resource, climate change, agriculture, fisheries, ecology, forestry, livestock, health, education, industry, energy and economy. In addition, upazila and haor-based information are also maintained in this database.

This web-enabled database contains a number of application tools which are useful for viewing and querying data and information with data analysis facilities. Since this geo-spatial database contains the latest and authentic information on different sectors, it can be used as base information for evaluation and monitoring the activities of projects taken under the Master Plan. The database is also compatible with the NWRD of WARPO.

8.4 Phasing of Plan

The Master Plan will be implemented in three phases in concurrence with the Sixth Five Year Plan and Perspective Plan of the Government of Bangladesh. Ideally the first phases will be initiated in the 2012-13 financial years termed as “short term” for immediate action. This phase will be completed at the end of the financial year 2016-17. The other two phases are termed as “medium term” and “long term”. These three phases for implementation of the Plan are defined as follows:

- Short term 1-5 years (FY 2012-13 to FY 2016-17)
- Medium term 6-10 years (FY 2017-18 to FY 2021-22)
- Long term 11-21 years (FY 2022-23 to FY 2031-32)

Irrespective of the starting period, projects which will be completed within 1st five year are short term, within 6-10 years are medium term and within 11-20 years are considered as long term projects.

However, there would be both impacts and implications beyond 2032 i.e., beyond the period of the Plan. Longer term impacts will be felt in the case of infrastructure with lifetime that would go beyond that date. This will include water management structures, buildings for service facilities, etc.

8.5 Cost of the Plan

Development Area wise cost estimate of the Plan is presented in Table 8.1. Thematic area wise cost estimate is presented in the Table 8.2. The costs have been shown according to short, medium and long terms.

Table 8.1: Investment cost by Development Area (amount in lakh taka)

Development Area	Nos of Project	Short Term	Medium Term	Long Term	Total	Contribution
Transportation	15	171,143	299,556	45,578	516,277	18.41%
Fisheries	22	217,916	194,906	91,601	504,423	17.99%
Power and Energy	4	28,886	220,931	91,173	340,989	12.16%
Forest	6	66,130	100,690	79,683	246,504	8.79%
Mineral Resources	3	500	215,000		215,500	7.68%
Agriculture	20	94,555	108,109	1,233	203,897	7.27%
Water Resources	9	118,994	59,180	200	178,374	6.36%
Health	16	48,466	56,951	14,945	120,363	4.29%
Biodiversity and wetland	10	26,410	38,680	47,910	113,000	4.03%
Water Supply and Sanitation	2	58,800	36,750	9,450	105,000	3.74%
Livestock	10	19,643	26,903	30,148	76,694	2.73%
Industry	9	1,717	51,000	20,000	72,717	2.59%
Education	7	17,742	15,096	39,138	71,975	2.57%
Social Services	6	2,058	1,882	11,660	15,600	0.56%
Pearl Culture	1	2,000	4,300	3,700	10,000	0.36%
Housing and Settlement	1		9,100		9,100	0.32%
Tourism	13	1,104	1,617	1,171	3,892	0.14%
Grand Total	**154**	**876,063**	**1,440,652**	**487,590**	**2,804,305**	**100.00%**

Table 8.2: Investment cost by Thematic Area (amount in lakh taka)

Thematic Area	Project Nos	Short Term	Medium Term	Long Term	Total cost	Contribution
Agricultural development for food security	53	333,391	332,484	129,139	795,014	28.35%
Biodiversity enhancement and wetland management	16	92,540	139,370	127,593	359,504	12.82%
Enterprise and Technology Development	16	31,103	486,931	111,173	629,206	22.44%
Improved physical infrastructure	28	187,150	293,722	39,297	520,169	18.55%
Improved water and disaster management	9	118,994	59,180	200	178,374	6.36%
Social safety net and improved standard of living	32	127,066	119,779	75,193	322,038	11.48%
Grand Total	**154**	**890,244**	**1,431,467**	**482,595**	**2,804,305**	**100.00%**

Chapter 9 Governance and Enabling Environment

9.1 Current Institutional Framework

9.1.1 Mandates of BHWDB

The main role of the Bangladesh Haor and Wetland Development Board is to coordinate, monitor and evaluate the proposed projects under this Master Plan. As per the resolution 2000, the BHWDB has been mandated to coordinate the activities for integrated development of haor areas and to formulate relevant projects. Its major functions are as follows:

1 Coordinate the integrated development of haor and wetlands in Bangladesh among ministries, agencies and local government bodies as well as prepare a Master Plan for integrated development of haor and wetlands;
2 Formulate projects related to the development of haor and wetlands and implement projects through local government bodies or other agencies;
3 Examine and coordinate different projects to be implemented by different ministries and agencies and provide proper advice to the implementing agencies; and
4 Take necessary steps to perform the related activities of the Board.

The BHWDB is governed by a "Board" which comprises the following members:

Honorable Prime Minister	Chairperson
Minster, Ministry of Local Government, Rural Development and Cooperative	Member
Minister, Ministry of Finance	Member
Minister, Ministry of Environment and Forest	Member
Minister, Ministry of Water Resources	Member
Minister, Ministry of Agriculture	Member
Minister, Ministry of Fisheries and Livestock	Member
Minister, Ministry of Land	Member
State Minister, Ministry of Planning	Member
Member of Parliament (three) of the area concerned nominated by the Government	Member
Secretary, Ministry of Water Resources	Member Secretary

This Board is the highest authority for approval of policy directives for the BHWDB. The Board approves projects to be implemented under block allocation. There is a ten-member Executive Committee chaired by the Minister for Water Resources. This Executive Committee provides assistance to the Board.

The "Executive Committee" Member of the Bangladesh Haor and Wetland Development Board consists of the following members:

Minister, Ministry of Water Resources	Chairperson
Cabinet Secretary, Cabinet Division	Member
Secretary, Ministry of Environment and Forest	Member
Secretary, Planning Commission	Member
Secretary, Ministry of Local Government Division	Member

Secretary, Ministry of Fisheries and Livestock	Member
Secretary, Ministry of Land	Member
Dr Fazlul Bari, Professor, WRE, BUET	Member
Giasuddin Ahmed Choudhury, Executive Director, CEGIS	Member
Secretary, Ministry of Water Resources	Member- Secretary

9.1.2 Planning Institutions

An understanding of the planning institutions at different levels is essential if the BHWDB is to contribute in the coordination of activities of the Master Plan and take up periodic updates on the progress of the Plan.

9.1.3 Government Planning Process

The Executive Committee of the National Economic Council (ECNEC) is the highest executive body responsible for all policy decisions on the recommendations of the National Economic Council (NEC), which consists of all the members of the Cabinet chaired by the Prime Minister.

This technical body attached to the Planning Division of the Planning Ministry is responsible for advising and assisting the government on development planning, a process which also involves the line ministries and their agencies.

Planning Organizations

A) Ministry of Planning: The Planning Ministry has three divisions viz. Planning Division; Statistical Division; Implementation, Monitoring and Evaluation Division (IMED). Each headed by a Secretary.

B) Planning Commission: The Commission is chaired by the Minister of Planning with six divisions each headed by a member. The divisions are: Programmes and Co-ordination, General Economic, Social- Economic Infrastructure, Physical Infrastructure, Agriculture and Industry/Energy Divisions.

C) ERD: The Economic Relations Division (ERD) of the Ministry of Finance is also involved and co-ordinates external assistance and signs agreements with development partner on behalf of the government.

Planning Units within Ministries

All the ministries have a Planning wing that processes the project documents, Project Concept Papers (PCP), Development Project Proforma (DPP), Study Project (SSP), Technical Assistance Project Proforma (TAPP), Annual Development Programme (ADP) etc. prepared by the line agencies attached to them.

The implementing agencies conduct feasibility studies and prepare other detailed reports/documents.

ECNEC

As explained earlier, the ECNEC is the executive body for the implementation of the policies adopted by the NEC. It is presided over by the Prime Minster, but the Finance Minister acts as the alternate chairperson. The ECNEC is responsible for approval of development projects on the basis of recommendations from the Planning Commission.

Approval Process

The Planning Minister approves DPPs for investment projects recommended by Inter-Ministerial Meetings presided over by the Sector Member concerned of the Planning Commission. The ECNEC approves the DPP for projects costing over a specific range and the Planning Commission presents such projects to the ECNEC with recommendation of the Inter-Ministerial Meeting. The Inter-Ministerial Meeting which is often referred to as Pre-ECNEC is presided over by the relevant Member of the Planning Commission with representatives from the sponsoring ministry, the Finance Division, Ministry of Establishment, IMED, the Economic Relations Division (ERD) and the line agency concerned.

9.1.4 Regulatory and Planning Agencies

Policy Obligations

Regulatory and planning agencies are required to frame and periodically revise policies, rules, procedures and guidelines for integration of the plans of different sectors. These include all aspects of natural resources management while social and environmental assessments have been made mandatory in all development plans. In planning public investments, government agencies with assistance from service and information providers will, as far as possible, develop multipurpose projects using an integrated multi-disciplinary approach. Finally, there is a requirement to take steps against degradation and, where necessary, revive natural water bodies affected by man-made interventions or other causes. The government has put emphasis on preservation, protection and restoration of the environment. EIA has been made mandatory for almost all water resources projects or projects related with the water sector.

Department of Environment (DoE)

The Department of Environment (DoE) discharges its responsibilities through a head office and six divisional offices located at Dhaka, Chittagong, Khulna, Bogra, Barisal and Sylhet. It is responsible for helping to secure a clean and healthy environment for the benefit of present and future generations through fair and consistent application of environmental rules and regulations. The DoE also guides, offers training and promotes awareness programmes on environmental issues. It promotes sustainable action on critical environmental problems that demonstrate practical solutions and galvanize public support and involvement.

9.1.5 Implementing Agencies

The major implementing agencies will implement the projects proposed in the Master Plan with assistance of local government bodies. The government project appraisal guidelines will be followed and a mechanism will be developed to resolve inter-agency conflicts.

The major implementing organizations are required to involve local government and the private sector. In implementing public projects, government agencies will ensure that they are designed with specific provision for O&M activities.

Bangladesh Water Development Board (BWDB)

The BWDB is responsible for controlling the flow in all channels, rivers and underground aquifers, as well as for developing standards and guidelines for water management structures, levy and collect charges from irrigation and FCDI schemes, undertake projects and sign contracts.

Its functions include planning, design and construction of water management structures, dredging and re-excavation of channels, land reclamation works, flood management, river training and erosion control, construction and maintenance of coastal embankments and rain water harvesting, etc. It is also responsible for flood and drought forecasting, hydrological survey and investigations, research and establishment and training of water user associations and other stakeholder organizations.

Local Government Engineering Department (LGED)

The LGED has been established for planning and implementation of local level rural urban and small scale water resources infrastructure development programmes. The LGED works closely with local stakeholders to ensure people's participation and bottom–up planning in all stages of project implementation cycle. The broad objectives of LGED's development activities are to improve the socio-economic condition of the country through supply of infrastructures at local level and capacity building of stakeholders. The LGED promotes labour-based technology to create employment opportunity at local level and uses local materials in construction and maintenance to optimise project implementation cost without hampering the desired quality. The LGED works with a wide range of diversified programmes such as construction of roads, bridges/ culverts and markets as well as social mobilisation, empowerment and environmental protection.

Department of Public Health Engineering (DPHE)

The DPHE is mandated to ensure drinking water supply and waste management. The major responsibilities include facilitating rural water supply system through shallow tube wells and deep tube wells. The DPHE also provides sanitation facilities throughout the country as well as support to the local government institutions (LGIs) in the development and O&M of water and sanitation facilities, particularly in rural areas.

Bangladesh Agricultural Development Corporation (BADC)

The BADC is responsible for the procurement of mechanised minor irrigation systems (LLPs, STWs and DTWs) as well as for storage and distribution of seeds, fertilizers, pesticides, agricultural machinery, irrigation equipment etc. It is also responsible for policy planning and implementation of minor irrigation, development projects and also on-farm water management.

Bangladesh Inland Water Transport Authority (BIWTA)

The BIWTA is mainly responsible for maintaining navigation channels. It also collects processes and preserves hydro-morphological data of the major rivers of Bangladesh. It has the mandate to carry out dredging and other suitable measures to maintain the navigational routes in designated waterways.

Department of Fisheries (DoF)

The Department of Fisheries disseminates improved aquaculture technologies through training and demonstration and extends extension advisory services to local stakeholders. It also enhances fisheries resources through enacting conservation and management measures, assists the administrative ministry in formulating policies, acts etc., enforces quality control measures and issuance of health certificates for exportable fish and fish products and conducts fisheries resources surveys and assessments of stock to develop fisheries database for proper planning. Furthermore, the DoF facilitates arrangements for institutional credit for fish and shrimp farmers, fishers and fish

traders, formulates and implements development projects towards sustainable utilization of fisheries resources to ensure food security and facilitates alternative income generating activities for rural poor and unemployed people towards poverty alleviation.

Roads and Highways Department (RHD)

The RHD is responsible for the construction and maintenance of the major road and bridge network of Bangladesh. It has a sustainable capacity to plan, manage and deliver its full range of responsibilities in respect of main roads and bridges for ensuring a safe, cost effective and well maintained road network.

Forest Department (FD)

The Forest Department is responsible for the management of forests including extension through massive afforestation and tree planting programmes throughout country. It also has the responsibility of preserving and protecting forest resources and its biodiversity.

Department of Agricultural Extension (DAE)

The DAE is in the unique position of having direct contact with farmers throughout the country through field level officials. It provides agricultural extension services tofarmers regularly in terms of agricultural procedure and input, such as seeds, fertilizer, machinery, irrigation equipment and related services, etc. It also has the ability to convey public service messages to the largest water-consuming group in the country, i.e. the irrigating community.

The DAE will be given the responsibility for development of dry season agriculture. It will also encourage and promote: i) continued development of minor irrigation etc., ii) crop diversification programmes for efficient water utilisation and iii) establishment of a regulatory system for agricultural chemicals that pollute ground and surface water and development of a control mechanism for reducing non-point pollution from agro-chemicals.

Disaster Management Bureau (DMB)

The DMB provides services such as awareness raising, collecting, preserving and disseminating management and geographical information including mapping and damage assessment. It is also responsible for managing natural disasters at all stages (i.e. pre, during and post) caused by floods, cyclones, droughts, earthquakes etc.

The DMB is required to develop early warning (assisted by the BWDB) and flood-proofing systems to manage floods, droughts and other natural disasters and designate flood risk zones and take appropriate measures to provide the desired levels of protection for life, property, vital infrastructure, agriculture and wetlands.

Department of Agriculture Marketing (DAM)

The DAM of the Ministry of Agriculture is responsible for the development and dissemination of critical agricultural market information to farmers, traders, government, policy makers, development agencies and other stakeholders.

Bangladesh Parjatan Corporation (BPC)

The BPC is involved in the development of tourist spots and tourism related activities. The BPC is responsible for introducing Bangladesh globally as a top tourist destination, develop its tourism

prospects and facilities and establish tourism infrastructures. It is responsible for developing, expanding and promoting tourism business and creating awareness on tourism among the people. The BPC also establishes training institutes for training of potential tourism personnel and brings out related publications.

Bangladesh Fisheries Development Corporation (BFDC)

The BFDC is a public sector organization under the Ministry of Fisheries & Livestock. The corporation is fully dedicated to the development of fisheries in Bangladesh especially in the field of marine fisheries.

Bangladesh Fisheries Research Institute (BFRI)

The BFRI is responsible for carrying out basic and adaptive research for development and optimum utilisation of all living aquatic resources and coordinate fisheries research activities in Bangladesh. The research also includes development of standardised techniques for maximising productions. This agency is responsible for the development of skilled research manpower through training as well as training of extension workers, planners, fish farmers and other relevant persons for technology transfer.

Department of Livestock Services (DLS)

The Department of Livestock Services, a department of the Ministry of Fisheries and Livestock, plays an important role in the national economy, contributing significantly to agriculture and the gross national product.

Bangladesh Small and Cottage Industries Corporation (BSCIC)

The BSCIC is a prime government organization entrusted for rapid industrialisation of small and cottage Industries in the country. BSCIC aims to provide facilities to existing and new entrepreneurs to expand and develop their markets and to sustain in the competitive environment.

Bangladesh Power Development Board (BPDB)

The BPDB generates and provides electricity for desired economic, social and human development of the country. The main mission of the BPDB is to deliver electricity at reasonable and affordable prices with professional service excellence and make electricity available to all citizens on demand by the year 2020.

Petrobangla

The Bangladesh Oil Gas and Minerals Corporation known as Petrobangla conducts oil and gas exploration, development, transmission, distribution and conversion together with development and marketing of minerals.

Directorate of Primary Education

Primary education is considered as a national responsibility of the government. Recognition of education as a fundamental right of the people has ushered in a new era in Bangladesh. The major activates of the DPE are 1) Steps taken to Increase enrolment and reduce dropout rates (since 1991), 2) Preparation of curriculum of primary education and development of textbooks, 3) Elimination of gender disparity, 4) Academic supervision.

9.1.6 Local Government Institutions

Local Government Division

The Local Government Division (LGD) under the Ministry of Local Government, Rural Development and Cooperatives provides guidance and directives and maintains checks and balances in local government units at the union and Paurashava levels, through district and upazila authorities in the case of Union Parishads and directly with the Paurashavas. The LGD implements and oversees its policies and plans with respect to water supply and sanitation in urban and rural areas, rural works programmes etc. through the DPHE, the LGED and Local Government Institutions (LGI).

Local Government Institutions

In compliance with State Policy and recommendations of the Local Government Commission, three tiers of Local Government are being established in Bangladesh: Zila Parishad (ZP), Upazila Parishad (UZP) and Union Parishad (UP).

Zila Parishad

The Zila Parishad is intended to review all development activities of the districts, upazilas and municipalities and construct and maintain roads, culverts and bridges, which are not reserved by upazilas, municipalities or the central government.

Upazila Parishad

The Upazila Parishad (UZP) is mainly responsible for preparation, approval and implementation of development plans within its jurisdiction.

Union Parishad

The Union Parishad (UP) is mainly responsible for implementation of development schemes assigned by UZPs, development and use of local resources, maintenance of public property and review of the development activities of all agencies at union level.

9.1.7 NGO and Private Sector

Non-Government Organizations (NGOs) are playing an increasingly significant role in influencing public policy on issues such as land reform, primary education, environment and water management planning. In recent years, they have also adopted a “watchdog” role in environment and governance issues and have become involved in advocacy on behalf of disadvantaged groups and other sections of civil society. They are also included in development sectors such as health, education, etc. The other major activity of NGOs is micro-finance, particularly targeted towards the rural poor people.

The private sector is closely involved in all aspects of development and management of many sectors. Examples include consultants, contractors, equipment importers and suppliers, distribution and sales organizations and service providers, including maintenance of equipment and training and credit agencies, etc.

9.2 Options for Improved Management

The concept of decentralisation of project management and community participation will be pursued. People of the haor area who are directly or indirectly benefited or affected by the

implementation of a project are considered as local stakeholders of that particular project. The local stakeholders may be farmers, fishermen, small traders, craftsmen, boatmen, landless people, destitute women or any other member of the local community.

It may be noted that, there is a permanent committee in Shanir haor under Sunamganj district known as the Shanir haor Development Committee comprised of members from 47 villages around the haor. This locally constituted committee has defined its own mandate and is responsible for monitoring water levels and the condition of the embankment until harvesting of Boro rice is over. In addition three guards are appointed by the committee in March and April (the critical period for flash floods) to patrol the embankment and to monitor the water levels. If needed, people are mobilised to reinforce weak spots in the embankment or to fill public cuts.

In the light of the Participatory Water Management Guidelines, 2000, participation of stakeholders may be ensured for sustainable management of natural resources in haor areas. The stakeholders of the bottom level of the proposed institutional framework are the haor Management Group (HMG). The constitution of HMG and its legal status will be worked out (during formulation of project) taking the lessons of group formation and their activities under different government agencies like the BWDB, the LGED, the Forest Department, etc. The HMG representing the stakeholders will be the driving force for the development and management of haor. Ideally this group would have decision-making power at all stages from local level to district level. The HMG will be responsible for the operation and maintenance of local projects in a sustainable way as determined by the government/executing agency. Depending on the type and size of the project, the HMG will need to contribute towards the operation and maintenance of the project.

The modalities and detailed comprehensive institutional arrangement for O&M activities involving all stakeholders may be worked out later. For the present, the existing procedures of respective government agencies will continue to be followed.

9.3 Present and Future Legislation

Legislation provides the basis for action by government and non-government entities. The state owns all natural resources and the government tacitly authorises the use of these resources. However, priorities are not clearly indicated and in some areas altogether ignored such as the environmental aspects of over exploitation of natural resources. As indicated earlier, the economic value of wetlands, externalities in use of natural resources and the tendency towards natural monopoly require effective regulatory measures. Regulatory systems monitor and enforce established laws, agreements, rules and standards. The principal areas covered by regulations are water rights and allocation, standards of service, water quality and environmental protection, watershed management, soil and water conservation, prices charged by regulated utilities, ease of entry to water services industries, etc. In Bangladesh, there are number of regulations in the books for covering the areas listed here, but more alarmingly they are badly administered. This is partly due to the multiplicity of agencies administering the use of natural resources, each following its own agenda without regard to the effect it has on the others.

The use of natural resources rights legislation must be backed by appropriate rules for their administration. Clear administrative procedures for determining priority of use, allocation

mechanism, timing, duration and the quantity and quality of supply are important for protecting both government and private sector investments.

Management of the water resources of haor is very crucial in terms of efficiency, source of water, geographical restrictions on its use (including linkage to land use), limitation on class of use, quality restrictions on source and return flows and rules for any transfer of rights by the holder. The rules and procedures for administration of water legislation and regulation must be kept simple and easily implementable.

Many countries still treat water and land-use as separate issues. Public sector plans for committing these resources are made by different agencies and are not well coordinated. It is efficient to integrate land use and water use issues both in planning and operation. Appropriate rules and procedures should guide the administration of a system of rights/licenses and the working of an efficient water market. In Bangladesh, project delays are common due to ineffectiveness of procedures for land acquisition. There should be a clear mechanism for assuring consistency and timeliness of implementing water rights and interlinked land rights.

9.4 Capacity Building of BHWDB

BHWDB has been created as an exclusive government institution for management and integrated development of haor and wetland resources for macro-level planning. For implementation of Master Plan, other mandated tasks and maintenance of haor and wetland database, BHWDB needs to enhance capacity for coordination of works. In this connection BHWDB has initially identified about 17 Ministries and 34 Government, NGO, International NGO, Public and Research agencies, which are directly/indirectly involved in planning, implementation of Master Plan and other development activities in the haor area.

BHWDB should have an Organizational Development Plan (ODP) which includes description of its mandate, mission, vision and future role, present strategy, main activities, training plan, strategy and action plans to initiate a process of improving its organizational effectiveness.

Chapter 10 Investment Portfolio

10.1 Introduction

This chapter provides a summary description of the investment project portfolio that has been developed based on strategic thematic areas. The investment project portfolio provides a complete set of projects for each of the Development Areas formulated in consultation with the respective implementing agencies and based on recommendations from the grass root level. These project portfolios are integrated and prioritised for implementation in phases. Each project has been formulated to achieve the overall objectives of the Master Plan in an integrated fashion as well as the specific objectives of its relevant DA. The details of the projects are given in volume III of the Master Plan.

10.2 Project Portfolio

The responsibility for implementation of these projects lies with the respective line agencies, local government institutions with assistance from special types of national institutions. Private agencies will also be involved under the framework of the proposed investment project portfolio. The line agencies will execute the projects after conducting feasibility study, EIA, SIA following government rules and procedures.

The present projects of different implementing agencies will continue to be implemented in the plan period. Master Plan has considered such initiatives but costs of these initiatives have not been included in the portfolio of Master Plan of Haor Area.

The portfolio consists of 154 projects identified under 17 Development Areas. They are summarised as follows in Table 10.1 to Table 10.17 (project costs are in lakh taka and durations are in years).

Table 10.1: Summary of water resources projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
WR-01***	Pre-Monsoon Flood Protection and Drainage Improvement in haor areas	Protection from flash flood and improvement of drainage under existing haor schemes	5	12,550
WR-02**	Flood Management of haor areas	Protection from flash flood and improvement of drainage in potential new haor areas	7	81,643
WR-03***	River Dredging and Development of Settlement	Improvement of drainage capacity and development of new settlement platform	5	48,970
WR-04**	Development of Early Warning System for Flash Flood prone areas in haor and dissemination to Community Level	Development early flash flood warning system and dissemination to the community	20	768
WR-05***	Village Protection against Wave Action of honoraria	Protection of villages from wave erosion through green belt development and revetment work	3	31,046
WR-06**	Monitoring of the Rivers in haor area	Study of the morphological characteristics of the rivers of the haor areas to identify different types of activities to keep the haor functioning	4	900
WR-07***	Impact study of the interventions of transboundary river system	Assess the impact of any type of intervention at upstream of international boundary	5	1,500
WR-08**	Study of the Climate Change impact of haor areas	Climate change impact study on haor areas	4	800
WR-09***	Strengthening and Capacity Development of BHWDB	Organizational Development Plan and Capacity Development of BHWDB	2	197
	Total			178,374

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.2: Summary of Agriculture projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
AG-01***	Expansion of irrigation through utilization of surface water by double lifting in haor area	Bringing additional cultivable area under surface water irrigation	5	13,000
AG-02***	Minor Irrigation by low lift pumps project	Improvement of surface water irrigation system	6	10,000
AG-03**	Investigation and expansion of ground water irrigation	Improvement and expansion of groundwater irrigation	8	75,000
AG-04*	Promotion and plantation of Agar Plant	Production of high cost perfume material and raw material for medicine	20	3,120
AG-05*	Automation of rice transplantation system by Auto Rice Transplanter	Minimising labour and time cost for harvesting and planting/ sowing of crops	8	40,000
AG-06**	Mechanization of Agriculture through Combined Harvester	Facilitation of quick harvesting to protect crops from flash flood damage and reduce post-harvest loss	8	45,000
AG-07**	Improvement of Quality of Crop Grain through Dryer system	Minimizing post-harvest loss of crops for drying and improve quality of seeds and grain of crops	8	285
AG-08***	Intensive Cultivation of homestead vegetables and horticulture	Promotion of cultivation of homestead vegetables, mushroom pulses, spices and fruits	5	135
AG-09**	Development of climate resilient High Yielding Varieties of rice and non-rice crops	Introduction of short duration, cold-tolerant, high-yielding rice and non-rice crop cultivars	16	1,000
AG-10**	Selection of Short Duration Boro Rice Cultivars/ Advanced Line	Introduction of comparatively suitable high yield HYV/Hybrid rice varieties for Boro season	14	102
AG-11***	Changing Cropping Pattern to increase cropping intensity in haor areas	Improvement of cropping system for growing double or triple crops by utilizing fallow land	9	1,500
AG-12*	Extension of Integrated Pest Management Training Project	Reduction of use of pesticides for protection of plants	13	700
AG-13**	Expansion of Integrated Crop Management Training	Minimising the consumption of non-renewable and other resources for better management of crops	12	700
AG-14*	Extension of Jute cultivation project	Production of cash crops for fuel and construction materials	12	700
AG-15**	Integrated Development of Applied Research for Improved Farming Systems	Development of integrated farming systems for quality of diet and employment opportunities	8	1,500
AG-16**	High Value-non-Rice-cum-Deep Water Rice Culture	Production of crop by increasing land utility and high value non-rice crops	10	1,500
AG-17***	Assistance to Landless, Marginal and Small Farmers to overcome soaring input, and food prices in impoverished haor area	Reduction of poverty of marginal and small farmers through boosting agricultural production	8	4,000
AG-18**	Application of GIS for farm productivity enhancement through land suitability assessment of major cropping pattern in haor region	Development of crop suitability database with GIS mapping and analysis tools	3	450
AG-19*	Improvement of Storage Facilities and Agricultural Marketing System in haor area	Reduction of nonfunctional margins of traders and ensuring availability of agriculture inputs at fair price	5	5,000
AG-20**	Introduction of Innovative Agriculture through Vegetables cultivation on Floating Bed	Production of vegetables utilizing water hyacinth technology in water bodies	5	205
	Total			203,897

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.3: Summary of Fisheries projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
FI-01***	Development and Establishment of Fish Sanctuaries	Conservation and management of wetlands with community involvement for protection and improvement of fish biodiversity	15	6,860
FI-02***	Habitat Restoration for Fish Diversity	Restoration of fish habitat for conserving fish biodiversity and boosting up fish production	15	328,000
FI-03***	Beel Nursery Programme for Increasing Fish Fingerling Recruitment	Restoration of fish species diversity and boosting up production in the floodplains and in turn improving fishermen's livelihood	18	6,250
FI-04*	Good Fisheries Management Practices following the Mohanganj Experience	Protection of fish/fingerling and brood fish from indiscriminate fishing through awareness programme	18	1,691
FI-05**	Floodplain Aquaculture under the Community Enterprise Approach	Boosting up fish production through utilisation of vast floodplain area under the community enterprise approach	15	2,500
FI-06**	Community and Household-based Net-pen Fish Culture in the Haor/Floodplain	Improvement of the livelihoods of local community and households	15	25,000
FI-07***	Fish Fingerling Stocking and Raising Programme	Increasing diversity and the composition of fish species to improve low species dominance	18	512
FI-08**	Capacity Development and Alternate Income Generating Activities (AIGAS) for Fisher Community	Provision of alternative income source to the fisher community for protecting brood fish	15	14,448
FI-09***	Renovation of Hatcheries for Conserving Quality Brood Stock and Production of Fish Seeds	Conservation of brood fish stock and production of native and purebred fish seeds	5	5,000
FI-10**	Study on Review of Policies, Regulations and Lease System for Sustaining Fisheries Resources	Improvement of fisheries management for the livelihood of haor/beel dependent fishers	3	500
FI-11***	Restoration of River Duars (Deep Pools) for Protecting Brood/Mother Fish	Protecting and conservation of riverine brood/mother fish from over and indiscriminate fishing	10	6,240
FI-12**	Renovation of Fish Ponds and Dissemination of Improved Aquaculture Technology to Fish Farmers	Increasing culture fish production by utilizing homestead ponds through promoting improved culture technology	10	4,500
FI-13**	Development and Construction of Innovative Fish Pass/Fish Friendly Structures	Introduction of environmental friendly fish pass for better management of fisheries resources by facilitating fish migration	10	25,000
FI-14*	Establishment of Fisheries Information Service Center	Rapid and efficient dissemination of improved fish culture technology along with related information and open water fisheries management and conservation to relatively distant and remote areas by using modern information and communication technology	5	1,300
FI-15**	Introduction of Deep Water Rice-cum-Fish Culture	Improvement of wetland dependent livelihoods by utilizing broadcast Aman field under the community enterprise approach	10	1,000
FI-16**	Establishment and Rehabilitation of Fish Landing Centers	Ensuring safe and hygienic landing of fish, facilitating temporary preservation for reducing wastage and ensuring quality fish for distant marketing	10	14,600
FI-17**	Establishment of Fish Drying and Fermentation Center	Drying and fermenting harvested fish for preservation and for reducing wastage	10	2,650
FI-18**	Study on Impact of Climate	Determining baseline condition and assessing the	15	50,000

DA Code	Project title	Key Objective	Duration	Cost
	Change and Interventions on Fisheries Resources	impact and prescribing adaptation measures for climate change and interventions on fisheries resources		
FI-19*	Development and Establishment of Cold Storage and Ice Plants	Long-term Preservation of harvested fish for distant marketing and export of fish and fish products	6	1,522
FI-20*	Research on Fish Stock Improvement through Gene Pool Preservation and In-breeding Depression	Preservation of the genetic material of indigenous and endangered fish species through establishing gene banks	16	1,500
FI-21*	Rehabilitation of Existing Fish Processing Units and Establishment of a New Fish Processing Industry	Preservation of fish and fish products for export and for reducing fish wastage	10	2,500
FI-22**	Community and Household-based Cage Fish Culture	Boosting up fish production and improvement of the livelihoods of fishermen and landless people	10	2,850
	Total			504,423

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.4: Summary of Pearl Culture projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
PC-01**	Development and Dissemination of pearl culture technology in haor area	Introduction of pearl culture technology in the haor area and enhancement of local supply of pearl	17	10,000
	Total			10,000

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.5: Summary of Livestock projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
LS-01***	Improvement of fodder availability for livestock development	Ensuring availability of fodder by preservation and development of technology for local farmers	9	8,823
LS-02**	Integration of livestock in traditional farming system	Integration of livestock in the farming system for improvement of socio-economic condition of the poor people	10	7,956
LS-03*	Farmers training programs for capacity building	Capacity development of farmers and generation of employment opportunity	4	2,400
LS-04*	Establishment of pilot breeding programme for cattle development	Conservation and development of local breeds through native bulls and training of farmers on breeding process	8	3,600
LS-05**	Promotion of small and mini dairy farms	Increasing production of milk and creation of employment opportunities	9	5,850
LS-06***	Promotion of conventional and alternative feed resources for livestock feeding	Development and use of agro-resources for alternative feeds for livestock	9	1,625
LS-07**	Extension of Livestock Services through establishment of Union Livestock Service Center (ULSC)	Establishment of support service institution for livestock support services at grass root level	9	16,250
LS-08*	Development of Livestock Products through involvement of Community Organization	Development of marketing facilities by involvement of community organization for ensuring fair price	9	12,400
LS-09***	Development of Community Animal Health Workers for Livestock Healthcare	Ensuring and improvement of animal health by community health workers, thereby reducing mortality and improve production	5	6,600
LS-10***	Promotion of Small and Mini Poultry and Duck Farms	Increasing production of poultry product and creating employment opportunities	8	11,190
	Total			76,694

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.6: Summary of Forest projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
FR-01**	Establishment of One Forest Nurseries in each of the 57 Upazilas of the haor areas	Enhancement of the supply of fuel wood and fruits for local people	17	38,449
FR-02***	Afforestation through involvement of local Community in haor area	Enhancement of the local supply of fuel wood for local communities. Plantation of trees along all existing roadsides, embankment edges, homesteads and institutions such as school premises, mosque premises, Eidgah and other spiritual institutions	17	34,954
FR-03***	Afforestation of Roads, Embankments, Homesteads and Institutions	plant trees along all the existing road-sides, embankment-edges, homesteads and institutions	17	35,625
FR-04*	Reclamation of Izmali land for promotion of Social Forestry	Restoration of the ecosystems in Izmali lands and ensuring order towards sustainable use of natural resources	17	71,538
FR-05**	Increase the Capacity of Community for forest conservation and Improvement	Development of awareness among local people about the importance of forests	17	59,146
FR-06*	Research Programmes on haor areas	Undertaking research to list all the flora and fauna of the haor area including the minor groups of plants and animals and to unveil the dynamics of the haor ecosystems and find details of the socioeconomic aspects of the haor people	16	6,792
	Total			246,504

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.7: Summary of Biodiversity and wetland Management projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
BW-01***	Eco- management zoning of haor wetlands for biodiversity protection	Determination of natural ecological features for development of a management plan for wetlands	3	5,000
BW-02***	Restoration of important wetlands	Protection and restoration of wetlands for threatened ecological communities and ensuring wise use of biological resources	4	6,000
BW-03**	Development and implementation of important wetlands for global significance.	Establishment of a new Protected Area (PA) having appropriate representation of ecosystems prevailing and conservation of biodiversity in the entire haor basin	7	5,000
BW-04*	Establishment of global wetlands center	Development of a global network for promotion of global and regional excellence in wetlands management and research	7	30,000
BW-05*	Review of policy for biodiversity management	Updating and strengthening of the legal provisions for biodiversity and wetlands conservation	3	2,000
BW-06***	Habitat preservation programme for plants, wildlife, fisheries and migratory birds	Preservation of biodiversity by providing suitable environment for plants and animal species	9	15,000
BW-07**	Research and education programme on haor wetlands biodiversity conservation and management	Exploration and establishment of a scientific basis for a conservation strategy of wetland biodiversity	9	15,000
BW-08**	Management of commercially important haor wetland biodiversity	Initiation and promotion of management of commercially important wetlands biodiversity.	9	20,000
BW-09 **	Pollution control and prevention from agriculture, industry and urban settlement	Identifying the sources of pollution along with prevention measures from different sources	9	7,000
BW-10***	Adaption and Mitigation to Climate Disaster Risks in haor Basin	Damage assessment due to climate change as well as prepare and implement adaptation and mitigation plan for haor basin	9	8,000
	Total			113,000

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.8: Summary of Transportation projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
TR-1***	Up gradation of Rural Roads	Creation of accessibility by connecting upazila, union, village and growth centers	10	215,625
TR-2***	Submersible rural road construction	Development of environment friendly road network to provide accessibility to haor people during dry season	9	149,025
TR-3***	Submersible District road construction (Sulla to Ajmiriganj)	Develop environment friendly road network to provide accessibility to haor people not connected with the existing road network	8	3,900
TR-4***	Submersible District road construction (Khaliajuri to Ajmiriganj)	Develop environment friendly road network to provide accessibility to haor people not connected with the existing road network	8	5,460
TR-5***	Submersible District road construction (Itna to Ajmiriganj)	Develop environment friendly road network to provide accessibility to haor people not connected with the existing road network	8	3,640
TR-6***	Submersible District road construction (Austagram to Lakhai)	Develop environment friendly road network to provide accessibility to haor people not connected with the existing road network	8	4,680
TR-7***	Submersible District road construction (Derai to Jagannathpur)	Develop environment friendly road network to provide accessibility to haor people not connected with the existing road network	3	5,200
TR-8**	Construction of Regional Highway	Develop regional connectivity in the haor region	2	12,800
TR-9*	Construction of Surma Bridge at Chhatak	Develop regional connectivity	5	6,000
TR-10***	Development of inland navigation by dredging in nine river routes	Development of navigability in nine river routes to ensure perennial and unintercepated inland navigation to decrease the transportation cost and time	9	84,800
TR-11**	Development of 150 landing facilities in the rural area	Ensure easy and safe embarkation of passenger and cargo in the rural area and provide improved berthing facility for the vessels and crafts	6	15,000
TR-12**	Installation of navigational aids along the river routes	Provision for aids to navigation to ensure round the clock operations of vessels avoiding the risks of grounding, capsizing or otherwise in distress	4	5,560
TR-13**	Hydrographic survey in the nine major river routes	Identification of navigable channel and determine the volume of dredging for digital hydrographic chart preparation and dissemination	3	87
TR-14**	Construction of terminal buildings at 15 major passenger stations	Provide improved passenger facilities like waiting rooms, toilets, drinking water, restaurant etc. and storm warning signal	6	2,250
TR-15*	Development of parking yards, storage facilities and security walls at 13 stations	Expeditious loading/unloading of cargo, removal of vehicular congestion and ensure safety of the cargo	5	2,250
	Total			**516,277**

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.9: Summary of Water Supply and Sanitation projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
WS-01***	Establishment Sustainable and Community based haor friendly Water Supply Technologies	Establishment of safe drinking water technologies in the haor area	13	50,000
WS-02***	Introduce the Sustainable and Community based Flood Proof Hygienic Sanitation System in haor areas	Establishment of sanitation technologies in the haor area	13	55,000
	Total			105,000

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.10: Summary of Housing and Settlement projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
ST-01**	Eco Village Platform Development for mitigate future Housing and settlement demand	Provision of suitable and safe places for housing and settlement	3	9,100
	Total			9,100

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.11: Summary of Education projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
ED-01***	Establishment of Community based Multi-grade Learning Centers	Provision of access to pre-primary and primary level education for the ultra-poor and inhabitants of remote areas	8	5,064
ED-02**	Community based School Feeding Programme	Increasing opportunities for education for the ultra-poor and inhabitants of remote areas of the haor region	5	2,365
ED-03***	Establishment of Primary Schools	Ensuring basic education for all in the haor region	3	15,007
ED-04**	School Boat Facilities for Inaccessible Areas	Increasing accessibility to school during monsoon for the ultra-poor and inhabitants of remote areas of the haor region	8	12,595
ED-05*	Awareness Generation Programmes on Gender Discrimination	Ensuring gender parity in primary, secondary and higher level education in the haor area	3	94
ED-06**	Introduce skill based training programmes	Increasing skilled labour force in the haor area for income generation	5	3,600
ED-07*	Establishment of High Schools, Colleges and Madrasa	Provision of higher level education for haor children and encourage spiritual views among the students through madrassa-based education	8	33,250
	Total			71,975

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.12: Summary of Health projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
HE-01***	Up gradation of Upazila Health Complex (UHC) and Construction of Upazila Health & Family Welfare Center (UHFWC)	Improvement of health facilities in the haor area with provision of general health care services	8	53,550
HE-02***	Maternal and Reproductive Health Development Programme	Improvement of maternal and child health and reduction of maternal mortality	3	571
HE-03***	Child Mortality Reduction Programme	Improvement of child health	8	16,725
HE-04**	Promotion of nutrition status of the haor people	Improvement of the nutritional status of the haor people	3	105
HE-05**	Improve the quality of hospital service	Provision of quality health care services for better health	8	22,226
HE-06*	Capacity Development of Non-government, Non-profit Health Care Agencies using Private-Public-Partnership (PPP)	Strengthening of NGOs and non-profit health care agencies	3	400
HE-07*	Expansion of Alternative Medical Care (Unani, Ayurvedic & Homeopathic system of medicine)	Improvement of health with the expansion of alternative (Unani, Ayurvedic & Homeopathic system of medicine) health care services	3	1,200
HE-08*	Strengthening of supervision and monitoring system	Development of a supervision and monitoring system to ensure quality health care services	3	1,650
HE-09***	Community health care: Establishment of Community clinics (CC)	Improvement of health with the provision of general health care services and availability of services at the doorstep of the community people	8	4,020
HE-10***	Community health care: Mobile clinic and emergency medical team	Provision of health care services to the community people in remote inaccessible areas and ensuring emergency services during and after disasters	8	14,400
HE-11**	Establishment of e-Health Services and Facilities up to Community Level	Access to health information for prevention/control of diseases, proper health facility planning and project management	8	152
HE-12**	Strengthening referral system from CC to UHFWC; UHFWC to UHC; UHC to District Hospitals	Improvement of health care service delivery system in Community Clinics, Upazila Health and Family Welfare Centers, Upazila Health Complexes and District Hospitals	8	90
HE-13**	Environmental Health Programme	Control of diseases, which arise from climate change, environmental and occupational health hazard and also strengthening of information base/evidence on health hazards	3	3,664
HE-14**	Capacity development of health personnel	Development of human resources in the health sector	3	250
HE-15*	Medical Waste Management in District Hospital and Upazila Health Complex	Ensuring safe, environment friendly and cost-effective management of wastes collected from different health facilities	8	1,065
HE-16*	GIS mapping of health facilities and disease pattern	Fulfillment of the requirement of health related spatial data for prevention/control of diseases for proper health facility planning and project management	3	295
	Total			120,363

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.13: Summary of Tourism projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
TS-01***	Development of Mega Eco-parks	Enhancement of ecotourism based development in the haor area and preservation of biodiversity	8	200
TS-02**	Establishment of War Museums	Preservation of sites bearing historical significance related with the 1971 Liberation War for upholding its values to the future generation	1	60
TS-03**	Establishment of Amusement Parks	Development of recreational area considering the environmental sensitivity of the haor region	8	1,000
TS-04**	Development of Tourist/Picnic Spots	Development of recreational area specially for local tourists considering environmental sensitivity	8	60
TS-05***	Construction of Bird Watching Tower	Attracting tourists/bird watchers	8	60
TS-06*	Renovation of Zamindar Palaces	Preservation of the historical places of the haor region and attracting both local and foreign tourists	3	72
TS-07***	Dolphin Sighting Tour Programme	Observation of the magnificence of Gangetic dolphins	18	360
TS-08***	Hakaluki Haor Sightseeing Tour Programme	Attracting tourists to observe the scenic beauty of Hakaluki haor	18	540
TS-09**	Development of Fish Park	Attracting tourists to increase local and foreign earnings and preservation of fish biodiversity	1	20
TS-10***	Establishment of Wildlife Sanctuary	Preservation of wildlife biodiversity and attracting local and foreign tourists	2	100
TS-11**	Promotional Programmes on Haor for Electronic and Print Media	Attracting the attention of tourists for increasing revenue earning	1	100
TS-12**	Construction of Tourism Infrastructures	Improvement of facilities for tourists	18	1,000
TS-13*	Training programmes in Hotel Management and Food Catering	Capacity development of human resources engaged in tourism sector	18	320
	Total			3,892

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.14: Summary of Social facilities projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Cost
SS-01**	Construction of Growth centers/Rural markets	Increasing market facilities for local people and creating option for quick purchase of local product	18	694
SS-02*	Construction of Food Godowns	Increasing storage facilities and helping the government to collect food grain for national reserve	8	10,000
SS-03***	Up gradation/construction of religious prayer house, graveyards and cremation grounds	Creation of congenial and secular environment for people of every religion and ensure proper burial of the deceased	8	3,000
SS-04**	Awareness Generation Programme for the Spiritual Leaders	Orientation of spiritual leaders on important issues like basic education and health care, social behavior, natural resource management, gender equity etc.	8	126
SS-05*	Construction of Playground and Supply of Sports materials	Provision for conducting sports activities for physical and mental wellbeing	8	1,380
SS-06***	Up gradation and Construction of Police Stations	Ensuring good law and order situation in haor area	8	400
	Total			15,600

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.15: Summary of Industry projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Project cost
IN-01**	Can food Industry	Protection of fish from rotting in the haor area for increasing foreign earnings through export	5	10,000
IN-02**	Beverage Industry	Increasing foreign earning through export of pineapple juice	3	1,000
IN-03***	Small and Cottage Industries Development programme for destitute women's in haor area	Women empowerment in the haor area using local natural resources.	1	1,500
IN-04*	Swamp Water Processing Industry	Sustainable use of flash flood water	2	10,000
IN-05**	Tea processing Industry	Increasing empowerment of tribal people/Adibashi of the haor area through income generation	3	10,000
IN-06**	Gas cylinder Industry	Production and distribution of gas cylinders for sustainable use of natural gas	4	30,000
IN-07*	Industrial Park	Encouragement to foreign investment through establishment of an industrial zone with required infrastructure and utility facilities considering tax exemption	4	10,000
IN-08***	Establishment of Charcoal Industry	Ensuring availability of fuel materials in the haor area during wet season	2	200
IN-09***	Boat Manufacturing Industry	Generation of rural employment and business activities through manufacture of different types of boats	2	17
	Total			72,717

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.16: Summary of Power and Energy projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Project cost
PW-01***	Expansion of electric distribution systems in haor districts	Increasing the coverage of electricity supply to ensure electricity for every house	12	255,320
PW-02**	Expansion of solar power generation systems	Ensuring power supply in remote areas of the haor region that are beyond reach of grid lines as well as reducing pressure on the use of non-renewable energy sources and utilizing renewable sources like solar power for power generation.	8	84,600
PW-03*	Pre-feasibility Study on Renewable Energy Potentials and Power Generation Possibilities in Haor Area	Assessment of power/energy supply need for households and the agriculture, commercial, industrial and other sectors in remote areas through harnessing water, solar, wind and hybrid power	10	89
PW-04*	Development of mini-hydropower schemes	Increasing power generation through renewable sources like small hydro power plants	10	980
	Total			340,989

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 10.17: Summary of Mineral Resources projects

(Project costs are in lakh taka and durations are in years)

DA Code	Project title	Key Objective	Duration	Project cost
MR-01**	Seismic survey, exploration drilling in the haor districts to explore new gas field	Exploration of new gas fields	5	200,000
MR-02**	Development of Mines for gravel, white clay, glass sand, coal and peat extraction from haor districts	Extraction of minerals from the haor area	5	15,000
MR-03***	Strengthening capacity of miner and mining labor in haor districts	Capacity development of miners and labors	1	500
	Total			215,500

Note: *** Very High Priority, ** High Priority, * Medium Priority

10.3 Priotarisation of the Projects

The Development Area-wise issues and problems identified from the grass root level and data supplied by each government department have been presented in bi-lateral meetings and workshops with line agencies. Based on these problems and issues, the participants of upazila level workshops have identified probable solutions spread over a 20-year period for each of the Development Areas. Priotarisation has been also suggested considering local conditions and importance of the activities.

The upazila level consultation process (workshops and FGDs) has identified and prioritised local development issues through consensus. The participants have analysed the issues and identified the key problems. Sets of interventions have been identified to address specific issues. It has been realized during the process that the interventions have been very much interlinked and therefore difficult to priorities.

Three categories of priority of the projects have been recommended based on technical consideration, interdependency, people's demand and sequence of integrated development. Three levels of priorities have been defined for the projects i.e. very high, high and medium priority.

Very High Priority: Very high priority projects are those which are overdue and cover the top five ranked issues identified at the upazila level consultation process. These projects are extremely significant for the economic uplift of the area. They are independent of other external actions in the region and could also be treated as an action plan for immediate implementation.

High Priority: These types of projects are required to be implemented as per government policy directives. They include initiatives proposed in the plans of different implementing agencies. These set of projects are dependent on external and internal actions to be taken in and outside the region. They are to be implemented in the medium term period conceived in the Master Plan.

Medium Priority: Apart from the very high and high types, the rest of the projects are considered as medium priority projects. These projects are highly dependent on other types of priority projects and cannot be implemented in isolation. It is required to identify their backward linkage with the other two types of priorities before implementing the projects. Moreover, this type of projects may be highly significant nationally but may not be that significant at the haor region level. The Table 10.18 shows the priority of the identified projects.

Table 10.18: Priority wise projects of Development Areas (cost in lakh taka)

Development Area	Very High		High		Medium	
	No of Projects	Total Cost	No of Projects	Total Cost	No of Projects	Total Cost
Water Resources	5	94,263	4	84,111		
Agriculture	5	28,635	10	125,742	5	49,520
Fisheries	6	352,862	11	143,048	5	8,513
Pearl Culture			1	10,000		
Livestock	4	28,238	3	30,056	3	18,400
Forest	2	70,579	2	97,595	2	78,330
Biodiversity & Wetland	4	34,000	4	47,000	2	32,000
Transportation	8	472,330	5	35,697	2	8,250
Water Supply & Sanitation	2	105,000				
Housing and Settlement			1	9,100		

Development Area	Very High		High		Medium	
	No of Projects	Total Cost	No of Projects	Total Cost	No of Projects	Total Cost
Education	2	20,071	3	18,560	2	33,344
Health	5	89,266	6	26,487	5	4,610
Tourism	5	1,260	6	2,240	2	392
Social Services	2	3,400	2	820	2	11,380
Industry	3	1,717	4	51,000	2	20,000
Power and Energy	1	255,320	1	84,600	2	1,069
Mineral Resources	1	500	2	215,000		
Total	55	1,557,441	65	981,056	34	265,809
% of Total Cost		55.54%		34.98%		9.48%

Chapter 11 Benefits of the Plan

11.1 Introduction

This chapter provides an overview of the impact of the investment portfolio in the haor area in view of its biophysical, economic and social conditions. The impacts and benefits have been considered based on the difference between future with and without the Master Plan within 2030. The development trend situation without the Master Plan has been already described in chapter-6.

The development of the Master Plan of haor Area 2031 offers the possibility of developing a long term vision of the future governance of natural resources in the haor area and utilisation of limited public and private resources more effectively through multiple objective oriented development projects.

11.2 Benefit by Development Area

Strategies established the principles upon which Master Plan of Haor Area has been formulated to achieve the government set goals and targets. The plan has been formulated based on the strategies under the six thematic areas. Projects have been identified according to technical consideration and through multi-level consultation process. Development Area (DA) wise expected benefits due to the implementation of the master plan are described below:

11.2.1 Water Resources

The benefit which is expected from water resources is based on proposed dredging of major rivers, rehabilitation of FCD and FCDI projects, and implementation of new FCD/FCDI projects and construction of wave and erosion protection measures. It is estimated that a total length of 124 Km of river will be dredged which will improve the drainage facilities, navigation and connectivity with haor and beel. A total of 9 new projects have been proposed which will protect an additional area of 163,115 ha from pre monsoon flash flood. The rehabilitation of 25 existing schemes of area of 124,754 ha will further enhance the resilience against pre monsoon flash flood. A total of 202 homestead area will be protected against wave action through construction of revetment work and green belt.

These interventions will help to protect agriculture and fisheries from flash floods, improve pre and post monsoon drainage of haor areas and improve conveyance capacity and navigability of the principal rivers of the region. The projects of water resources will also enhance the benefit of other sector.

11.2.2 Agriculture

The benefits which are expected from agriculture Development Area is based on total cropped area, area and production of rice and non-rice production, cropping intensity, extension of irrigated area by both surface and groundwater. It has been estimated that the total cropped area will be increased from 1.93 to 2.36 million ha though the net cropped area will decrease from 1.31 to 1.22 million ha. The cropping intensity will be increased to 194% from the present value of 147% through use of HYV, appropriate use of fertilizer, pesticides and irrigation etc. The rice and non-rice area will be increased from 1.74 to 1.93 million ha and from 0.19 to 0.43 million ha respectively. The total

production of rice and non-rice will be increased from 5.25 to 6.55 million ton and from 1.53 to 2.49 million ton respectively. The total irrigated area will be increased from 0.817 to 0.957 million ha.

11.2.3 Fisheries

The benefit which is expected from fisheries development area is based on enhancing fish production (both capture and culture fisheries), management of fish wastage and export of fish resources and enhancing employment through fish sector. To enhance fish production the strategies to be followed are proper installation of fish passes in hydraulic structures; controlling size and species wise fishing; establishing fish sanctuary for fish spawning; conserving and managing water bodies and restoring the ecosystem.

It is estimated that both capture and culture fish production will be increased from 0.319 to 0.437 metric ton and from 0.114 to 0.232 metric ton respectively. Total fish export from haor area will be increased from 452 ton to 905 ton. Number of fishermen and fisherwomen will be increased to 0.306 million from 0.260 million and 0.67million from 0.57 million respectively in the haor region.

11.2.4 Pearl Culture

The benefit which is expected from the pearl culture development is based on production and marketing of pearl which will enhance the employment opportunity of local people along with development of their livelihood. National economy and export will also be boosted through proper implementation of pearl culture plan in the haor area. The benefits in this sector will be materialized through implementation of pilot projects at upazila level in suitable beels and other perennial pockets in the haor basin; setting up laboratory equipments in district level, enhancing capacity building by proper pearl culture training and establishment of strong marketing system etc. with the help of government.

11.2.5 Livestock

The benefit which is expected from the livestock sub sector is based on increased production of milk, meat and egg to meet the nutritional demand, enhancing employment and overall benefit to national economy. Production of milk, meat and egg will be increased to 1.46 million ton, 0.33 million ton and 2,326 million number from 0.62 million ton, 0.14 million ton and 990 million numbers respectively. Benefits can be derived through breed up gradation; developed feed resources; improved health care system of animals and poultry; development of dairy, meat and poultry processing industries; establishment of service centers for the farmers; technological development in upbringing of the livestocks processing of livestock products and improved marketing system etc.

11.2.6 Biodiversity and Wetland

The benefit which is expected from the biodiversity and wetland area development is based on biodiversity protection, restoration of internationally and nationally important wetlands, habitat preservation [for plants, wildlife (including Dolphin), fisheries and migratory birds], sustainable management of wetland biodiversity and commercially important species and pollution control. These benefits can be derived through implementation of region wise zoning based on land use pattern and ecological attributes of biological resources; establishment of a recovery programme for threatened species of wild flora and fauna; establishment of a Global Wetland Center for research; education, conservation, awareness, networking, recreation, monitoring and evaluation;

strengthening of local institutions for wetland and biodiversity management; identification of ecologically important areas within the region; monitoring of wetlands to recognise the changes of ecology of wetlands; wetland data management through carrying out a comprehensive national inventory and coordination and rationalisation of government programmes to encourage wetland conservation.

11.2.7 Forest

The benefit which is expected from the forest Development Area is based on the increased fuel-wood supply, restoration of environmental sustainability, reduced exposure of uncovered lands like "Izmali" lands etc. These benefits can be brought through establishment of upazila forest nursery; afforestation in "Izmali" lands; creation of freshwater wetland forest; roadside plantation; and community involvement in forest management. Implementation of the plan will result in increased plantation for both hill and agro forest and strip plantation. There will be increase of 14, 000 ha of hill and agro forests by 2031 involving local community. Similarly, (additional) 5,000 km of strip plantation will be increased on side of the road, embankment and homesteads by 2030. Restoration of the "Izmali" land covering 4,180 ha and establishment of a 2 hectare upazila nursery has been considered in the plan to materialize the benefits in the forest development area.

11.2.8 Education

Through implementation of the plan, 349 primary schools, 657 multigrade learning centers, 415 secondary schools, 119 colleges, 143 Madrasas and 50 vocational institutes have been proposed for construction. The community based multigrade learning centers thrives to introduce pre-primary level education. The feeding programme and boating services are expected to increase attendance of students, increase opportunities for education for the poor, ultra-poor and inhabitants of remote and inaccessible areas of the haor region. It is aimed to fulfill the MDG and OPP goals of achieving literacy rate of 100% from the current 38%. It will also reduce dropout rates at primary level from 44% to 5%, increase net enrollment rate in primary school from 82% to 100%, increase attendance rate in primary school from 74% to 100%, increase attendance rate in secondary level from 37% to 80%, increase transition rate from primary to secondary level from 60% to 100%.

11.2.9 Health

Health plan has been developed to achieve sustainable and long term improvement in health care services in the haor area. Under the plan, 27 nos. of Upazila Health Complex (UHC) will be upgraded from 31 to 50 beds. Eighty seven number of Upazila Health & Family Welfare Center (UHFWC) and 268 number of community clinics have been proposed for construction along with arrangement of 150 mobile boat clinics covering all types of healthcare services up to community level. The plan also covers programmes on maternal and child health care, promotion of nutrition status, improvement of hospital services, strengthening of referral system, expansion of alternative medical care, etc. The environmental programme and the medical waste management will help to reduce environmental health hazards.

Provision of health care services will be improved specially in the remote locations, which will have impact in decreasing disease prevalence, reducing the rate of under-5 child malnutrition from 46% to 33%, increasing delivery conducted by skilled health personnel from 13% to 50%, decreasing maternal mortality rate (per 1000 live births) from 3.2 to 1.2, reducing under-5 child mortality rate

(per 1000 live births) from 76 to 48, reducing infant mortality rate (per 1000 live births) from 57% to 32%.

11.2.10 Power and Energy

The new electricity distribution systems as proposed in the plan will cover additional 1,111 villages through construction of 8 sub-stations, expansion of 19,333 km long (11, 6.35 Kv) lines and 10,750 km long (0.4/0.23 Kv) lines. This will increase the coverage of electricity supply in the rural areas from 44% to 100% villages (15,374 nos.). The per capita electricity consumption will be enhanced from 47 to 250 KWh. The Percentage of household to be brought under electrification will be increased from 20% to 100%. The solar electrification is estimated to cover one million households. The feasibility study of mini-hydropower scheme has been proposed to assess the possibility of generation of hydro-electricity to fulfill the energy demand of the haor region.

11.2.11 Transportation

Rural people of the haor area will be the largest beneficiary due to the development of transportation system under this plan. Development of transportation sector is sure to bring massive changes in accessibility not only within the settlements but also to service areas like education, health, industries and markets. This will act as catalyst for promoting development of other sectors like agriculture, livestock, fisheries, power and energy and tourism, etc.

The proposed 32 km regional highway, 88 km submersible district roads, upgradation of 2,875 km rural roads and development of 496 km submersible embankment into submersible rural road will enhance rural connectivity. Under the Roads communication, traffic and passenger will be increased from 1.62 to 2.25 and 12 to 17 million respectively. Similarly, under the inland navigation, freight will be increased from 11.40 to 14.77 billion ton-km and passenger will be increased from 4.65 to 6.02 billion passenger-Km. Additional 5,00,000 employments will be generated in the haor area in a span of ten years time due to development of inland navigation. A developed inland navigation system in the haor area is estimated to save 50 million liters of diesel and 1,25,000 tons of CO_2 emission annually because of lower fuel consumption. Thus this will contribute substantially to mitigate the impact of climate change.

11.2.12 Tourism

The eco-tourism development plan will generate employment and ensure socio-economic development through promotion and development of tourism. A number of tourism facilities as proposed will be developed such as 2 nos. of mega eco-parks, 2 nos. of amusement parks, 6 nos. of tourist/picnic spots and a tourist center near Hammam Waterfall including hotels, restaurants, parking areas etc. Moreover, 3 nos. of bird watching tower, a fish park and a wildlife sanctuary will be constructed to preserve haor biodiversity. Renovation of the existing 6 nos. of zamindar palaces will contribute in reviving its historical importance. Construction of the two war museums will preserve the sites bearing historical significance of the 1971 liberation war and uphold its values to the future generation. The sightseeing programmes to Hakaluki haor and dolphin tracks will provide opportunity to view the unique beauty of haor region.

11.2.13 Social Services

There will be a balanced distribution of resources among people and improved marketing of products through construction of 63 nos. of rural markets/growth centers as proposed in the plan. Two hundred food godowns will be constructed near each growth center or rural markets. The godowns will be used to supply food grains during emergency periods as well as to store surplus food grain. Facilities for practicing religion will be provided through construction of 100 nos. of mosques/temples and churches. Shortage of proper burial place is an issue for haor region. The issue will be addressed through construction of 100 graveyards or cremation grounds. Provision for sports will be made through construction or expansion of 69 playgrounds (one large playground for each upazila). For ensuring safety and security of people in the haor region, establishment of 80 nos. of police stations/outposts have been proposed in the Master Plan.

11.2.14 Mineral Resources

The benefit from the mineral resources area is based on the achievement that will be obtained from exploration of mineral resources through exploration of new gas fields; extraction of coal and peat; and extraction of other minerals like glass sand, limestone, white clay, gravel and ordinary sand etc. The plan has also proposed to conduct seismic survey to identify the new gas fields and quantify the reserve to maximize benefit in the mineral resources development.

11.2.15 Housing and Settlement

The benefits which are expected from the development of housing and settlement are based on protecting the villages of haor from wave erosion and flash floods, expansion of eco-friendly settlement area, ensuring housing for the poor and development of rural livelihood in a healthy liveable environment. The Master Plan of the Haor Area has formulated some projects to maximize the benefits by utilising the spoil (earth obtained) from the dredging of rivers. The dredged spoil will be utilised for development of 38 nos. of settlement platform, adding an additional 1396 ha of new settlement areas and development of 38 nos. of eco-villages (model village). The programme includes construction of revetment works and green belt to protect the villages from wave erosion.

11.2.16 Industry

The benefits which have been expected from the development of the industry are based on development of the scope of industrialization of the haor region in a sustainable and environmentally friendly manner which will enable regional development, enhance employment and foster national development. The plan has proposed for establishment of several industries appropriate for this region which includes- can food industry, beverage industry, small and cottage industries for destitute women, mineral water processing plant, tea processing industry, gas cylinder industry, industrial park, charcoal industry and boat manufacturing industry etc. The development can advance through-establishment of agro-based industries, ensuring participation of women. Proposed industries are to be set up on highlands or lands unfit for farming, discouraging establishment of industries on land reserved for cattle pasture or forest as well as rivers, wetlands and urban area etc.

11.2.17 Water Supply and Sanitation

The benefits from water supply and sanitation development are based on provision of water supply and sanitation facilities to the people living in the rural area and promoting hygiene awareness.

Development projects of the water supply and sanitation system are proposed to be implemented through Local Government Institute (LGI), public-private sector, NGOs, CBOs and women groups (involving local women) and Government. Present provision per water source (PSF, RWH and TW etc.) is 93–152 people which will be reduced to 50 people per source. Similarly present provision for 13–18 households per water source (PSF, RWH and TW etc.) will be reduced to 5 households. The present access to general sanitary latrine is less than 50% households, which will be increased to 90% in 2012 and 100% in 2030.

11.3 Gross Regional Products (GRP)

The gross regional products with and without the Master Plan projects have been estimated based on trend analysis of future condition. In case of the Master Plan, the forecasted GRP has been estimated based on a judgement of the magnitude and timing of project implementation. It gives an indicative description of the regional economic impacts on the haor area. Figure 11.1 shows the sector wise gross regional products in the haor area.

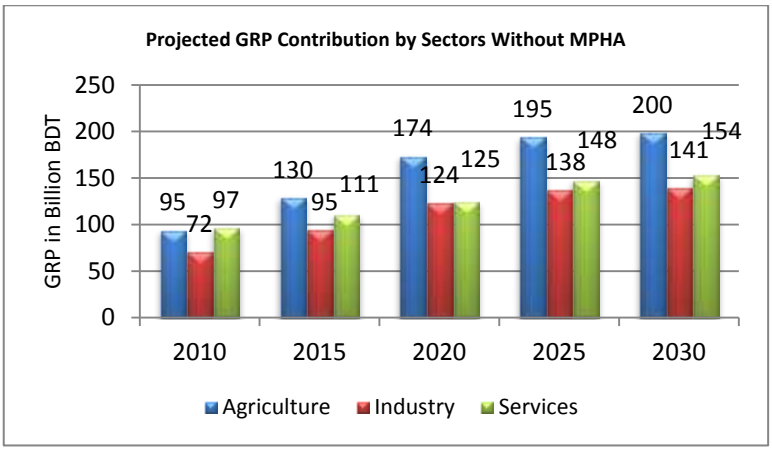


Figure 11.1: Sector wise gross regional products from haor area

According to the Outline Perspective Plan and the 6th Five Year Plan, the GoB aims to achieve growth rate of double digits by the year 2021 to fulfill the projected increase of GDP of the strategic goals.

The GRP following the regional growth trend is expected to reach 336 billion BDT by 2015, 423 billion BDT by 2020 and 495 billion BDT by 2030. This means that the GRP from the haor region is expected to be doubled from the base year 2010 to 2030. Consequently, the sectoral share of agriculture, industry and services will be 42%, 29% and 30% respectively. Growth in each sector is expected to accelerate through the development influx induced by Vision 2021. The FAP-6 had projected GRP growth of 414 billion by the year 2015 which seems ambitious with respect to the current economic growth of the haor region. If the proposed projects under the Master Plan of Haor Area are implemented, then the gross product derived would exceed the regional growth rate and reach to about 717 billion BDT in 2030. Figure 11.2 shows the trend of gross regional products with and without the Master Plan of Haor Area.

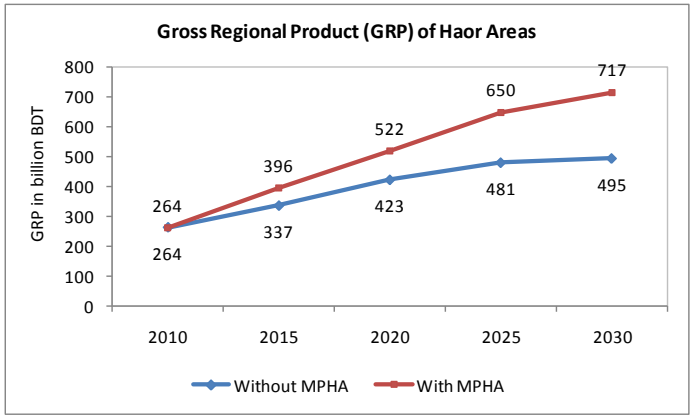


Figure 11.2: Trend of gross regional products with and without Master Plan of Haor Area

11.4 Other Socio-economic Benefit

11.4.1 Income Wages and Employment

In the haor region agriculture, fisheries and livestock and poultry industries have been the most vibrant sectors from time immemorial. Interventions in water management, agriculture, fisheries and livestock will bring about a big change in the cropping pattern and irrigation management which will improve agriculture productivity and employment opportunities for surplus labour force in the agricultural sector. It is estimated that at present 967 million person days/year of employment is generated in the crop sector and within the 20-year Master Plan time period the employment opportunities expected to be generated is about 1929 million person days/year i.e. an additional 962 million person days/year.

11.4.2 Urbanisation and Migration

Urbanisation will be one of the driving forces in the haor region during implementation of water resources, communication network of waterways and road and social infrastructure (education and health etc.) programmes. All these interventions will mainstream distant haor regions with the national and global development process. It will improve economic and social mobility. The haor population will find ways to move from one place to another in search of livelihoods, education, business and improved health services. Concentration of growth centers and planned housing will be developed around upazila and district towns. Rural well-off families receiving remittances from home and abroad will settle around the growth centers, cities and towns and find ways to make innovative investments of their savings.

11.4.3 Equity and Landless People

The landless population is one of the important constituents of the total population of Bangladesh. Only 3% of the haor population has no cultivable land. On the other hand, 81% of non-farm holdings have no cultivable land which is higher than the national (average (74%). At present, the total haor population is about 19.37 million and its total number of households is 3.65 million of which 52% own agricultural land (1.9 million). The rest of the household population depends earn their livelihoods from business, off-farm activities (non-agriculture), service, fisheries, transport-boatman, remittances and other wage earning. At present, functional landlessness in the region amongst the rural population already exceeds 50% and will further increase rapidly due to new land occupied for agriculture, housing, urbanisation, industrialisation, afforestation etc. So, the landless and wage-earning population is increasing in proportion to the population growth.

It is expected that the increased labor force created by population growth will be absorbed in the implementation process of the Plan through inter-sectoral migration and in-migration process within the region/country in different backward and forward linkage industries as well in the urbanisation and idustrialisation processes. Some districts of the haor area, particularly, Sylhet, Maulvibazar and Habiganj, receive huge amounts of remittance inflow from abroad, which will pave the way for investment avenues in different non-traditional sectors like tourism and other local resource base export oriented industries. The economic diversification and integration will create an enabling environment and increase employment opportunities for the landless and wage earner group population. Implementation of the 20-year visionary Master Plan of Haor Area will ensure equity among all strata of the haor population through effective and sustainable use of wetland resources.

Chapter 12 Implementation Plan

12.1 Introduction

The Master Plan contains154 projects under 17 Development Areas. Many of the projects may be linked operationally or conceptually or implemented in parallel with other projects. The Plan may be implemented in three phases starting from the financial year 2012-2013 and ending of the financial year 2031-2032.The three phases of the Plan are:

- Short Term: 1-5 years from FY 2012-13 to FY 2016-17
- Medium Term: 6-10 years from FY2017-18 to FY2021-22
- Long Term: 11-20 years from FY2022-23 to FY2031-32

The implementation schedule of the Master Plan is given in Section 12.3. The projects should be implemented after conducting feasibility study, EIA and SIA. The impact of the completed projects should be observed /evaluated for preparation of the projects of 2nd phase. Moreover impacts of the projects need to be monitored and evaluated as a routine work of the implementing agencies. The Plan will have both impacts and implications after the implementation of the proposed portfolios which will continue well beyond 2032. Longer term impacts will be felt in infrastructure with lifetimes that go beyond that period. The operation and maintenance implications will continue in the future. Monitoring of the implementation of the Plan will be a continuous process for which the BWHDB will be responsible. There will also be annual reviews and five-yearly reformulations running along with the Five Year Planning process.

12.2 Implementation Mechanism

Development projects are undertaken by the central government and are implemented by different line agencies, which receive specific fund allocations. Development activities at district and upazila levels are pursued by different agencies of the GoB. Usually, each agency has its own mandate which is mainly focused towards a particular sector sometimes without giving proper attention to the effect of such development activities on other sectors. Such uni-sectoral development activities are not fully effective and do not reflect the requirements of the target people. Locally mobilized funds by the local government institutions namely City Corporation, Paurashava, Zila Parishad, Upazila Parishad, Union Parishad may also be used to implement the portfolios suitable for the local Government institutions. Private sector may also find some of the portfolios suitable for implementation and accordingly funds may be mobilized for implementation. Table 12.1 gives the number of projects under different development areas included in the Master Plan.

Table 12.1: Portfolio projects under different Development Areas

Development Area	No of Projects
Agriculture	20
Education	7
Fisheries	22
Forest	6
Health	16
Housing and Settlement	1
Industry	9
Livestock	10
Mineral Resources	3
Pearl Culture	1
Power and Energy	4
Tourism	13
Water Resources	9
Water Supply and Sanitation	2
Biodiversity and wetland	10
Agriculture	20
Education	7
Total	154

The project portfolios will assist the respective implementing agencies to prepare full-fledged project proposals according to the government approved format. However, a provision for feasibility study for each project is required to be included under the Annual Development Programme of Bangladesh. This Master Plan is vulnerable to fluctuations of government investment programmes because of lengthy approval processes. Nevertheless, after it is approved, respective agencies will examine how the projects can fit into their existing investment programmes.

With the involvement of multiple agencies and their diverse activities, the objectives of the Plan are practically achievable, depending on successful implementation through timely initiation of activities. The implementation will be the responsibility of the line agencies concerned. The critical assumption is allocation and availability of government funds, channeled through line agencies in a timely fashion with overall coordination of the BHWDB. The implementing agencies will follow the existing rules and regulations and ensure good governance.

Apart from the Ministry of Water Resources, fifteen other ministries will have important role in implementing the Master Plan. At district and upazila levels, a District Steering Committee (DSC) headed by the Deputy Commissioners of the respective districts and the Upazila Nirbahi Officer will have vital roles in the proper implementation of the Plan. This could be the key instrumental platform, which will guide and monitor the implementation of the Plan at district as well as upazila level.

12.3 Implementation Schedule

Each project proposed under different DAs has its own schedule for implementation. Nevertheless, an integrated implementation schedule has been developed as per priority and considering the linkage among the DAs. The priorities and schedules have been developed based on the investment requirement across the different DAs and availability of development budgets of the GoB.

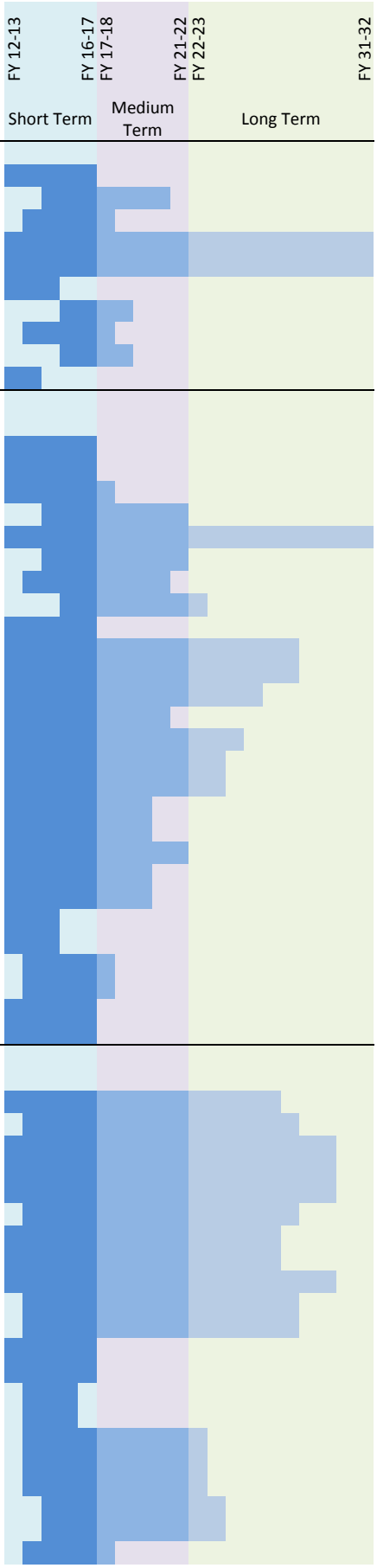
DAs of water resources, agriculture, fisheries, communication, water supply and sanitation and biodiversity and wetland management have been given high priority in the Plan for improving the quality of life of people as well as to protect the natural environment and aquatic resources of the region. Feasibility studies and Environmental Management Plans are therefore necessary before implementation of the Master Plan projects. It is also a prerequisite to develop the capacity of the line agencies for efficient and timely implementation of the projects.

The Plan also emphasises the need for immediate action for the preservation of important wetlands and biodiversity of haor and prevention of further degradation of the natural environment of the haor area.

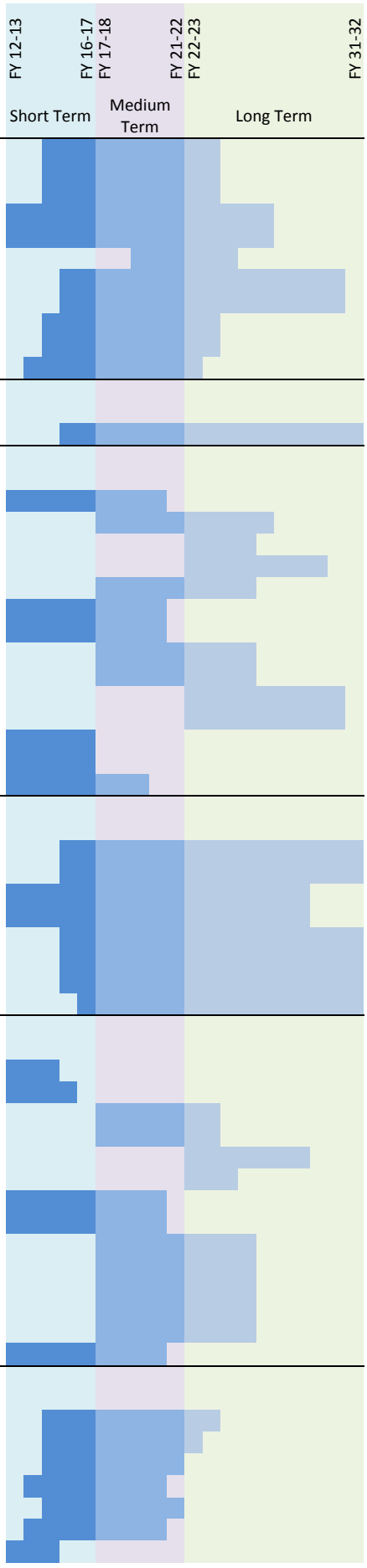
Projects of other DAs (Livestock, Forest, Education, Health, Housing and Settlement, Pearl culture, Energy and Power, Mineral Resources, Tourism, Social Services and Facilities and Industry) have also been given priority for further investment of the government to ensure accelerated development of those particular DAs in the haor region. The implementation schedule is presented in Table 12.2.

Table 12.2: Implementation schedule

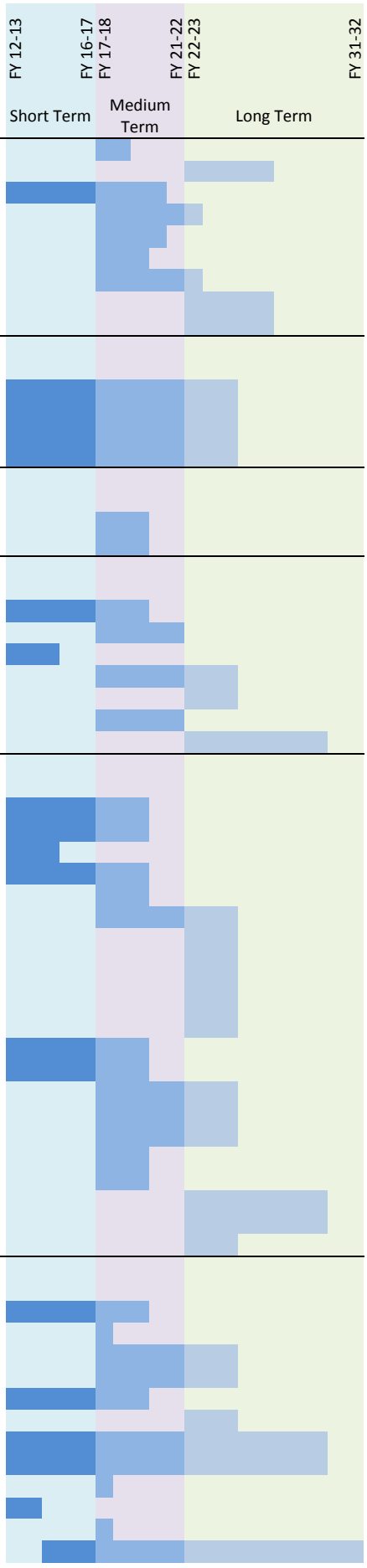
DA Code	Projects by Development Area
	Water Resources
WR-01***	Pre-Monsoon Flood Protection and Drainage Improvement in Haor Areas
WR-02**	Flood Management of Haor Areas
WR-03***	River Dredging and Development of Settlement
WR-04**	Development of Early Warning System for Flash Flood prone areas in Haor and dissemination to Community Level
WR-05***	Village Protection against Wave Action of Haor Area
WR-06**	Monitoring of the Rivers in Haor Area
WR-07***	Impact study of the interventions of transboundary river system
WR-08**	Study of the Climate Change impact of Haor areas
WR-09***	Strengthening and Capacity Development of BHWDB
	Agriculture
AG-01***	Expansion of irrigation through utilization of surface water by double lifting in haor area
AG-02***	Minor Irrigation by low lift pumps project
AG-03**	Investigation and expansion of ground water irrigation
AG-04*	Promotion and plantation of Agar Plant
AG-05*	Automation of rice transplantation system by Auto Rice Transplanter
AG-06**	Mechanization of Agriculture through Combined Harvester
AG-07**	Improvement of Quality of Crop Grain through Dryer system
AG-08***	Intensive Cultivation of homestead vegetables and horticulture
AG-09**	Development of climate resilient High Yielding Varieties of rice and non-rice crops
AG-10**	Selection of Short Duration Boro Rice Cultivars/ Advanced Line
AG-11***	Changing Cropping Pattern to increase cropping intensity in haor areas
AG-12*	Extension of Integrated Pest Management Training Project
AG-13**	Expansion of Integrated Crop Management Training
AG-14*	Extension of Jute cultivation project
AG-15**	Integrated Development of Applied Research for Improved Farming Systems
AG-16**	High Value-non-Rice-cum-Deep Water Rice Culture
AG-17***	Assistance to Landless, Marginal and Small Farmers to overcome soaring input, and food prices in impoverished Haor area
AG-18**	Application of GIS for farm productivity enhancement through land suitability assessment of major cropping pattern in Haor Region
AG-19*	Improvement of Storage Facilities and Agricultural Marketing System in Haor Area
AG-20**	Introduction of Innovative Agriculture through Vegetables cultivation on Floating Bed
	Fisheries
FI-01***	Development and Establishment of Fish Sanctuaries
FI-02***	Habitat Restoration for Fish Diversity
FI-03***	Beel Nursery Programme for Increasing Fish Fingerling Recruitment
FI-04*	Good Fisheries Management Practices following the Mohanganj Experience
FI-05**	Floodplain Aquaculture under the Community Enterprise Approach
FI-06**	Community and Household-based Net-pen Fish Culture in the Haor/Floodplain
FI-07***	Fish Fingerling Stocking and Raising Programme
FI-08**	Capacity Development and Alternate Income Generating Activities (AIGAS) for Fisher Community
FI-09***	Renovation of Hatcheries for Conserving Quality Brood Stock and Production of Fish Seeds
FI-10**	Study on Review of Policies, Regulations and Lease System for Sustaining Fisheries Resources
FI-11***	Restoration of River Duars (Deep Pools) for Protecting Brood/Mother Fish
FI-12**	Renovation of Fish Ponds and Dissemination of Improved Aquaculture Technology to Fish Farmers
FI-13**	Development and Construction of Innovative Fish Pass/Fish Friendly Structures
FI-14*	Establishment of Fisheries Information Service Centre



DA Code	Projects by Development Area
FI-15**	Introduction of Deep Water Rice-cum-Fish Culture
FI-16**	Establishment and Rehabilitation of Fish Landing Centers
FI-17**	Establishment of Fish Drying and Fermentation Centre
FI-18**	Study on Impact of Climate Change and Interventions on Fisheries Resources
FI-19*	Development and Establishment of Cold Storage and Ice Plants
FI-20*	Research on Fish Stock Improvement through Gene Pool Preservation and In-breeding Depression
FI-21*	Rehabilitation of Existing Fish Processing Units and Establishment of a New Fish Processing Industry
FI-22**	Community and Household-based Cage Fish Culture
	Pearl Culture
PC-01**	Development and Dissemination of pearl culture technology in Haor Area
	Livestock
LS-01***	Improvement of fodder availability for livestock development
LS-02**	Integration of livestock in traditional farming system
LS-03*	Farmers training programs for capacity building
LS-04*	Establishment of pilot breeding programme for cattle development
LS-05**	Promotion of small and mini dairy farms
LS-06***	Promotion of conventional and alternative feed resources for livestock feeding
LS-07**	Extension of Livestock Services through establishment of Union Livestock Service Center (ULSC)
LS-08*	Development of Livestock Products through involvement of Community Organization
LS-09***	Development of Community Animal Health Workers for Livestock Healthcare
LS-10***	Promotion of Small and Mini Poultry and Duck Farms
	Forest
FR-01**	Establishment of One Forest Nurseries in each of the 57 Upazilas of the Haor Areas
FR-02***	Afforestation through involvement of local Community in Haor Area
FR-03***	Afforestation of Roads, Embankments, Homesteads and Institutions
FR-04*	Reclamation of Izmali land for promotion of Social Forestry
FR-05**	Increase the Capacity of Community for forest conservation and Improvement
FR-06*	Research Programmes on Haor Areas
	Biodiversity and wetland
BW-01***	Eco- management zoning of Haor wetlands for biodiversity protection
BW-02***	Restoration of important wetlands
BW-03**	Development and implementation of important wetlands for global significance.
BW-04*	Establishment of global wetlands center
BW-05*	Review of policy for biodiversity management
BW-06***	Habitat preservation programme for plants, wildlife, fisheries and migratory birds
BW-07**	Research and education programme on Haor wetlands biodiversity conservation and management
BW-08**	Management of commercially important Haor wetland biodiversity
BW-09 **	Pollution control and prevention from agriculture, industry and urban settlement
BW-10***	Adaption and Mitigation to Climate Disaster Risks in Haor Basin
	Transportation
TR-1***	Upgradation of Rural Roads
TR-2***	Submersible rural road construction
TR-3***	Submersible District road construction (Sulla to Ajmiriganj)
TR-4***	Submersible District road construction (Khaliajuri to Ajmiriganj)
TR-5***	Submersible District road construction (Itna to Ajmiriganj)
TR-6***	Submersible District road construction (Austagram to Lakhai)
TR-7***	Submersible District road construction (Derai to Jagannathpur)



DA Code	Projects by Development Area
TR-8**	Construction of Regional Highway
TR-9*	Construction of Surma Bridge at Chhatak
TR-10***	Development of inland navigation by dredging in nine river routes
TR-11**	Development of 150 landing facilities in the rural area
TR-12**	Installation of navigational aids along the river routes
TR-13**	Hydrographic survey in the nine major river routes
TR-14**	Construction of terminal buildings at 15 major passenger stations
TR-15*	Development of parking yards, storage facilities and security walls at 13 stations
	Water Supply and Sanitation
WS-01***	Establishment Sustainable and Community based Haor friendly Water Supply Technologies
WS-02***	Introduce the Sustainable and Community based Flood Proof Hygienic Sanitation System in Haor areas
	Housing and Settlement
ST-01**	Eco Village Platform Development for mitigate future Housing and settlement demand
	Education
ED-01***	Establishment of Community based Multigrade Learning Centers
ED-02**	Community based School Feeding Programme
ED-03***	Establishment of Primary Schools
ED-04**	School Boat Facilities for Inaccessible Areas
ED-05*	Awareness Generation Programmes on Gender Discrimination
ED-06**	Introduce skill based training programmes
ED-07*	Establishment of High Schools, Colleges and Madrasa
	Health
HE-01***	Upgradation of Upazila Health Complex (UHC) and Construction of Upazila Health & Family Welfare Centre (UHFWC)
HE-02***	Maternal and Reproductive Health Development Programme
HE-03***	Child Mortality Reduction Programme
HE-04**	Promotion of nutrition status of the haor people
HE-05**	Improve the quality of hospital service
HE-06*	Capacity Development of Non-government, Non-profit Health Care Agencies using Private-Public-Partnership (PPP)
HE-07*	Expansion of Alternative Medical Care (Unani, Ayurvedic & Homeopathic system of medicine)
HE-08*	Strengthening of supervision and monitoring system
HE-09***	Community health care: Establishment of Community clinics (CC)
HE-10***	Community health care: Mobile clinic and emergency medical team
HE-11**	Establishment of e-Health Services and Facilities up to Community Level
HE-12**	Strengthening referral system from CC to UHFWC; UHFWC to UHC; UHC to District Hospitals
HE-13**	Environmental Health Programme
HE-14**	Capacity development of health personnel
HE-15*	Medical Waste Management in District Hospital and Upazila Health Complex
HE-16*	GIS mapping of health facilities and disease pattern
	Tourism
TS-01***	Development of Mega Eco-parks
TS-02**	Establishment of War Museums
TS-03**	Establishment of Amusement Parks
TS-04**	Development of Tourist/Picnic Spots
TS-05***	Construction of Bird Watching Tower
TS-06*	Renovation of Zamindar Palaces
TS-07***	Dolphin Sighting Tour Programme
TS-08***	Hakaluki Haor Sightseeing Tour Programme
TS-09**	Development of Fish Park
TS-10***	Establishment of Wildlife Sanctuary
TS-11**	Promotional Programmes on Haor for Electronic and Print Media
TS-12**	Construction of Tourism Infrastructures



DA Code	Projects by Development Area	FY 12-13 / FY 16-17 (Short Term)	FY 17-18 / FY 21-22 (Medium Term)	FY 22-23 / FY 31-32 (Long Term)
TS-13*	Training programmes in Hotel Management and Food Catering			
	Social Services			
SS-01**	Construction of Growth centers/Rural markets			
SS-02*	Construction of Food Godowns			
SS-03***	Upgradation/construction of religious prayer house, graveyards and cremation grounds			
SS-04**	Awareness Generation Programme for the Spiritual Leaders			
SS-05*	Construction of Playground and Supply of Sports materials			
SS-06***	Upgradation and Construction of Police Stations			
	Industry			
IN-01**	Can food Industry			
IN-02**	Beverage Industry			
IN-03***	Small and Cottage Industries Development programme for destitute women's in haor area			
IN-04*	Swamp Water Processing Industry			
IN-05**	Tea processing Industry			
IN-06**	Gas cylinder Industry			
IN-07*	Industrial Park			
IN-08***	Establishment of Charcoal Industry			
IN-09***	Boat Manufacturing Industry			
	Power and Energy			
PW-01***	Expansion of electric distribution systems in Haor districts			
PW-02**	Expansion of solar power generation systems			
PW-03*	Pre-feasibility Study on Renewable Energy Potentials and Power Generation Possibilities in Haor Area			
PW-04*	Development of mini-hydropower schemes			
	Mineral Resources			
MR-01**	Seismic survey, exploration drilling in the Haor districts to explore new gas field			
MR-02**	Development of Mines for gravel, white clay, glass sand, coal and peat extraction from Haor districts			
MR-03***	Strengthening capacity of miner and mining labor in Haor districts			

Note: *** Very High Priority, ** High Priority, * Medium Priority

12.4 Responsibilities

Each of the proposed projects has been primarily assigned to a specific line agency. These agencies will be responsible for conducting full-fledged feasibility studies and detail design in cooperation with relevant other organizations. During feasibility study and detailed engineering design, the study team is expected to use modern technology such as mathematical and physical models, integrated environmental analysis, RS, GIS and other analytical tools. In short, the line agencies will develop their own projects drawn from the Master Plan and implement them observing normal administrative and financial procedures.

The proposed investment portfolios of the projects also identify the agencies that are expected to perform a supporting role within a particular thematic area. Programme databases within the MIS can be used to identify primary and secondary responsibilities for each agency. The responsibilities are strategic in terms of sustainability or institutional advantage. The scarcity of resources combined with the complexity and scale of the tasks require careful planning and management. For this reason an integrated system of responsible institutions is required, each having a clear defined role which it can pursue in a single minded manner. The supporting role would be partnership role and under no circumstances be considered as a subordinate relationship. The line agencies will therefore need to take these potential advantages of partnership relation fully into consideration during the preparation and implementation of the work plans of the proposed projects.

If more than one agency is involved in a project, it will be formulated in consultation with all the agencies involved. Once such a project has been prepared, the potential financiers, i.e. the government, development partner, private sector or beneficiaries will use Plan Conformity as one of the pre-financing appraisal criteria.

A list of the identified line ministries, agencies/organizations responsible for the implementation of the Plan is given in Table 12.3. Each of these agencies will be responsible for identifying and designing the specific projects Table 12.4. In most cases, the preparation should begin immediately if the full benefit of the Plan is to be achieved within the targeted time frame. Descriptions of the activities of the project are available within the proposed investment portfolio (Volume III) while guiding principals have been described in the development strategy of the Master Plan.

12.5 Coordination

The Plan will be implemented by different live agencies under the overall monitoring, coordination and advice of the BWHDB as its mandate is to coordinate the activities for an integrated development of the haor area. Thus, the BHWDB will be responsible for monitoring the project activities. Monitoring may involve site visits, consultation with stakeholders etc. An MIS is to be developed and followed by the BHWDB.

It may be noted that according to the NWPo and the NWMP, the programmes of the NWMP are being implemented by different agencies under the overall monitoring, coordination and advice of WARPO. Thus, a debate may surface on the possible duplication or overlapping of WARPO's role and that of the BWHDB in the implementation of the Plan. BHWDB's role as monitoring implementation of the portfolios suggested in the master Plan will remain limited for the haor area only and it would perform its monitoring mandate in parallel with WARPO. Both the BHWDB and WARPO would work

together in partnership. Duplication will be avoided. In this regard, a MoU may be drafted and signed by these two organizations (both under the MoWR).

Since the BHWDB will be the agency to operate the Plan and its role in the context of the implementation is seen as proactive and indirect, it would be worthwhile for the BHWDB to take a closer look at the implications of the Plan. To do so, it should immediately prepare its Five Year Plan. To make the BWHDB an effective and efficient organization, its mandate should be backed by an Act and appropriate rules and regulations. Furthermore, the Wetland Policy should be finalized and declared by the GoB. To assume an effective role, the BWHDB's current capacity will have to be strengthened both technically and operationally. The BHWDB should immediately recruit new staff according to the existing approved set-up.

In particular, it will need a dedicated group of staff recruited/hired directly rather than seconded temporarily from other agencies. This and other relevant issues have been addressed in the 'BWHDB Capacity Building' programme/project.

Table 12.3: Ministry and implementing agency wise project and investment cost

Ministry	Implementing Agency	Number of Projects	Investment Cost(in lakh taka)
Ministry of Water Resources	Bangladesh Haor and Wetland Development Board	8	68,086
	Bangladesh Water Development Board	10	536,808
	Joint Rivers Commission, Bangladesh	1	1,500
	Sub-Total	**19**	**606,394**
Ministry of Agriculture	Bangladesh Agriculture Development Corporation	3	98,000
	Bangladesh Agriculture Research Council	1	450
	Bangladesh Agriculture Research Institute	3	2,785
	Department of Agricultural Extension	11	94,542
	Department of Agriculture Marketing	1	5,000
	Sub-Total	**19**	**200,777**
Ministry of Fisheries and Livestock	Bangladesh Fisheries Development Corporation	4	21,272
	Bangladesh Fisheries Research Institute	4	61,412
	Department of Fisheries	13	80,720
	Department of Livestock	10	76,694
	Sub-Total	**31**	**240,098**
Ministry of Civil Aviation and Tourism	Bangladesh Parjatan Corporation	14	33,892
	Sub-Total	**14**	**33,892**
Ministry of Commerce	Bangladesh Chamber of Commerce and Industries	1	10,000
	Sub-Total	**1**	**10,000**
Ministry of Communications	Roads and Highway Department	7	41,680
	Sub-Total	**7**	**41,680**
Ministry of Education	Directorate of Secondary and Higher Education	1	33,250
	Directorate of Technical Education	1	3,600
	Sub-Total	**2**	**36,850**
Ministry of Environment	Department of Environment	4	38,000

Ministry	Implementing Agency	Number of Projects	Investment Cost(in lakh taka)
and Forests			
	Forest Department	5	239,712
	Sub-Total	**9**	**277,712**
Ministry of Food and Disaster Management	Directorate General of Food	1	10,000
	Disaster Management Bureau	1	8,000
	Sub-Total	**2**	**18,000**
Ministry of Health and Family Welfare	Department of Health Engineering	2	57,570
	Directorate General of Health Services	14	62,793
	Sub-Total	**16**	**120,363**
Ministry of Industries	Bangladesh Industrial and Technical Assistance Center	1	1,000
	Bangladesh Small and Cottage Industries Corporation	5	21,717
	Sub-Total	**6**	**22,717**
Ministry of Local Government Division	City Corporation	1	10,000
	Department of Public Health Engineering	2	105,000
	Local Government and Rural Development	1	9,100
	Local Government Engineering Department	4	368,344
	Local Government Institute	4	14,875
	Sub-Total	**12**	**507,319**
Ministry of Power, Energy & Mineral Resources	Bangladesh Power Development Board	1	980
	Bureau of Mineral Development	1	15,000
	Petrobangla	1	200,000
	Rural Electrification Board	2	339,920
	Sub-Total	**5**	**555,900**
Ministry of Primary and Mass Education	Directorate of Primary Education	4	22,530
	Sub-Total	**4**	**22,530**
Ministry of Religious Affairs	Islamic Foundation	1	126
	Sub-Total	**1**	**126**
Ministry of Shipping	Bangladesh Inland Water Transport Authority	3	90,447
	Bangladesh Inland Water Transport Corporation	3	19,500
	Sub-Total	**6**	**109,947**
	Total 16 Ministries and 38 Agencies	**154**	**2,804,305**

Table 12.4: Proposed implementation lead agencies

DA Code	Projects by Development Area	Ministry	Lead Agency	Supporting Agencies	Funding
Water Resources					
WR-01***	Pre-Monsoon Flood Protection and Drainage Improvement in Haor Areas	Water Resources	BWDB	BHWDB, CEGIS, IWM	GoB and DP
WR-02**	Flood Management of Haor Areas	Water Resources	BWDB	BHWDB, CEGIS, IWM	GoB and DP
WR-03***	River Dredging and Development of Settlement	Water Resources	BWDB	BHWDB, CEGIS	GoB and DP
WR-04**	Development of Early Warning System for Flash Flood prone areas in Haor and dissemination to Community Level	Water Resources	BWDB	BHWDB, CEGIS	GoB and DP
WR-05***	Village Protection against Wave Action of Haor Area	Water Resources	BWDB	BHWDB, CEGIS	GoB and DP
WR-06**	Monitoring of the Rivers in Haor Area	Water Resources	BWDB	BHWDB, CEGIS	GoB and DP
WR-07***	Impact study of the interventions of transboundary river system	Water Resources	JRC,b	BHWDB, CEGIS	GoB and DP
WR-08**	Study of the Climate Change impact of Haor areas	Water Resources	BHWDB	CEGIS	GoB and DP
WR-09***	Strengthening and Capacity Development of BHWDB	Water Resources	BHWDB	CEGIS	GoB and DP
Agriculture					
AG-01***	Expansion of irrigation through utilization of surface water by double lifting in haor area	Agriculture	BADC	BWDB, DAE	GoB and DP
AG-02***	Minor Irrigation by low lift pumps project	Agriculture	BADC	BWDB, CEGIS	GoB and DP
AG-03**	Investigation and expansion of ground water irrigation	Agriculture	BADC	BWDB, DAE, CEGIS	GoB and DP
AG-04*	Promotion and plantation of Agar Plant	Fisheries and Livestock	BFRI	DAE	PPP
AG-05*	Automation of rice transplantation system by Auto Rice Transplanter	Agriculture	DAE	BRRI, DoC	PPP
AG-06**	Mechanization of Agriculture through Combined Harvester	Agriculture	DAE	DoC, BRRI	PPP
AG-07**	Improvement of Quality of Crop Grain through Dryer system	Agriculture	BARI	BRRI, BARI	PPP
AG-08***	Intensive Cultivation of homestead vegetables and horticulture	Agriculture	DAE	BADC, BARI	GoB and DP
AG-09**	Development of climate resilient High Yielding Varieties of rice and non rice crops	Agriculture	BARI	BARI, BINA, BRRI	GoB and DP
AG-10**	Selection of Short Duration Boro Rice Cultivars/ Advanced Line	Agriculture	DAE	BRRI, DAE, NGO, BINA	GoB and DP
AG-11***	Changing Cropping Pattern to increase cropping intensity in haor areas	Agriculture	DAE	BARI, BRRI	GoB and DP
AG-12*	Extension of Integrated Pest Management Training Project	Agriculture	DAE	NGO, BARI, BRRI	GoB and DP
AG-13**	Expansion of Integrated Crop Management Training	Agriculture	DAE	BJRI, NGO	GoB and DP
AG-14*	Extension of Jute cultivation project	Agriculture	DAE	BJRI, NGO	GoB and DP
AG-15**	Integrated Development of Applied Research for Improved Farming Systems	Agriculture	BARI	BARI, DAE, BLRI, DLS, SRI, DoF, DF	GoB and DP
AG-16**	High Value-non-Rice-cum-Deep Water Rice Culture	Agriculture	DAE	BARI, BINA, BRRI, BADC, NGO	GoB and DP
AG-17***	Assistance to Landless, Marginal and Small Farmers to overcome soaring input, and food	Agriculture	DAE	BRRI, BARI, BINA, NGO	GoB and DP

DA Code	Projects by Development Area	Ministry	Lead Agency	Supporting Agencies	Funding
	prices in impoverished Haor area				
AG-18**	Application of GIS for farm productivity enhancement through land suitability assessment of major cropping pattern in Haor Region	Agriculture	BARC	CEGIS	GoB and DP
AG-19*	Improvement of Storage Facilities and Agricultural Marketing System in Haor Area	Agriculture	DAM	DAE, BADC	GoB and DP
AG-20**	Introduction of Innovative Agriculture through Vegetables cultivation on Floating Bed	Agriculture	DAE	BADC, BARI	GoB and DP
Fisheries					
FI-01***	Development and Establishment of Fish Sanctuaries	Fisheries and Livestock	DoF	BWDB, CEGIS, NGO	GoB and DP
FI-02***	Habitat Restoration for Fish Diversity	Water Resources	BWDB	DoF	GoB and DP
FI-03***	Beel Nursery Programme for Increasing Fish Fingerling Recruitment	Fisheries and Livestock	DoF	NGO	GoB and DP
FI-04*	Good Fisheries Management Practices following the Mohanganj Experience	Water Resources	BWDB	NGO	GoB and DP
FI-05**	Floodplain Aquaculture under the Community Enterprise Approach	Fisheries and Livestock	DoF	BWDB, LGED, NGO	Private
FI-06**	Community and Household-based Net-pen Fish Culture in the Haors/Floodplain	Fisheries and Livestock	DoF	NGO	GoB and DP
FI-07***	Fish Fingerling Stocking and Raising Programme	Fisheries and Livestock	DoF	NGO, Local community	GoB and DP
FI-08**	Capacity Development and Alternate Income Generating Activities (AIGAS) for Fisher Community	Fisheries and Livestock	DoF	NGO	GoB and DP
FI-09***	Renovation of Hatcheries for Conserving Quality Brood Stock and Production of Fish Seeds	Fisheries and Livestock	DoF	BFRI	GoB and DP
FI-10**	Study on Review of Policies, Regulations and Lease System for Sustaining Fisheries Resources	Fisheries and Livestock	DoF	BFRI, NGO	GoB and DP
FI-11***	Restoration of River Duars (Deep Pools) for Protecting Brood/Mother Fish	Water Resources	BWDB	DoF	GoB and DP
FI-12**	Rennovation of Fish Ponds and Dissemination of Improved Aquaculture Technology to Fish Farmers	Fisheries and Livestock	DoF	NGO	GoB and DP
FI-13**	Development and Construction of Innovative Fish Pass/Fish Friendly Structures	Water Resources	BWDB	DoF	GoB and DP
FI-14*	Establishment of Fisheries Information Service Centre	Fisheries and Livestock	DoF	FLID, CEGIS, NGO	GoB and DP
FI-15**	Introduction of Deep Water Rice-cum-Fish Culture	Fisheries and Livestock	DoF	DAE, NGO	GoB and DP
FI-16**	Establishment and Rehabilitation of Fish Landing Centres	Fisheries and Livestock	BFDC	DoF	GoB and DP
FI-17**	Establishment of Fish Drying and Fermentation Centre	Fisheries and Livestock	BFDC	DoF	GoB and DP
FI-18**	Study on Impact of Climate Change and Interventions on Fisheries Resources	Fisheries and Livestock	BFRI	DoF, CEGIS, University, Research Institute	GoB and DP
FI-19*	Development and Establishment of Cold Storage and Ice Plants	Fisheries and Livestock	BFDC	DoF, Public-private-partnership	GoB and DP
FI-20*	Research on Fish Stock Improvement through Gene Pool Preservation and In-breeding Depression	Fisheries and Livestock	BFRI	University, Research organization	GoB and DP

DA Code	Projects by Development Area	Ministry	Lead Agency	Supporting Agencies	Funding
FI-21*	Rehabilitation of Existing Fish Processing Units and Establishment of a New Fish Processing Industry	Fisheries and Livestock	BFDC	DoF	GoB and DP
FI-22**	Community and Household-based Cage Fish Culture	Fisheries and Livestock	DoF	NGO	Private
Pearl Culture					
PC-01**	Development and Dissemination of pearl culture technology in Haor Area	Fisheries and Livestock	DoF	BFRI	GoB and DP
Livestock					
LS-01***	Improvement of fodder availability for livestock development	Fisheries and Livestock	DLS	BHWDB	GoB and DP
LS-02**	Integration of livestock in traditional farming system	Fisheries and Livestock	DLS	BHWDB, DAE	GoB and DP
LS-03*	Farmers training programs for capacity building	Fisheries and Livestock	DLS	BHWDB, LGED	GoB and DP
LS-04*	Establishment of pilot breeding program for cattle development	Fisheries and Livestock	DLS	BHWDB, DAM	GoB and DP
LS-05**	Promotion of small and mini dairy farms	Fisheries and Livestock	DLS	BHWDB, MoWCA	Private
LS-06***	Promotion of conventional and alternative feed resources for livestock feeding	Fisheries and Livestock	DLS	BHWDB	GoB and DP
LS-07**	Extension of Livestock Services through establishment of Union Livestock Service Center (ULSC)	Fisheries and Livestock	DLS	BHWDB, LGRD	GoB and DP
LS-08*	Development of Livestock Products through involvement of Community Organization	Fisheries and Livestock	DLS	BHWDB, DAM	GoB and DP
LS-09***	Development of Community Animal Health Workers for Livestock Healthcare	Fisheries and Livestock	DLS	BHWDB	GoB and DP
LS-10***	Promotion of Small and Mini Poultry and Duck Farms	Fisheries and Livestock	DLS	NGO, BHWDB	Private
Forest					
FR-01**	Establishment of One Forest Nurseries in each of the 57 Upazilas of the Haor Areas	Environment and Forests	FD	BHWDB	PPP
FR-02***	Afforestation through involvement of local Community in Haor Area	Environment and Forests	FD	BHWDB, CEGIS	PPP
FR-03***	Afforestation of Roads, Embankments, Homesteads and Institutions	Environment and Forests	FD	BHWDB, FD, CEGIS	PPP
FR-04*	Reclamation of Izmali land for promotion of Social Forestry	Environment and Forests	FD	BHWDB, CEGIS, NGO	GoB and DP
FR-05**	Increase the Capacity of Community for forest conservation and Improvement	Environment and Forests	FD	BHWDB, CEGIS, NGO, FD	GoB and DP
FR-06*	Research Programmes on Haor Areas	Fisheries and Livestock	BFRI	BHWDB, CEGIS, NGO	GoB and DP
Biodiversity and wetland					
BW-01***	Eco- management zoning of Haor wetlands for biodiversity protection	Water Resources	BHWDB	BHWDB, CEGIS, NGO, IUCN	GoB and DP
BW-02***	Restoration of important wetlands	Environment and Forests	DoE	BHWDB, CEGIS, NGO, IUCN	GoB and DP
BW-03**	Development and implementation of important wetlands for global significance.	Water Resources	BHWDB	BHWDB, FD, DOE, CEGIS, IUCN, NGO	GoB and DP

DA Code	Projects by Development Area	Ministry	Lead Agency	Supporting Agencies	Funding
BW-04*	Establishment of global wetlands center	Water Resources	BHWDB	BHWDB, FD, DoF, DOE, CEGIS, FD	GoB and DP
BW-05*	Review of policy for biodiversity management	Environment and Forests	DoE	BHWDB, FD, DOE, CEGIS, IUCN, NGO	GoB and DP
BW-06***	Habitat preservation program for plants, wildlife, fisheries and migratory birds	Environment and Forests	DoE	FD, CEGIS, IUCN, NGO	GoB and DP
BW-07**	Research and education program on Haor wetlands biodiversity conservation and management	Environment and Forests	DoE	FD, DOE, DoF, University, Research institute, CEGIS, NGO	GoB and DP
BW-08**	Management of commercially important Haor wetland biodiversity	Water Resources	BHWDB	FD, DoE, DoF, BPC, CEGIS	GoB and DP
BW-09 **	Pollution control and prevention from agriculture, industry and urban settlement	Water Resources	BHWDB	DoE, DAE, LGI, DPHE, CEGIS	GoB and DP
BW-10***	Adaption and Mitigation to Climate Disaster Risks in Haor Basin	Food and Disaster Management	DMB	CEGIS, NGO, BHWDB, IUCN	GoB and DP
Transportation					
TR-1***	Upgradation of Rural Roads	Local Government Division	LGED		GoB and DP
TR-2***	Submersible rural road construction	Local Government Division	LGED		GoB and DP
TR-3***	Submersible District road construction (Sulla to Ajmiriganj)	Communications	RHD		GoB and DP
TR-4***	Submersible District road construction (Khaliajuri to Ajmiriganj)	Communications	RHD		GoB and DP
TR-5***	Submersible District road construction (Itna to Ajmiriganj)	Communications	RHD		GoB and DP
TR-6***	Submersible District road construction (Austagram to Lakhai)	Communications	RHD		GoB and DP
TR-7***	Submersible District road construction (Derai to Jagannathpur)	Communications	RHD		GoB and DP
TR-8**	Construction of Regional Highway	Communications	RHD		GoB and DP
TR-9*	Construction of Surma Bridge at Chatak	Communications	RHD		GoB and DP
TR-10***	Development of inland navigation by dredging in nine river routes	Shipping	BIWTA	BWDB	GoB and DP
TR-11**	Development of 150 landing facilities in the rural area	Shipping	BIWTC	LGED	GoB and DP
TR-12**	Installation of navigational aids along the river routes	Shipping	BIWTA		GoB and DP
TR-13**	Hydrographic survey in the nine major river routes	Shipping	BIWTA	CEGIS	GoB and DP
TR-14**	Construction of terminal buildings at 15 major passenger stations	Shipping	BIWTC		GoB and DP
TR-15*	Development of parking yards, storage facilities and security walls at 13 stations	Shipping	BIWTC		PPP
Water Supply and Sanitation					
WS-01***	Establishment Sustainable and Community based Haor friendly Water Supply Technologies	Local Government Division	DPHE	LGI, CEGIS, NGO, ITN-BUET	GoB and DP

DA Code	Projects by Development Area	Ministry	Lead Agency	Supporting Agencies	Funding
WS-02***	Introduce the Sustainable and Community based Flood Proof Hygienic Sanitation System in Haor areas	Local Government Division	DPHE	CEGIS, Hindu Religious WCIF	GoB and DP
Housing and Settlement					
ST-01**	Eco Village Platform Development for mitigate future Housing and settlement demand	Local Government Division	LGRD	BHWDB	GoB and DP
Education					
ED-01***	Establishment of Community based Multigrade Learning Centres	Primary and Mass Education	DPE		GoB and DP
ED-02**	Community based School Feeding Programme	Primary and Mass Education	DPE	NGO, Private company	GoB and DP
ED-03***	Establishment of Primary Schools	Primary and Mass Education	DPE	LGED	GoB and DP
ED-04**	School Boat Facilities for Inaccessible Areas	Local Government Division	LGI		GoB and DP
ED-05*	Awareness Generation Programmes on Gender Discrimination	Primary and Mass Education	DPE	Islamic Foundation, Hindu Religious WCIF, CEGIS	GoB and DP
ED-06**	Introduce skill based training programmes	Education	DTE		GoB and DP
ED-07*	Establishment of High Schools, Colleges and Madrasa	Education	DSHE	LGED	GoB and DP
Health					
HE-01***	Upgradation of Upazila Health Complex (UHC) and Construction of Upazila Health & Family Welfare Centre (UHFWC)	Health and Family Welfare	DHE		GoB and DP
HE-02***	Maternal and Reproductive Health Development Programme	Health and Family Welfare	DG-Health	DGFP	GoB and DP
HE-03***	Child Mortality Reduction Programme	Health and Family Welfare	DG-Health	DGFP	GoB and DP
HE-04**	Promotion of nutrition status of the haor people	Health and Family Welfare	DG-Health	DGFP, NNP	GoB and DP
HE-05**	Improve the quality of hospital service	Health and Family Welfare	DG-Health	CEGIS	GoB and DP
HE-06*	Capacity Development of Non-government, Non-profit Health Care Agencies using Private-Public-Partnership (PPP)	Health and Family Welfare	DG-Health	NGO	GoB and DP
HE-07*	Expansion of Alternative Medical Care (Unani, Ayurvedic & Homeopathic system of medicine)	Health and Family Welfare	DG-Health	LGED	GoB and DP
HE-08*	Strengthening of supervision and monitoring system	Health and Family Welfare	DG-Health	DGFP	GoB and DP
HE-09***	Community health care: Establishment of Community clinics (CC)	Health and Family Welfare	DHE		GoB and DP
HE-10***	Community health care: Mobile clinic and emergency medical team	Health and Family Welfare	DG-Health	Private Agency	GoB and DP
HE-11**	Establishment of e-Health Services and Facilities up to Community Level	Health and Family Welfare	DG-Health	CEGIS	GoB and DP
HE-12**	Strengthening referral system from CC to UHFWC; UHFWC to UHC; UHC to District Hospitals	Health and Family Welfare	DG-Health	DGFP	GoB and DP

DA Code	Projects by Development Area	Ministry	Lead Agency	Supporting Agencies	Funding
HE-13**	Environmental Health Programme	Health and Family Welfare	DG-Health	CEGIS	GoB and DP
HE-14**	Capacity development of health personnel	Health and Family Welfare	DG-Health	DGFP	GoB and DP
HE-15*	Medical Waste Management in District Hospital and Upazila Health Complex	Health and Family Welfare	DG-Health	DGFP, City Corporation	GoB and DP
HE-16*	GIS mapping of health facilities and disease pattern	Health and Family Welfare	DG-Health	CEGIS	GoB and DP
Tourism					
TS-01***	Development of Mega Eco-parks	Civil Aviation and Tourism	BPC	FD, PPP	PPP
TS-02**	Establishment of War Museums	Civil Aviation and Tourism	BPC	LGED	GoB and DP
TS-03**	Establishment of Amusement Parks	Civil Aviation and Tourism	BPC	Private Agency	PPP
TS-04**	Development of Tourist/Picnic Spots	Civil Aviation and Tourism	BPC	Private Agency	PPP
TS-05***	Construction of Bird Watching Tower	Civil Aviation and Tourism	BPC	LGED	Private
TS-06*	Renovation of Zamindar Palaces	Civil Aviation and Tourism	BPC	LGED	GoB and DP
TS-07***	Dolphin Sighting Tour Programme	Civil Aviation and Tourism	BPC	Private Agency	Private
TS-08***	Hakaluki Haor Sightseeing Tour Programme	Civil Aviation and Tourism	BPC	LGI, Private Agency	Private
TS-09**	Development of Fish Park	Civil Aviation and Tourism	BPC	DoF, BFRI	Private
TS-10***	Establishment of Wildlife Sanctuary	Civil Aviation and Tourism	BPC	FD	GoB and DP
TS-11**	Promotional Programmes on Haor for Electronic and Print Media	Civil Aviation and Tourism	BPC	LGED, City Corporations, LGI	GoB and DP
TS-12**	Construction of Tourism Infrastructures	Civil Aviation and Tourism	BPC	LGED	PPP
TS-13*	Training programmes in Hotel Management and Food Catering	Civil Aviation and Tourism	BPC	Private Agency, NHTI	GoB and DP
Social Services					
SS-01**	Construction of Growth centers/Rural markets	Local Government Division	LGED	PPP	GoB and DP
SS-02*	Construction of Food Godowns	Food and Disaster Management	DG-Food		GoB and DP
SS-03***	Upgradation/construction of religious prayer house, graveyards and cremation grounds	Local Government Division	LGED		GoB and DP
SS-04**	Awareness Generation Programme for the Spiritual Leaders	Religious Affairs	IF	NGO	GoB and DP
SS-05*	Construction of Playground and Supply of Sports materials	Local Government Division	LGI	National Sports Council	GoB and DP
SS-06***	Upgradation and Construction of Police Stations	Local Government Division	LGI		GoB and DP

DA Code	Projects by Development Area	Ministry	Lead Agency	Supporting Agencies	Funding
Industry					
IN-01**	Can food Industry	Commerce	BCCI		Private
IN-02**	Beverage Industry	Industries	BITAC	Private Agency	Private
IN-03***	Small and Cottage Industries Development program for destitute women's in haor area	Industries	BSCIC	Union Parishad	GoB and DP
IN-04*	Swamp Water Processing Industry	Industries	BSCIC	DPHE	Private
IN-05**	Tea processing Industry	Industries	BSCIC	Private Agency	Private
IN-06**	Gas cylinder Industry	Civil Aviation and Tourism	BPC	Private Agency	Private
IN-07*	Industrial Park	Local Government Division	City Corporation		GoB and DP
IN-08***	Establishment of Charcoal Industry	Industries	BSCIC		Private
IN-09***	Boat Manufacturing Industry	Industries	BSCIC		Private
Power and Energy					
PW-01***	Expansion of electric distribution systems in Haor districts	Power, Energy & Mineral Resources	REB		GoB and DP
PW-02**	Expansion of solar power generation systems	Power, Energy & Mineral Resources	REB	Private Agency, NGO, Grameen Shakti, BRAC	Private
PW-03*	Pre-feasibility Study on Renewable Energy Potentials and Power Generation Possibilities in Haor Area	Water Resources	BHWDB	CEGIS	GoB and DP
PW-04*	Development of mini-hydropower schemes	Power, Energy & Mineral Resources	BPDB		PPP
Mineral Resources					
MR-01**	Seismic survey, exploration drilling in the Haor districts to explore new gas field	Power, Energy & Mineral Resources	Petrobangla		PPP
MR-02**	Development of Mines for gravel, white clay, glass sand, coal and peat extraction from Haor districts	Power, Energy & Mineral Resources	BoMD		PPP
MR-03***	Strengthening capacity of miner and mining labor in Haor districts	Local Government Division	LGI	BMD	GoB and DP

Note: *** Very High Priority, ** High Priority, * Medium Priority

GoB Government of Bangladesh
DP Development Partner
PPP Public Private Partnership
Private Private Agency

Chapter 13 Funding Mechanism

13.1 Disbursement Schedule

Most of the capital investment will come from government allocation. As such, the Annual Development Programme (ADP) allocation of the government needs to be increased. Environment funds and alternative sources of financing as acknowledged in the different policies and detailed out in the Master Plan should be looked into. Alternative funding sources may include the Government of Bangladesh Climate Change Trust Fund (CCTF), Climate Change Resilience Fund (CCRF), Green Fund, Global Environment Facility (GEF) Fund, Short-lived Climate Pollutants (SLCP), Coalition Fund etc. The total estimated capital cost for the implementation of the Master Plan is BDT 2,804,305 lakh taka. The year-wise capital cost of the Master Plan projects is presented in Figure 13.1 and portfolio wise cost in Table 13.1 and Table 13.2.

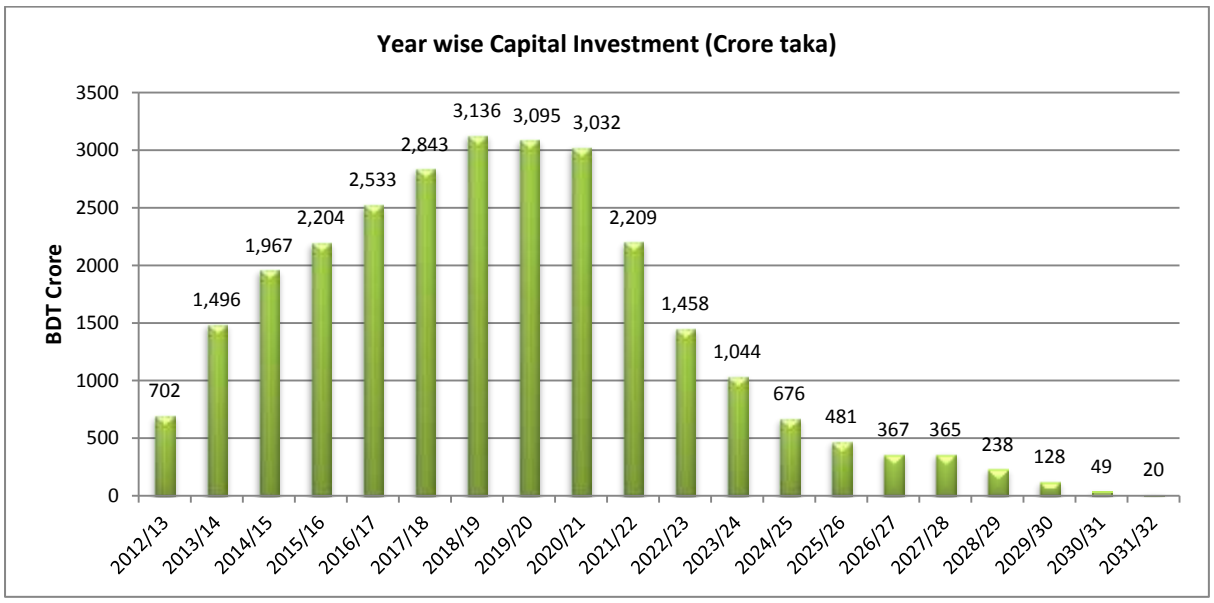


Figure 13.1: Year-wise capital investments

Table 13.1: Project wise investment requirement

(Duration in year and Cost in lakh Taka)

DA Code	Project Title	Duration in Year	Short Term	Medium Term	Long Term	Total cost
	Water Resources					
WR-01***	Pre-Monsoon Flood Protection and Drainage Improvement in Haor Area	5	12,550	-	-	12,550
WR-02**	Flood Management of Haor Area	7	28,575	53,068	-	81,643
WR-03***	River Dredging and Development of Settlement	5	44,073	4,897	-	48,970
WR-04**	Development of Early Warning System for Flash Flood prone area in Haor and dissemination to Community Level	20	353	215	200	768
WR-05***	Village Protection against Wave Action of Haor Area	3	31,046	-	-	31,046
WR-06**	Monitoring of the Rivers in Haor Area	4	450	450	-	900
WR-07***	Impact study of the interventions of transboundary river system	5	1,350	150	-	1,500
WR-08**	Study of the Climate Change impact of Haor area	4	400	400	-	800
WR-09***	Strengthening and Capacity Development of	2	197	-	-	197

DA Code	Project Title	Duration in Year	Short Term	Medium Term	Long Term	Total cost
	BHWDB					
	Total		118,994	59,180	200	178,374
	Agriculture					
AG-01***	Expansion of irrigation through utilization of surface water by double lifting in haor area	5	13,000	-	-	13,000
AG-02***	Minor Irrigation by low lift pumps project	6	9,500	500	-	10,000
AG-03**	Investigation and expansion of ground water irrigation	8	25,500	49,500	-	75,000
AG-04*	Promotion and plantation of Agar Plant	20	1,435	874	811	3,120
AG-05*	Automation of rice transplantation system by Auto Rice Transplanter	8	13,600	26,400	-	40,000
AG-06**	Mechanization of Agriculture through Combined Harvester	8	19,800	25,200	-	45,000
AG-07**	Improvement of Quality of Crop Grain through Dryer system	8	68	171	46	285
AG-08***	Intensive Cultivation of homestead vegetables and horticulture	5	135	-	-	135
AG-09**	Development of climate resilient High Yielding Varieties of rice and non-rice crops	16	490	280	230	1,000
AG-10**	Selection of Short Duration Boro Rice Cultivars/ Advanced Line	14	53	36	13	102
AG-11***	Changing Cropping Pattern to increase cropping intensity in haor area	9	1,005	495	-	1,500
AG-12*	Extension of Integrated Pest Management Training Project	13	392	245	63	700
AG-13**	Expansion of Integrated Crop Management Training	12	396	270	35	700
AG-14*	Extension of Jute cultivation project	12	396	270	35	700
AG-15**	Integrated Development of Applied Research for Improved Farming Systems	8	810	690	-	1,500
AG-16**	High Value-non-Rice-cum-Deep Water Rice Culture	10	660	840	-	1,500
AG-17***	Assistance to Landless, Marginal and Small Farmers to overcome soaring input, and food prices in impoverished Haor area	8	2,160	1,840	-	4,000
AG-18**	Application of GIS for farm productivity enhancement through land suitability assessment of major cropping pattern in Haor Region	3	450	-	-	450
AG-19*	Improvement of Storage Facilities and Agricultural Marketing System in Haor Area	5	4,500	500	-	5,000
AG-20**	Introduction of Innovative Agriculture through Vegetables cultivation on Floating Bed	5	205	-	-	205
	Total		94,555	108,109	1,233	203,897
	Fisheries					
FI-01***	Development and Establishment of Fish Sanctuaries	15	3,361	2,675	823	6,860
FI-02***	Habitat Restoration for Fish Diversity	15	141,040	114,800	72,160	328,000
FI-03***	Beel Nursery Programme for Increasing Fish Fingerling Recruitment	18	3,063	1,875	1,313	6,250
FI-04*	Good Fisheries Management Practices following the Mohanganj Experience	18	829	507	355	1,691
FI-05**	Floodplain Aquaculture under the Community Enterprise Approach	15	1,075	875	550	2,500
FI-06**	Community and Household-based Net-pen Fish Culture in the Haor/Floodplain	15	12,250	9,750	3,000	25,000
FI-07***	Fish Fingerling Stocking and Raising Programme	18	251	154	108	512

DA Code	Project Title	Duration in Year	Short Term	Medium Term	Long Term	Total cost
FI-08**	Capacity Development and Alternate Income Generating Activities (AIGAS) for Fisher Community	11	6,935	6,791	722	14,448
FI-09***	Renovation of Hatcheries for Conserving Quality Brood Stock and Production of Fish Seeds	5	5,000	-	-	5,000
FI-10**	Study on Review of Policies, Regulations and Lease System for Sustaining Fisheries Resources	3	500	-	-	500
FI-11***	Restoration of River Duars (Deep Pools) for Protecting Brood/Mother Fish	10	2,246	3,682	312	6,240
FI-12**	Renovation of Fish Ponds and Dissemination of Improved Aquaculture Technology to Fish Farmers	10	1,620	2,655	225	4,500
FI-13**	Development and Construction of Innovative Fish Pass/Fish Friendly Structures	10	7,000	15,500	2,500	25,000
FI-14*	Establishment of Fisheries Information Service Centre	5	1,170	130	-	1,300
FI-15**	Introduction of Deep Water Rice-cum-Fish Culture	10	280	620	100	1,000
FI-16**	Establishment and Rehabilitation of Fish Landing Centers	10	4,088	9,052	1,460	14,600
FI-17**	Establishment of Fish Drying and Fermentation Centre	10	742	1,643	265	2,650
FI-18**	Study on Impact of Climate Change and Interventions on Fisheries Resources	15	24,500	19,500	6,000	50,000
FI-19*	Development and Establishment of Cold Storage and Ice Plants	6	-	761	761	1,522
FI-20*	Research on Fish Stock Improvement through Gene Pool Preservation and In-breeding Depression	16	240	705	555	1,500
FI-21*	Rehabilitation of Existing Fish Processing Units and Establishment of a New Fish Processing Industry	10	700	1,550	250	2,500
FI-22**	Community and Household-based Cage Fish Culture	10	1,026	1,682	143	2,850
	Total		217,916	194,906	91,601	504,423
	Pearl Culture					
PC-01**	Development and Dissemination of pearl culture technology in Haor Area	17	2,000	4,300	3,700	10,000
	Total		2,000	4,300	3,700	10,000
	Livestock					
LS-01***	Improvement of fodder availability for livestock development	9	5,911	2,912	-	8,823
LS-02**	Integration of livestock in traditional farming system	10	-	3,501	4,455	7,956
LS-03*	Farmers training programs for capacity building	4	-	-	2,400	2,400
LS-04*	Establishment of pilot breeding programme for cattle development	8	-	-	3,600	3,600
LS-05**	Promotion of small and mini dairy farms	9	-	3,920	1,931	5,850
LS-06***	Promotion of conventional and alternative feed resources for livestock feeding	9	1,089	536	-	1,625
LS-07**	Extension of Livestock Services through establishment of Union Livestock Service Center (ULSC)	9	-	10,888	5,363	16,250
LS-08*	Development of Livestock Products through involvement of Community Organization	9	-	-	12,400	12,400
LS-09***	Development of Community Animal Health	5	6,600	-	-	6,600

DA Code	Project Title	Duration in Year	Short Term	Medium Term	Long Term	Total cost
LS-10***	Workers for Livestock Healthcare Promotion of Small and Mini Poultry and Duck Farms	8	6,043	5,147	-	11,190
	Total		19,643	26,903	30,148	76,694
	Forest					
FR-01**	Establishment of One Forest Nurseries in each of the 57 Upazilas of the Haor Area	17	7,690	16,533	14,226	38,449
FR-02***	Afforestation through involvement of local Community in Haor Area	17	15,729	12,234	6,991	34,954
FR-03***	Afforestation of Roads, Embankments, Homesteads and Institutions	17	16,031	12,469	7,125	35,625
FR-04*	Reclamation of Izmali land for promotion of Social Forestry	17	14,308	30,761	26,469	71,538
FR-05**	Increase the Capacity of Community for forest conservation and Improvement	17	11,829	25,433	21,884	59,146
FR-06*	Research Programmes on Haor Area	16	543	3,260	2,988	6,792
	Total		66,130	100,690	79,683	246,504
	Biodiversity and wetland					
BW-01***	Eco- management zoning of Haor wetlands for biodiversity protection	3	5,000	-	-	5,000
BW-02***	Restoration of important wetlands	4	6,000	-	-	6,000
BW-03**	Development and implementation of important wetlands for global significance.	7	-	2,950	2,050	5,000
BW-04*	Establishment of global wetlands center	7	-	-	30,000	30,000
BW-05*	Review of policy for biodiversity management	3	-	-	2,000	2,000
BW-06***	Habitat preservation programme for plants, wildlife, fisheries and migratory birds	9	10,050	4,950	-	15,000
BW-07**	Research and education programme on Haor wetlands biodiversity conservation and management	9	-	10,050	4,950	15,000
BW-08**	Management of commercially important Haor wetland biodiversity	9	-	13,400	6,600	20,000
BW-09 **	Pollution control and prevention from agriculture, industry and urban settlement	9	-	4,690	2,310	7,000
BW-10***	Adaption and Mitigation to Climate Disaster Risks in Haor Basin	9	5,360	2,640	-	8,000
	Total		26,410	38,680	47,910	113,000
	Transportation					
TR-1***	Upgradation of Rural Roads	10	60,375	133,688	21,563	215,625
TR-2***	Submersible rural road construction	10	41,727	92,396	14,903	149,025
TR-3***	Submersible District road construction (Sulla to Ajmiriganj)	8	1,326	2,574	-	3,900
TR-4***	Submersible District road construction (Khaliajuri to Ajmiriganj)	8	2,402	3,058	-	5,460
TR-5***	Submersible District road construction (Itna to Ajmiriganj)	8	1,238	2,402	-	3,640
TR-6***	Submersible District road construction (Austagram to Lakhai)	8	2,059	2,621	-	4,680
TR-7***	Submersible District road construction (Derai to Jagannathpur)	3	5,200	-	-	5,200
TR-8**	Construction of Regional Highway	2	-	12,800	-	12,800
TR-9*	Construction of Surma Bridge at Chhatak	5	-	-	6,000	6,000
TR-10***	Development of inland navigation by dredging in nine river routes	9	56,816	27,984	-	84,800
TR-11**	Development of 150 landing facilities in the rural area	6	-	14,250	750	15,000
TR-12**	Installation of navigational aids along the river	4	-	5,560	-	5,560

DA Code	Project Title	Duration in Year	Short Term	Medium Term	Long Term	Total cost
	routes					
TR-13**	Hydrographic survey in the nine major river routes	3	-	87	-	87
TR-14**	Construction of terminal buildings at 15 major passenger stations	6	-	2,138	113	2,250
TR-15*	Development of parking yards, storage facilities and security walls at 13 stations	5	-	-	2,250	2,250
	Total		171,143	299,556	45,578	516,277
	Water Supply and Sanitation					
WS-01***	Establishment Sustainable and Community based Haor friendly Water Supply Technologies	13	28,000	17,500	4,500	50,000
WS-02***	Introduce the Sustainable and Community based Flood Proof Hygienic Sanitation System in Haor area	13	30,800	19,250	4,950	55,000
	Total		58,800	36,750	9,450	105,000
	Housing and Settlement					
ST-01**	Eco Village Platform Development for mitigate future Housing and settlement demand	3	-	9,100	-	9,100
	Total		-	9,100	-	9,100
	Education					
ED-01***	Establishment of Community based Multigrade Learning Centers	8	2,735	2,329	-	5,064
ED-02**	Community based School Feeding Programme	5	-	2,365	-	2,365
ED-03***	Establishment of Primary Schools	3	15,007	-	-	15,007
ED-04**	School Boat Facilities for Inaccessible Area	8	-	6,801	5,794	12,595
ED-05*	Awareness Generation Programmes on Gender Discrimination	3	-	-	94	94
ED-06**	Introduce skill based training programmes	5	-	3,600	-	3,600
ED-07*	Establishment of High Schools, Colleges and Madrasa	8	-	-	33,250	33,250
	Total		17,742	15,096	39,138	71,975
	Health					
HE-01***	Upgradation of Upazila Health Complex (UHC) and Construction of Upazila Health & Family Welfare Centre (UHFWC)	8	28,917	24,633	-	53,550
HE-02***	Maternal and Reproductive Health Development Programme	3	571	-	-	571
HE-03***	Child Mortality Reduction Programme	8	9,032	7,694	-	16,725
HE-04**	Promotion of nutrition status of the haor people	3	-	105	-	105
HE-05**	Improve the quality of hospital service	8	-	12,002	10,224	22,226
HE-06*	Capacity Development of Non-government, Non-profit Health Care Agencies using Private-Public-Partnership (PPP)	3	-	-	400	400
HE-07*	Expansion of Alternative Medical Care (Unani, Ayurvedic & Homeopathic system of medicine)	3	-	-	1,200	1,200
HE-08*	Strengthening of supervision and monitoring system	3	-	-	1,650	1,650
HE-09***	Community health care: Establishment of Community clinics (CC)	8	2,171	1,849	-	4,020
HE-10***	Community health care: Mobile clinic and emergency medical team	8	7,776	6,624	-	14,400
HE-11**	Establishment of e-Health Services and Facilities up to Community Level	8	-	82	70	152
HE-12**	Strengthening referral system from CC to	8	-	49	41	90

DA Code	Project Title	Duration in Year	Short Term	Medium Term	Long Term	Total cost
	UHFWC; UHFWC to UHC; UHC to District Hospitals					
HE-13**	Environmental Health Programme	3	-	3,664	-	3,664
HE-14**	Capacity development of health personnel	3	-	250	-	250
HE-15*	Medical Waste Management in District Hospital and Upazila Health Complex	8	-	-	1,065	1,065
HE-16*	GIS mapping of health facilities and disease pattern	3	-	-	295	295
	Total		48,466	56,951	14,945	120,363
	Tourism					
TS-01***	Development of Mega Eco-parks	8	108	92	-	200
TS-02**	Establishment of War Museums	1	-	60	-	60
TS-03**	Establishment of Amusement Parks	8	-	540	460	1,000
TS-04**	Development of Tourist/Picnic Spots	8	-	32	28	60
TS-05***	Construction of Bird Watching Tower	8	32	28	-	60
TS-06*	Renovation of Zamindar Palaces	3	-	-	72	72
TS-07***	Dolphin Sighting Tour Programme	18	176	108	76	360
TS-08***	Hakaluki Haor Sightseeing Tour Programme	18	265	162	113	540
TS-09**	Development of Fish Park	1	-	20	-	20
TS-10***	Establishment of Wildlife Sanctuary	2	100	-	-	100
TS-11**	Promotional Programmes on Haor for Electronic and Print Media	1	-	100	-	100
TS-12**	Construction of Tourism Infrastructures	18	320	360	320	1,000
TS-13*	Training programmes in Hotel Management and Food Catering	18	102	115	102	320
	Total		1,104	1,617	1,171	3,892
	Social Services					
SS-01**	Construction of Growth centers/Rural markets	18	222	250	222	694
SS-02*	Construction of Food Godowns	8	-	-	10,000	10,000
SS-03***	Upgradation/construction of religious prayer house, graveyards and cremation grounds	8	1,620	1,380	-	3,000
SS-04**	Awareness Generation Programme for the Spiritual Leaders	8	-	68	58	126
SS-05*	Construction of Playground and Supply of Sports materials	8	-	-	1,380	1,380
SS-06***	Upgradation and Construction of Police Stations	8	216	184	-	400
	Total		2,058	1,882	11,660	15,600
	Industry					
IN-01**	Can food Industry	5	-	10,000	-	10,000
IN-02**	Beverage Industry	3	-	1,000	-	1,000
IN-03***	Small and Cottage Industries Development programme for destitute women's in haor area	1	1,500	-	-	1,500
IN-04*	Swamp Water Processing Industry	2	-	-	10,000	10,000
IN-05**	Tea processing Industry	3	-	10,000	-	10,000
IN-06**	Gas cylinder Industry	4	-	30,000	-	30,000
IN-07*	Industrial Park	4	-	-	10,000	10,000
IN-08***	Establishment of Charcoal Industry	2	200	-	-	200
IN-09***	Boat Manufacturing Industry	2	17	-	-	17
	Total		1,717	51,000	20,000	72,717
	Power and Energy					
PW-01***	Expansion of electric distribution systems in Haor districts	12	20,426	174,894	60,000	255,320
PW-02**	Expansion of solar power generation systems	8	8,460	45,684	30,456	84,600
PW-03*	Pre-feasibility Study on Renewable Energy	10	-	-	89	89

DA Code	Project Title	Duration in Year	Short Term	Medium Term	Long Term	Total cost
	Potentials and Power Generation Possibilities in Haor Area					
PW-04*	Development of mini-hydropower schemes	10	-	353	627	980
	Total		28,886	220,931	91,173	340,989
	Mineral Resources					
MR-01**	Seismic survey, exploration drilling in the Haor districts to explore new gas field	5	-	200,000	-	200,000
MR-02**	Development of Mines for gravel, white clay, glass sand, coal and peat extraction from Haor districts	5	-	15,000	-	15,000
MR-03***	Strengthening capacity of miner and mining labor in Haor districts	1	500	-	-	500
	Total		500	215,000	-	215,500
	Grand Total (154 Projects)		**876,063**	**1,440,652**	**487,590**	**2,804,305**

Note: *** Very High Priority, ** High Priority, * Medium Priority

Table 13.2: Development Area wise Disbursement schedule of capital cost for the Master Plan of Haor Area (in lakh taka)

Development Area	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	Total
Agriculture	5,313	13,768	26,226	27,806	21,442	18,616	17,983	21,983	30,695	18,833	284	208	141	126	174	82	62	62	62	31	203,897
Biodiversity and wetland	4,200	7,590	6,750	4,650	3,220	7,210	8,030	8,910	8,050	6,480	7,940	8,830	9,540	5,700	3,600	6,000	6,300				113,000
Education	3,508	8,212	5,009	506	506	3,257	4,566	3,263	2,154	1,856	4,603	7,221	5,368	3,325	3,325	3,325	6,650	5,320			71,975
Fisheries	7,826	34,866	45,935	62,623	66,667	32,603	32,967	38,565	45,955	44,816	38,924	11,583	9,540	11,866	9,364	10,045	87	162	30		504,423
Forest	7,058	7,058	5,646	21,854	24,515	21,132	18,504	23,239	20,280	17,535	17,535	9,928	10,914	10,846	8,449	6,689	5,984	3,586	3,926	1,827	246,504
Health	8,984	12,703	9,041	8,870	8,870	11,920	22,894	17,644	2,247	2,247	3,062	6,415	4,765	107	107	107	213	170			120,363
Housing and Settlement						1,820	4,550	2,730													9,100
Industry	1,587	130				9,200	19,000	14,300	7,500	1,000	5,500	9,500	3,000	2,000							72,717
Livestock	3,814	4,905	4,006	3,676	3,242	5,219	6,847	6,632	4,474	3,730	5,885	6,536	5,283	4,203	2,494	1,848	1,836	1,444	620		76,694
Mineral Resources		500				53,750	64,500	43,000	32,250	21,500											215,500
Pearl Culture				1,000	1,000	800	700	1,000	1,000	800	800	400	500	500	400	300	300	200	200	100	10,000
Power and Energy					28,886	34,823	31,517	39,196	55,792	59,602	32,325	26,468	12,971	6,488	6,439	6,446	18	9	4	4	340,989
Social Services	340	476	409	423	409	422	746	605	54	54	1,192	1,653	1,193	1,166	1,166	1,159	2,297	1,828	3	3	15,600
Tourism	156	204	248	274	221	507	347	294	239	230	245	350	293	80	80	49	44	18	7	7	3,892
Transportation	9,520	14,638	45,626	51,255	50,105	47,950	51,692	73,069	86,070	40,776	21,158	20,708	1,650	1,238	825						516,277
Water Resources	9,502	32,116	31,124	20,450	25,803	15,400	10,183	16,367	17,183	46	31	31	23	23	23	15	15	15	15	8	178,374
Water Supply and Sanitation	8,400	12,600	14,700	12,600	10,500	10,500	10,500	5,250	5,250	5,250	5,250	2,100	2,100								105,000
Grand Total	70,207	149,766	194,719	215,987	245,384	275,129	305,526	316,046	319,194	224,757	144,734	111,930	67,280	47,666	36,445	36,065	23,806	12,815	4,868	1,981	2,804,305

13.2 Ministry and Agency-wise Investment Cost

Before considering ways to finance the capital costs of the projects proposed in the Master Plan of Haor Area ministry/agency-wise investment cost has been estimated. The ministry wise distributions of investments are presented in Figure 13.2.

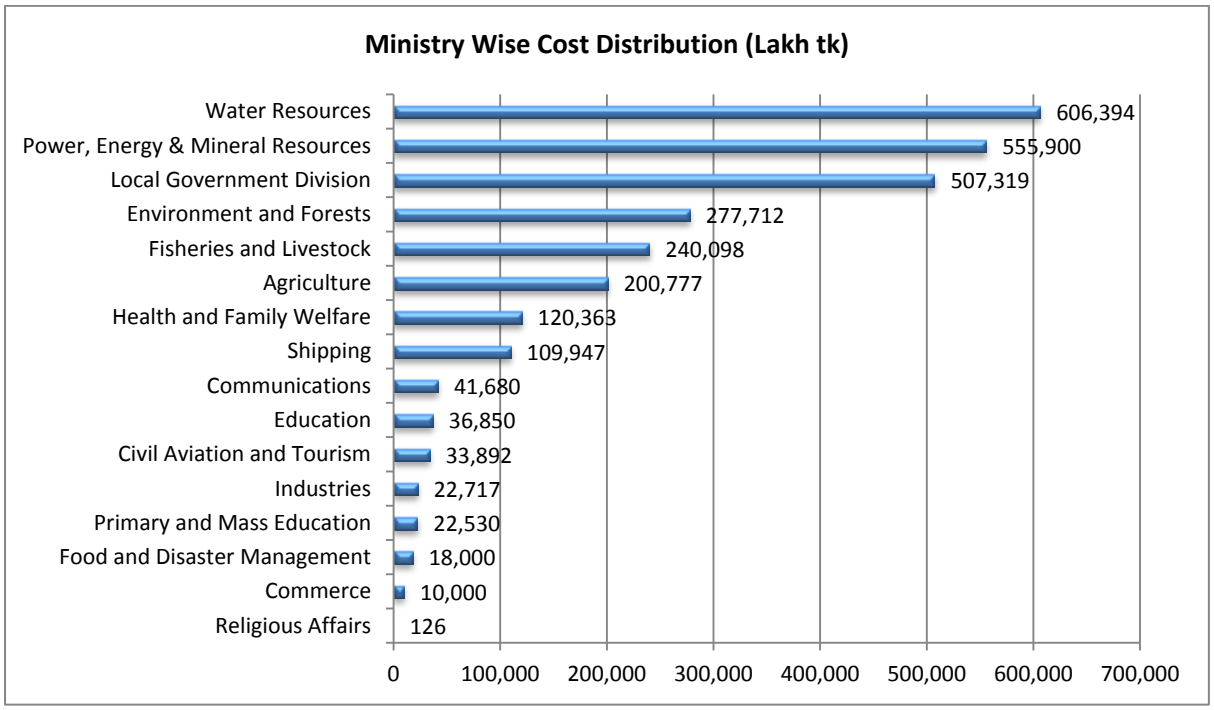


Figure 13.2: Ministry-wise project cost distribution

13.3 Funding Modality

In Bangladesh Development programmes and projects included in the Annual Development Programme (ADP) have been implemented with development funds of the Government of Bangladesh. Government takes loans from international banks and funding agencies and receives grants from friendly countries to implement some of its projects and programmes. Over the year the dependency and the fund from the development partners have been reducing. NGOs also get funds from outside through NGO Bureau. An investment trend of Public Private Partnership (PPP) has been seen in the country. Again some special funding sources relating to climate change are also available. The following section is a brief description of the proposed funding mechanism.

13.3.1 Allocation through ADP

All development projects of all sectors and departments are listed in the Annual Development Programme (ADP). Public funds are allocated project-wise in the ADP on an annual basis. Government mobilizes funds from its own national resources and borrows money from international banks and other development partners as well to implement these projects. Government also accepts grant fund from its development partners for the implementation of the technical assistance projects. The Sixth Five Year Plan presently being implemented and the Seventh Five Year Plan to be implemented during FY2016-FY2021 would be a vehicle for implementation of the projects portfolios of this Master Plan with national and development partner's fund.

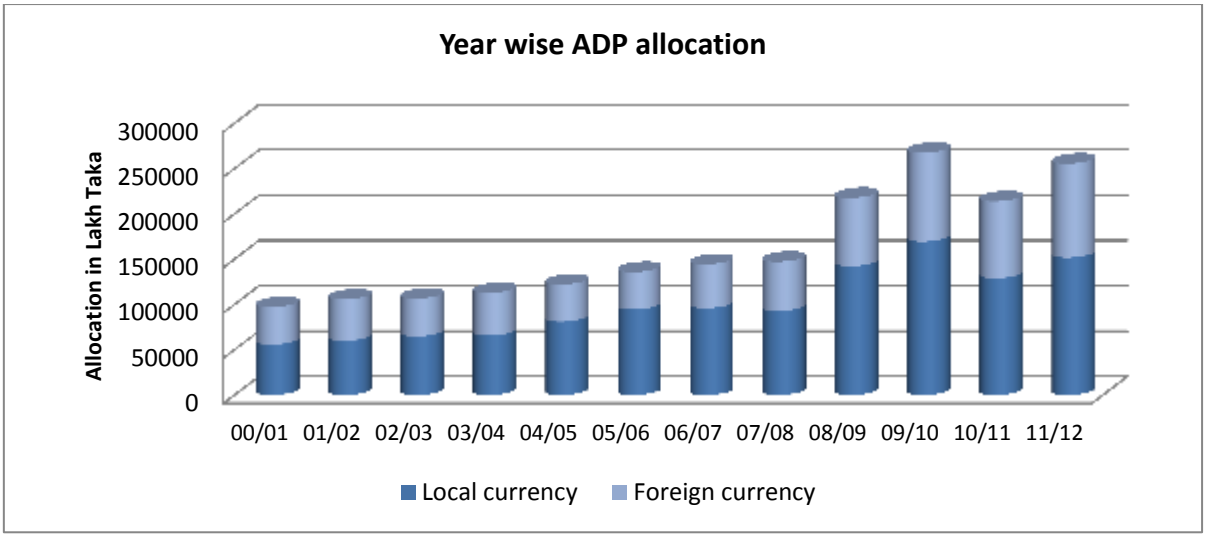


Figure 13.3: Year-wise ADP allocation

The year wise ADP and sectoral allocation shown in Figure 13.3 and Table 13.3 has been derived from published ADP documents for the period 2001-01 to 2010-12.

Table 13.3: Sectoral allocation in ADP

(Amount in Lakh Taka)

Sl	Sector	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	Average
1	Agriculture	88,394	93,715	85,272	99,800	87,273	112,511	185,965	158,736	312,692	272,491	249,511	273,464	168,319
2	Rural Development & Institutions	182,376	164,919	172,049	233,300	233,383	294,208	313,889	355,646	542,302	571,388	439,028	440,285	328,564
3	Water Resources	99,766	88,536	84,541	81,400	105,285	111,240	85,251	85,193	123,435	136,427	123,195	137,482	105,146
4	Industries	35,560	35,672	33,438	28,700	41,449	44,558	45,767	34,182	82,218	92,143	70,473	66,564	50,894
5	Power	220,219	224,999	227,542	322,100	324,338	311,998	340,586	363,317	516,394	490,042	499,472	717,247	379,855
6	Oil, Gas and Natural Resources	65,476	65,325	56,970	84,600	101,966	99,984	67,446	72,947	108,423	111,904	108,009	111,400	87,871
7	Transport	257,787	340,826	348,622	352,300	323,779	303,976	330,876	330,374	544,039	789,372	551,057	774,979	437,332
8	Communication	48,803	65,605	87,070	67,200	73,062	73,551	86,061	55,069	53,834	66,168	27,615	30,463	61,208
9	Physical Planning, Water Supply & Housing	111,407	137,155	121,348	120,800	103,576	129,590	133,516	159,628	374,337	622,784	354,573	565,106	244,485
10	Education & Religious Affairs	229,286	242,815	295,012	271,100	314,161	329,729	386,160	375,090	523,920	636,836	518,416	612,467	394,583
11	Sports & Culture	11,160	11,500	11,398	12,100	14,569	15,731	16,069	11,561	26,206	28,334	37,093	26,656	18,531
12	Health, Population & Family Welfare	170,119	173,416	181,186	161,200	215,626	226,935	249,401	272,875	343,480	436,118	392,025	394,253	268,053
13	Mass Media	10,626	7,415	8,535	8,100	7,516	7,867	8,518	12,345	12,438	12,406	10,361	11,636	9,814
14	Social Welfare, Women Affairs & Youth Development	21,416	21,543	26,973	25,000	24,868	30,496	37,658	16,765	44,917	50,975	39,962	44,512	32,090
15	Public Administration	22,249	19,309	16,930	34,300	18,645	27,512	43,931	50,763	98,925	112,690	116,027	108,562	55,820
16	Science & Technology	7,600	9,100	9,175	11,000	12,064	13,085	14,930	16,078	27,981	32,619	19,382	23,702	16,393
17	Labour & Employment	1,800	2,285	2,837	5,700	6,940	7,129	8,376	9,231	19,264	2,982	11,770	17,482	7,983
18	Block allocation	165,956	195,860	151,100	111,300	191,500	304,500	245,600	270,218	165,194	349,821	282,031	243,717	223,066

The major segment of the development programme budget (more than 76%) in 2011-12 is allocated for transport (17%); power (16%); education and religion (13%); physical planning and water supply (12%); rural development & institutions (10%); and health, population & family welfare sectors (9%). It is observed from analysing the data of 2007-08 to 2011-12 that the transport sector always gets the highest priority in the ADP followed by education and religion; power; rural development & institutions; physical planning; water supply & housing; health, population & family welfare; agriculture; water resources; oil; gas and natural resources; public administration; industries; communication; social welfare; women affairs & youth development; sports & culture; science & technology; labour & employment; and mass media. Table 13.4 shows the requirement of increase of ADP allocation (in %) to implement the Master Plan of Haor Area.

Table 13.4: Requirement of additional ADP allocation for the Master Plan implementation

Development Areas of Master Plan of Haor Area	Sector/Sub-sector of Annual Development Programme of GoB	% to Increase per year		
		Short Term	Medium Term	Long Term
Water Resources	Water resource	28.88	33.02	0.19
Agriculture	Crop	0.74	0.63	0.82
Education	Education and Religion	1.22	9.33	1.93
Power and Energy	Electricity	310.79	281.52	67.34
Fisheries and Pearl Culture	Fisheries	67.41	67.44	67.49
Forest and Biodiversity & wetland	Forest	2.56	3.00	0.39
Health	Health, Nutrition , Population and Family welfare	0.67	19.83	3.89
Industry	Industry	27.65	37.88	21.22
Livestock	Livestock	0.15	65.07	0.00
Mineral Resources	Oil, Gas and Natural Resource	3.69	2.88	0.30
Housing & Settlement and Water Supply & Sanitation	Physical Planning, Water Supply and Housing	0.10	0.09	0.29
Social Services	Rural Development and Rural Institute	7.56	13.22	1.03
Transportation and Tourism	Transportation	19.93	9.91	0.02

13.3.2 Public Private Partnership (PPP)

The economy of Bangladesh needs to boost up to the higher trajectory of growth and to take the people of this country out of the vicious cycle of poverty. A paradigm shift to bring qualitative change in the investment strategy is essential to meet the above objective. Public-Public Partnership is a concept added to the Bangladesh budget more formally in the financial year of 2011-12 to achieve a new dimension of financial investment modality.

The GDP growth has been set at 8% to be achieved by the year 2013 and at 10% by the year 2017, which would be sustained until 2021. As a vehicle to attain this higher growth, investment in infrastructure development, especially power and energy, ports, communication, supply of drinking water and waste management, education and health will be given the highest priority. A huge investment is required to achieve this target.

The Government of Bangladesh alone cannot provide such a huge amount of resources. It would be difficult to maintain macro-economic stability if the government has to finance such huge

investment by borrowing from domestic sources. It may not be possible, however, to obtain such funds as concessionary loans from the development partners. Past experience suggests that it is difficult to ensure economic use of public resources and the quality of service delivery when the government is involved in infrastructure development and maintenance. At the same time, direct involvement of the government in project execution process takes away the focus from its basic obligation to provide social and other important services. Since the implementation and funding of any infrastructure development projects is a long drawn process, the investment risk is much higher and at the same time, not commercially viable in many cases. It is therefore, difficult to attract private investment in all projects in this sector.

In this context the government is going to take special initiatives to involve the private sector under Public Private Partnership (PPP) to meet the probable investment gap in infrastructure development and maintenance alongside its own investment. The present government is committed to take timely measures to attract private investment in the country through PPP. A new initiative has been taken to create three new 'expenditure heads' to facilitate new projects under PPP.

- The first expenditure head will be named as PPP Technical Assistance to cover expenditure related to pre-feasibility studies and other preparatory work before asking the private sector to submit their bids for PPP projects. Relevant agencies will be able to receive necessary funds quickly from this head to prepare PPP project documents.
- Another type of allocation as Viability Gap Funding as subsidy or seed money to attract private initiatives for the construction of power plants, hospitals, schools, roads and highways which are non-profitable but essential for public services.
- There is another type of budget in the PPP budget to accelerate the process of investment through PPP. This allocation will be used for setting up an Infrastructure Investment Fund. Depending on the type of projects, the government will ensure its own participation by providing equity or loan to private investors. Different financial incentives will be extended from this fund to encourage investments.

13.3.3 Development Partners

Development partners are an integral part of the development activities in Bangladesh and have taken part in the country's development since 1972. The government and the development partners are both playing an important role in improving aid effectiveness in Bangladesh which is crucial for further progress in poverty reduction and reaching the MDG as well as for Bangladesh to become a middle income country by 2021. About 39 development partners are assisting Bangladesh in its development process. They are working in collaboration on 18 specific sectors or thematic areas. They are playing an active and vital role in policy formulation and taking strategic financial decisions with the government. These thematic areas are Agriculture, Food Security & Rural Development; Water Management; Water Supply and Sanitation; Education; Health Nutrition and Population; Energy; Transport and Communication; Urban; Poverty; Gender; Governance; Aid Effectiveness; Private Sector Development and Trade; Climate Change & Environment; ICT–Digital Bangladesh; Macro-economy; and Disaster & Emergency Relief.

The development partners are contributing towards the effective and coordinated implementation of national policies, strategies, plans and programmes of Bangladesh. They are assisting Bangladesh in the form of both grants and loans.

13.3.4 Private Agencies and NGOs

Development of a sustainable approach to poverty reduction and social service delivery in Bangladesh is required because of the scale of the problem and because of its severe and intractable nature. Over the past three decades, NGOs and the private sector have been acknowledged to take part significantly in poverty reduction and human development through a mix of public and private service provision. The government and the NGOs have achieved a wider coverage together in terms of services for the poor. Innovative and replicable approaches to tackling poverty have been developed. Government-NGO partnerships have also allowed the scope for both to utilise the comparative organizational advantages to enhance service provision outcomes. The government is utilising the services of NGOs and private agencies to maintain a steady progress in poverty reduction.

13.4 Funding Modality

The funding mechanism has been developed considering all possible sources and modality of project implementation. Table 13.5 represents the possible modality of the project implementation by GoB, Development partner, PPP and Private sector. Table 13.6 indicates the possible sources of funding for the proposed projects under the Master Plan.

Table 13.5: Possible funding mechanism for Master Plan of Haor Areas

(Amount in lakh taka)

Funding Mechanism	Nos. of Project	Short Term	Medium Term	Long Term	Total Investment	Investment
Bangladesh Government and Development Partner	123	783,988	1,021,769	411,439	2,217,196	79%
Public Private Partnership	15	74,782	310,257	32,883	417,923	15%
Private Agency	16	17,294	108,625	43,268	169,187	6%
Grand Total	154	876,063	1,440,652	487,590	2,804,305	100%

Table 13.6: Possible sources of funding

Development Area	Major Funding Sources / Mechanism						
	GEF	PPP	GoB and DP	CCTF	GF	CCRF	Private
Agriculture			√				
Biodiversity and Wetland	√			√	√	√	
Education			√				
Fisheries	√		√	√		√	
Forest	√			√	√	√	
Health			√				
Housing and Settlement			√				
Industry		√					√
Livestock			√				
Mineral Resources		√					
Pearl Culture			√				
Power and Energy		√					
Social Services			√				
Tourism		√					√
Transportation			√				
Water Resources			√				
Water Supply and Sanitation			√				

GoB	Government of Bangladesh	CCTF	Climate Change Trust Fund
GEF	Global Environment Fund	GF	Green Fund
PPP	Public Private Partnership	CCRF	Climate Change Resilient Fund
DP	Development Partner	Private	Private Agency

Chapter 14 Monitoring and Evaluation

14.1 Introduction

Monitoring has to be conducted regularly during implementation of the projects and evaluation should be done at both pre and post project levels. At least one mid-term evaluation and post project evaluation shall be mandatory for each project. These evaluations may be carried out by the BHWDB with active participation of the implementing agency of that project. The evaluation along with outputs should be used as the basis of the major reviews that assesses the output and outcome of the project in three to five year alternatives. Five-yearly reviews will cover substantive events and are likely to include redefinition of objectives, refinancing of the Master Plan of Haor Area or rescheduling of disbursements. Even so, optimal performance of the Plan will require modest adjustments on a more regular basis, at least annually.

14.2 Monitoring and Evaluation

The Master Plan of Haor Area has an investment portfolios in 6 strategic thematic areas distributed in 17 Development Area with a complete set of 154 projects. These are spatially and technically integrated and logically-phased to fulfill the overall goals of the Master Plan as well as the national targets of the country. To achieve the goals of the Plan, monitoring and evaluation of the portfolios of physical and social status are crucial. Each strategic thematic area has development objectives consistent with the overall and immediate objectives of the Plan. An indicator-based MIS will be developed using which the objectives of the proposed projects will be examined.

There are 38 government agencies affiliated with 16 different ministries, all of which could be identified as having functions or responsibilities relevant to the implementation of the Plan. The executive responsibility for monitoring, evaluating and updating the Plan will rest with the BHWDB. The BHWDB would be designated as lead agency and the MoWR as lead Ministry to co-ordinate the monitoring and evaluation of the projects. This does not involve day to day monitoring of physical and financial progress of any particular project. Such type of monitoring will be done according to the existing mechanism, following the government rules and regulations. Permanent Steering Committee with representation of the implementing Ministries and Agencies, Planning Commission and Ministry of Finance will be established. Inter-ministerial Technical Committees and Project Steering Committees will be constituted at appropriate levels. Directives and guidance of such committees will assist the lead agency and the lead Ministry in overall coordination. Besides, Implementation, Monitoring and Evaluation Division of the Ministry of Planning will evaluate and monitor these projects during and after implementation. Planning branch/wing of each implementing Ministry would also play significant role in evaluation and monitoring of these projects.

A Project Co-ordination Unit (PCU) will be also established to provide technical support to the BHWDB and lead agency in the discharge of their coordination functions. The terms of reference of the PCU would include, among others, the mandate to liaise with the service ministries and development partners.

14.3 Updating of Master Plan of Haor Area

The Master Plan of Haor Area may be considered as a living plan, which is to be reviewed and updated every five years. The Plan should be "capable of continuous evolution". Against the backdrop of availability of more knowledge and information about global climate change, the demand scenarios as well as some of the Plan's initial assumptions may change rendering the overall responsibility for monitoring, evaluation and updating of the Plan even more challenging for the BWHDB.

Glossary

Afal	High waves generated due to wind in the haor are locally known as Afal
Aman	Monsoon rice crop cultivated during July-September and harvested in mid-December-January
Aus	Pre-monsoon rice crop grown in Kharif I season, transplanted during mid-April-mid May and harvested during mid-July-mid August
B Aman	Broadcast or deep-waterAman
Baor	Baors are oxbow lakes, formed by dead arms of rivers
Beel	Beels are shallow lakes, which form in the lowest parts of the haor; sometimes these are perennial but more often seasonal. The water surfaces are contiguous with the groundwater table and beels that are sustained from groundwater to a large extent. Surface water accumulates in the beels during wet season, often spilling out into the main river system through khals.
Bondh	Crop land
Boro	Rice grown during the dry winter season, transplanted during January-mid February and harvested during mid-May
Country boat	Wood hull boat of traditional design capacity usually not more than 500 maunds (19 ton)
District	An administrative unit comprising several thanas/upzilas
Division	An administrative unit comprising several administrative districts
Duar	Scour hole in river bed which provides habitat for fish and river dolphins
Haat	Riverine landing market or assembly place
Haor	Haor are bowl-shaped depressions of considerable aerial extent lying between the natural levees of rivers or high lands of the northeast region of Bangladesh. In most cases, haor have formed as a result of peripheral faulting leading to the depression of haor areas. During the wet season, the haor are full of water, but during the dry season, they dry up except for the beels.
Hijal	Type of a water tolerant tree grown in swamps & forests
Household	Family unit that shares common resources for cooking and eating
Jalmohal	Water body used for fishery
Kanda	Highland on the haor, used for cattle grazing, cropping or rice threshing
Kharif season	Monsoon crop season. Cropping season from 15 March-15 October, often divided into Kharif I (March-June) and Kharif II (July-October).
Khal	Local name for a drainage channel connecting beels
Khas	Government owned land or waterbodies
Koroch	A type of water-tolerant tree grown in swamp forests
Mauza	Land revenue boundary consisting of land plots
Rabi season	Cropping season between 16 October and 15 March
T. Aman	Transplanted Aman
Taka (Tk)	Unit of Bangladeshi currency
Union	Geo-administrative unit under an upazila comprising several villages/wards

Acronyms and Abbreviations

ADP	Annual Development Programme
FCD	Flood Control and Drainage
AEZs	Agro-Ecological Zones
AH	Asian Highway
AIDS	Acquired Immune Deficiency Syndrome
AIGAS	Alternate Income Generating Activities
ARI	Acute Respiratory Infection
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BDT	Bangladeshi Taka
BFDC	Bangladesh Fisheries Development Corporation
BFRI	Bangladesh Fisheries Research Institute
BHWDB	Bangladesh Haor and Wetland Development Board
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BNH	Bangladesh National Herbarium
BPC	Bangladesh Parjatan Corporation
BPDB	Bangladesh Power Development Board
BSCIC	Bangladesh Small and Cottage Industries Corporation
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CBD	Convention on Biological Diversity
CC	Community Clinic
CEGIS	Center for Environmental and Geographic Information Services
CFB	Community Food Bank
CHT	Chittagong Hill Tracts
CNG	Compressed Natural Gas
CSBA	Community-based Skilled Birth Attendant
CSP	Concentrating Solar Power
DAE	Department of Agricultural Extension
DAM	Department of Agricultural Marketing
DA	Development Area
DEM	Digital Elevation Model
DLS	Department of Livestock Services
DMB	Disaster Management Bureau
DoE	Department of Environment
DoF	Department of Fisheries
DPE	Directorate of Primary Education

DPHE	Department of Public Health Engineering
DPP	Development Project Proforma
DSC	District Steering Committee
DSF	Demand Side Financing
DSS	Department of Social Services
DTWs	Deep Tube Wells
ECA	Ecologically Critical Areas
ECNEC	Executive Committee of the National Economic Council
ECNWRC	Executive Committee of the National Water Resources Council
EIA	Environmental Impact Assessment
EPZ	Export Processing Zone
ERD	Economic Relations Division
ESRP	Earth Stabilised Raised Pit
FAO	Food and Agriculture Organization
FAP	Flood Action Plan
FCDI	Flood Control Drainage and Irrigation
FD	Forest Department
FGD	Focus Group Discussion
FWC	Family Welfare Center
GDP	Gross Domestic Product
GIS	Geographic Information System
GBM	Ganges- Brahmaputra- Meghna
GoB	Government of the People's Republic of Bangladesh
GPI	Gender Parity Index
GRP	Gross Regional Product
GWP	Global Water Partnership
HFO	High-density Fuel Oil
HIV	Human Immunodeficiency Virus
HMG	Haor Management Group
HQ	Head Quarters
HYV	High Yielding Varieties
ICRD	Integrated Coastal Resources Database
ICT	Information and Communication Technology
ICT	Inland Container Terminal
ICZMPP	Integrated Coastal Zone Management Plan Project
IFCDR	Institute of Flood Control and Drainage Research
IHWRD	Integrated Haor and Water Resources Database
IMED	Implementation, Monitoring and Evaluation Division
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
IWFM	Institute of Water and Flood Management
IWM	Institute of Water Modeling
IWRM	Integrated Water Resource Management
IWT	Inland Water Transport

JRC	Joint Rivers Commission
KCG	Key Contact Group
KII	Key Informant Interview
kW	kilowatt
LAD	Least Available Depth
LGD	Local Government Division
LGED	Local Government Engineering Department
LGIs	Local Government Institutions
LLP	Low Lift Pumps
LPL	Lower Poverty Line
MDG	Millennium Development Goals
MEA	Multilateral Environmental Agreements
MIS	Management Information System
MMR	Maternal Mortality Rate
MoEF	Ministry of Environment and Forest
MoF&DM	Ministry of Food and Disaster Management
MOFL	Ministry of Fisheries and Livestock
MOH&P	Ministry of Housing and Public Works
MOHFW	Ministry of Health and Family Welfare
MOI	Ministry of Industries
MoWR	Ministry of Water Resources
MPO	Master Plan Organization
MT	Metric Ton
MW	Megawatt
NBSAP	National Biodiversity Strategy and Action Plan
NCA	Net Cultivated Area
NCS	National Conservation Strategy
NE	North East
NEC	National Economic Council
NEMAP	National Environmental Management Action Plan
NERP	Northeast Regional Water Management Plan
NGO	Non-Governmental Organization
NHP	National Health Programme
NNP	National Nutrition Programme
NWMP	National Water Management Plan
NWPo	National Water Policy
NWRC	National Water Resources Council
NWRD	National Water Resources Database
O&M	Operation & Maintenance
ODP	Organizational Development Plan
OPP	Outline Perspective Plan
PA	Protected Area
PAPD	Participatory Action Plan Development
PBS	Palli Bidyut Samitie

PCM	Public Consultation Meeting
PCP	Project Concept Paper
PCU	Project Co-ordination Unit
PGCB	Power Grid Company of Bangladesh
PPP	Public Private Partnership
PRA	Participatory Rural Appraisal
PRM	Participatory Resource Mapping
PRSP	Poverty Reduction Strategy Paper
PSF	Pond Sand Filter
PSMP	Power System Master Plan
RD	Rural Dispensary
REB	Rural Electrification Board
RHD	Roads and Highways Department
RRA	Rapid Rural Appraisal
RS	Remote Sensing
RWH	Rainwater Harvesting System
SB	Surma Basin
SEL	Sand Enveloped Latrine
SERP	Sand Enveloped Raised Pit
SIA	Social Impact Assessment
SME	Small and Medium Enterprise
SRDI	Soil Resources Development Institute
SRP	System Rehabilitation Project
SSPP	Survey and Study Project Proforma
STW	Shallow Tube Well
TAPP	Technical Assistance Project Proforma
TBA	Traditional Birth Attendant
U5MR	Under-5 Child Mortality Rate
UHC	Upazila Health Complex
UHFWC	Upazila Health & Family Welfare Center
ULSC	Union Livestock Service Center
UP	Union Parishad
UZP	Upazila Parishad
VSC	Village Sanitation Center
WARPO	Water Resources Planning Organization
WRE	Water Resources Engineering
ZP	Zila Parishad

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