URBAN DEVELOPMENT DIRECTORATE (UDD)
Ministry of Housing and Public Works
Government of the People's Republic of Bangladesh

Final Report
Regional Plan of Coastal Zone: Payra-Kuakata Coastal Area

June 08, 2021

Submitted by

Dr. Sarwar Jahan
Grand Terrace, Building – D
Flat # 801, 45 New Eskaton Road
Dhaka 1000, Bangladesh

EXECUTIVE SUMMARY

The overall goal of the regional plan is to achieve sustainable development of the Payra-Kuakata Coastal Region by integrated planning and implementation through multi-organizational involvement and community participation for optimum utilization of resources and reduction of poverty. The planning area includes seven upazilas from Patuakhali and Barguna district, namely, Galachipa, Kalapara, Rangabali, Barguna Sadar, Patharghata, Amtali, and Taltali.

Background

Landform, Soil, and Agriculture

The planning area mainly falls under the Ganges Tidal floodplain. The upazilas of the planning area are at risk of being affected by the sea level rise due to climate change. Risk assessment reveals detailed level of risk in the planning area. Forests in the planning area are not much prominent and mostly are reserved areas. Patharghata and Amtali upazila has the highest percentage of reserve forest area. Agricultural observation reveals that the dominant crop of this area is Single T. Aman and Net Cropped Area (NCA) of this crop is highest in Kalapara upazila.

Hydrology and environmental characteristics

A diverse nature of flora and fauna can be seen in the planning area. Even several trees from the Sundarbans can be found here too. Main crops of the area are rice, wheat, jute, pulses etc. Despite importance of ecological integrity and bio-diversity, the flora and fauna in this region are being affected by over exploitation, deforestation, inefficient forest management, agriculture and industrial pollution. The upazilas are also crisscrossed by numerous rivers and contains large number of pond areas.

Basic services

From the distribution of structures in planning area, it is seen that the overwhelmingly large percentage of the households have kutcha houses. Source of drinking water has been classified into three categories namely tap, tube-well and others. According to census data of 2011, the upazilas are mainly served by Tube-Well for the purpose of drinking water in both urban and rural areas. Both urban and rural areas suffer from a lack of sanitary toilet facilities to some extent. There exists a disparity between urban and rural areas of Patuakhali and Barguna district. There are not many private health facilities in the planning area. Barguna Sadar upazila has seven private hospitals and clinics and Patharghata has only three. Other upazilas do not have any private health facilities.

Vulnerabilities and Challenges

People in the Payra-Kuakata region live in an extremely dynamic estuarine environment facing such threats as: cyclone and storm surge, land erosion, flood, drainage congestion, salinity intrusion, drought, tectonic process and deteriorating coastal ecosystems. Besides, there are threats of climate change and upstream land and water uses. These threats affect almost every

aspect of life and limit livelihood choices of the people. These vulnerabilities create a context of insecurity, which in turn, discourage investments, limit economic activities and squeeze employment opportunities. An effective disaster warning system is being developed. A comprehensive disaster management program (CDMP), under the auspices of the Disaster Management Bureau (DMB) and the Bangladesh Red Crescent Society, is being implemented. Water and soil salinity is a common hazard in many parts of the coastal zone. Agricultural activities suffer greatly. Seventy percent of 2.35 million hectares within the Khulna and Barisal Divisions is affected by different degree of soil salinity. Lack of safe drinking water has been identified as the number one issue in the daily life of the coastal population. The water supply sector has achieved commendable success over the last few decades; overall about 95 percent of the population now has access to water from tube-wells, taps or ring-wells. The coastal zone of Bangladesh experiences extensive ecosystem degradation. Some of the interventions to cause degradation are: drainage for agriculture; dredging and canalization for navigation and flood protection; filling for solid waste disposal; land use for commercial, industrial or residential purposes; conversion of land for aquaculture; construction of dykes for flood control and irrigation; discharge of pesticides and herbicides; domestic and industrial waste; agricultural runoff and sediment; deep channels and other structures; hydrological alternation by canals; roads and other structures; and subsidence due to extraction of groundwater.

Current Scenarios and Development Potentials

Based on the current scenarios a union level analysis was performed to identify the potential areas for development. The following criteria have been considered for the analysis: Road length in the union, Structure frequency in the union, Number of various socio-economic facilities available in the union, and Population size of the union. By combining these criteria, an index value was developed and based on the index values, 14 unions or pourashavas were found to be of high development potential. 18 pourashavas or union were found to be moderately potential for development. A further analysis was performed to identify the potential location for eco-town development. All eco-towns should comply with planning policy statements including those relating to sustainable development such as: climate change adaptation, pollution control, open space, biodiversity, transport, and flooding, housing and economic development. Excluding Payra port area and 10 minute walking distance buffer area, flowing suitable areas has been identified through multi-criteria analysis.

Economic Growth Potentials of Upazilas

Galachipa upazila has the highest number of total employments among the seven upazilas while Taltali upazila has the lowest number. From economic base analysis, it was found that contrary to the lowest number of total employments, Taltali upazila has grown substantially from 2003 period with the second highest percentage increase in employment (116%). This indicates that Taltali upazila is developing faster than it seems that other upazilas in terms of total employment. Highest basic employment is seen in Galachipa upazila and again lowest in Taltali. When the basic employment of the sectors is observed, it is seen that the Education sector has the greatest number of basic employment indicating this sector serves people coming from outside the region most among all the sectors. From the shift-share analysis, it was found that only Amtali upazila can be considered Fast-Growing in terms of regional growth. Other

upazilas are lagging behind the national growth. All the upazilas are found to be Slow-Growing region in terms of Industry Mix (IM). Taltali and Amtali upazila are revealed to be fast-growing in terms of regionally located advantages.

Assessment and Development of Socio-Economic Facilities

One major problem of the area under study is the disparity among the Upazilas in terms of service facilities. Therefore, planning service facilities requires critical examination of existing facilities and their distribution. The social services/facilities for the Upazilas have been selected mainly considering their importance and data availability. The facilities have been broadly categorized into four groups:

1. Educational facilities: Primary schools, high schools, and madrashas.
2. Commercial facilities: Growth Centres and Rural Markets.
3. Health facilities: Upazila Health Complexes/Hospitals, Family Welfare Centres and Community Clinics.
4. Disaster management facility: Cyclone Shelters.

In this study the need for a facility has been determined on the basis of population threshold for that facility. Population threshold for facilities have been calculated using Reed-Muench method which had been further developed by Hagget and Gunawardena (Annex- II). Recommendations have been made on the basis of present and projected future populations.

Land Use Suitability Analysis for Urban and Infrastructure Development

In the present study, several suitability analyses have been done considering different impacts and every suitability analysis has been sub categorized into logical sub parameters observing its extent. The major suitability analyses are outlined below:

- Agricultural Suitability
- Hydro-Geological Suitability
- Flood Depth Mapping
- Urban Land Use Suitability

For the determination of suitability analysis, preference has been given to physical parameters. that positively influenced urban development. Urban Suitability analysis has been done after taking into consideration of all Suitability analysis mentioned above and a composite land use/infrastructure suitability map has been prepared based on various types of suitability analysis. According to this map, most of the area is moderately suitable (approx. 33.31%) to poorly suitable (approx. 35.35%) for infrastructure development.

Tourism Development Potential in the Region

Payra-Kuakata region offers ample opportunities for creating facilities for tourists. The region is home to unique flora and fauna and possesses many panoramic beauties. Forests, beaches, lakes and rivers make the region ideal place for ecotourism development. Based on various locations that could be attractive for tourists, a composite tourist zoning map has been prepared that identifies 13 zones which have important characteristics that may attract tourists both domestic and international. Three of these locations are attractive because of high quality

beach, five have a combination of forest and char (small island) and another five have both beach and mangrove forest. For proper development of these zones recommendations have been made for provision of adequate and proper Tourist Service Infrastructure for attracting tourists from home and abroad.

Developing the Transportation System

The main purpose of this project is to develop a comprehensive plan to promote tourism as well as enhance socio-economic and infrastructural development of the seven upazilas of the Barguna and Patuakhali Districts. The transportation model developed under this project will optimize the overall transportation system and business activities associated with the major transportation hubs like Payra Port and Kuakata Sea Beach as well as other small to medium growth centres in the project area. The model suggests the proposed land use change in the study area will significantly increase vehicular movement in the network for the future scenario, i.e., an indication that the proposed expansion of road network can be justified to handle the future traffic demand. At the same time, the network is not going to remain overly congested, i.e., decent amount of operating speed can be achieved. This further justifies that the proposed road network is sufficient. Recommendations have also been made to improve the water transportation system by addressing the problems related to (i) siltation, (ii) day & night navigational problems, (iii) shortage of passenger & cargo handling facilities including transit shed at river ports, (iv) Presence of manual loading/unloading of cargo at river ports, (v) underdeveloped rural launch landing stations, inadequate number of water crafts etc.

Payra Port and Its Impacts in the Region

The Payra Port Authority and the port were established on 19 November 2013 through the Payra Sea Port Act 2013. The port started commercial operations from August 2016 under the port authority. Payra deep sea port is still under construction that is planned to be completed in three phases and the first phase is completed already in 2016 which was started in 2013. It is situated in the Southern part of Bangladesh, in Patuakhali District's Kalapara Upazilla. The Payra Port Master Plan prepared in January, 2016 estimated that by 2025 when the port becomes fully operational it would handle nearly 2 million containers, 2.5 million tons of general cargo and nearly 43 million tons of other materials (oil products, grain, sand and aggregate, coal etc. The port and related facilities (airport, free trade zone etc.) would employ about 13000 people including labourers. Based on the number of employments generated directly by the Payra port, estimates show that after full development of the port total employment (direct + indirect) in the new township adjacent to the port may be as high as 43,550 with a total population of about 1,26,000.

Strategies for Integrated Development of the Region

The Payra-Kuakata region includes environmentally sensitive areas which need protection from harmful human intervention. At the same time development activities also need to be promoted for poverty reduction and livelihood activities. Accomplishment of these objectives would require formulation and enforcement of integrated development plan. Any development plan ultimately boils down to a set of programmes across all aspects of development. Based on

problems and potentials, strategies have been identified for development of the region. The main areas of focus are as follows: Management of the coastal environment including its protection and regeneration, management of the water resources in the region, facilitating sustainable economic opportunities for coastal communities, developing productive economic activities, development infrastructure, and development of social facilities including education, health, water and sanitation, mitigation of natural disasters.

Strategies for Mitigating Natural Disasters

In order to address the increasing risks due to extreme events like cyclone, storm surge, coastal flood, wind storm etc. due to climate change a substantial magnitude of public investment program is required to create resilient infrastructure, including drainage and flood control, water supply, sanitation, cyclone shelters, emergency access roads and bridges, slum improvements, bus terminals, boat landings, and markets. All the projects selected for such programme should be assessed for climate risk on the basis of agreed technical criteria and climate projections for 2040 in detailed designs. Institutional capacity to integrate climate and disaster risks into urban and regional planning and infrastructure management also need to be addressed. The priority investment program for mitigating natural disasters and ensuring safety and protection of the coastal population should focus on the following: Coastal embankment construction and rehabilitation, Flood control and drainage, and Infrastructure and urban services.

Mobilization of Resources for Development

For the development of the coastal zone, two sectors – tourism and fisheries, are of utmost importance, especially in in view of the observed interest of the private sector to undertake investments in projects in these two sectors. The priority areas that should constitute the investment strategy includes among others mitigation measures, environment management and water resource management. Financing of the investment program and projects will have to come from national and local government budgets, private investment (including foreign investment), NGO program resources, and multilateral and bilateral donors. Effective partnerships between local governments and the private sector can generate considerable benefits. Private companies, informal sector enterprises, CBOs, and NGOs can provide urban services, mobilize finance (or voluntary labor), introduce innovative technologies and undertake land development activities.

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURE

1. INTRODUCTION AND BACKGROUND

1.1 Introduction

The coastal zone of Bangladesh is different in a number of aspects from the rest of the country. It has several other issues that are different in the five coastal hydrological regions like the urgencies, coastal dynamics, and the interactions among people, water and lands are different in each of the hydrological region. Many sectors influence these interactions. Reinforcement of benefits from multiple sectors is the anticipated result of regional planning. Multi-sectoral planning in the coastal zone may be done in accordance with change trends and diversity of its (a) natural features, (b) erosion and accretion, (b) the distribution of natural, human made, and human resources, (c) demography and poverty, (c) exposure to hazards, and (d) potential risks. The risks shall be aggravated by predicted impacts of climate change. Furthermore, it contains several ecosystems upon which the livelihoods of millions of people are dependent. The coastal zone has immense development opportunities and needs integrated management of resources. Throughout the coastal zone, development is observed to be taking place to a certain extent depending on regional differences, as well as diverse development strategies and their impacts. A development strategy may focus on the worst areas in terms of development and human deprivations, or it may focus on areas with high growth potentials possessing better infrastructures, or a combination of both.

The uncertainties related to decision making pertaining to social values, the coastal environment and related decision have been addressed in varying degrees during the past two decades. Coastal zone policy (CZPo) in 2005 and the Coastal Development Strategy (CDS) in 2006 provide a general guidance to all concerned for the management and development of the coastal zone in a manner so that the coastal people are able to pursue their life and livelihoods within secure and conducive environment.

The CDS is based on the approved Coastal Zone Policy (CZPo). It is the linking pin between the CZPo and concrete interventions. It prepares for coordinated priority actions and arrangements for their implementation through selecting strategic priorities and setting targets. The CDS represents a departure from 'business as usual' in the management of the coastal zone towards utilizing its potentials. It attempts to get maximum benefit. CDS has nine strategic priorities for ensuring fresh and safe water availability; safety from man-made and natural hazards; optimizing the use of coastal lands; promoting economic growth emphasizing non-farm rural employment; sustainable and equitable management of natural resources: exploiting untapped and less explored opportunities; improving livelihood conditions of people; especially women; environmental conservation; and empowerment through knowledge management.

At several places of the CDS the idea of regional studies is promoted. Regional planning studies should be aimed at increasing the understanding of the complex processes that characterize the coastal zone. At the same time such studies can form a firm body of knowledge base on which future interventions can be based.

1.2 Goals and Objectives

The overall goal of the regional plan is to achieve sustainable development of the Payra-Kuakata Coastal Region (**Figure 1-1**) by integrated planning and implementation through multi organizational involvement and community participation for optimum utilization of resources and reduction of poverty. This would require fulfillment of the following objectives to achieve coordination and integration of proposed planning initiatives:

- make optimal use of development opportunities
- minimize negative externalities on existing development
- safeguard ecological processes
- ensure equitable distribution of benefits for poverty alleviation

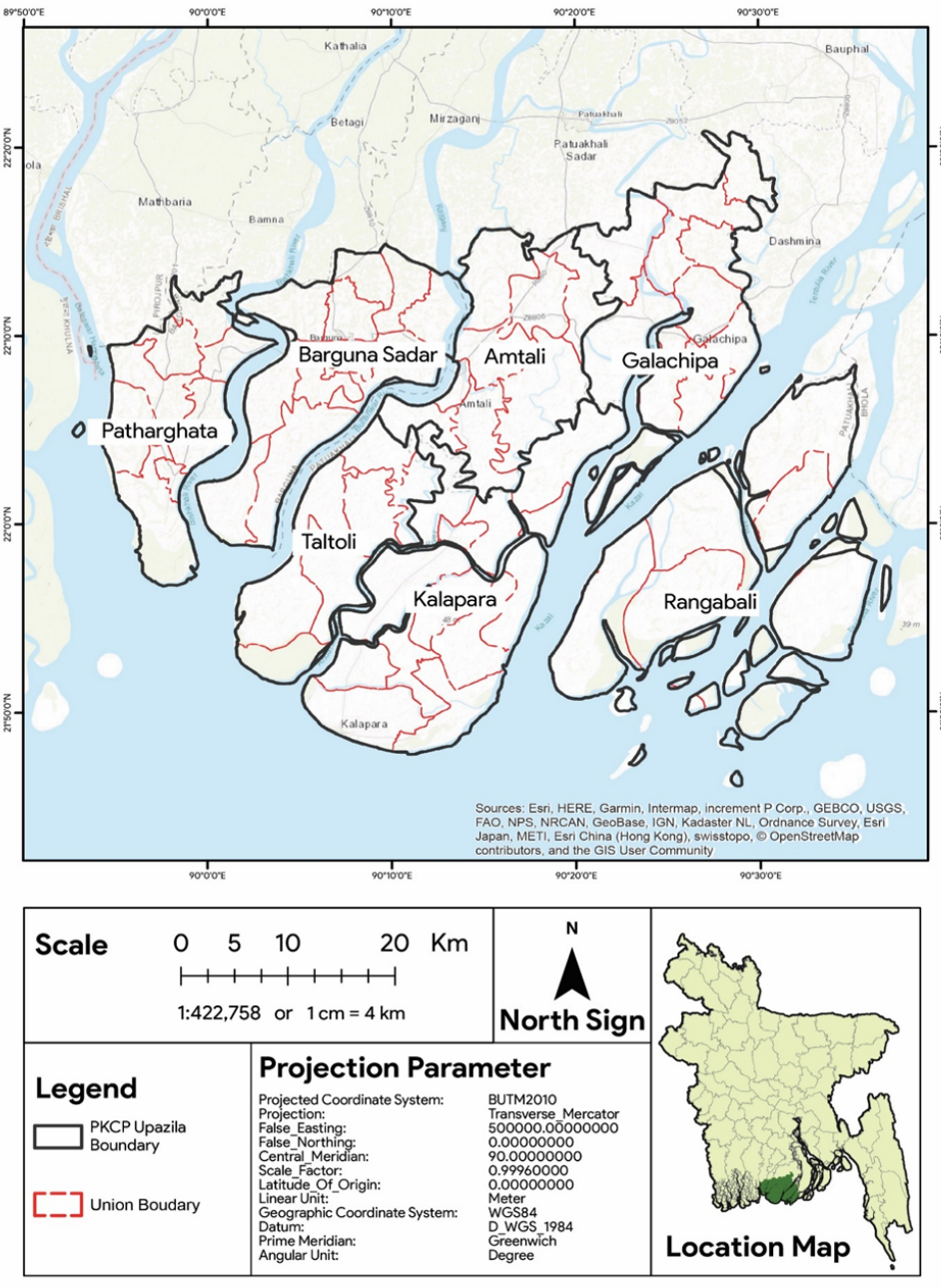


Figure 1-1: Payra-Kuakata Coastal Region

The specific objectives of the plan are to:

(i) To integrate coastal zone with the mainstream of development process of the country.
(ii) To frame policies for the best use of land and its control for the Payra-Kuakata coastal region.
(iii) To optimize coastal environment for sustenance of marginal people.
(iv) Formulation of Policies and plans for mitigation of different types of hazards, minimizing the adverse impacts of climate change and recommend possible adaptation strategies for the region.
(v) Formulation of Policies and plans for gradual nucleation of settlements with policies and plans for development of growth centers of the area.
(vi) Formulation of a planning package for development of tourism in Payra-Kuakata coastal region, and also to accommodate future changes in existing land use pattern, socio-economic condition of the area and quality of life of the people due to establishment of the third sea port in the region in an integrated and comprehensive manner.

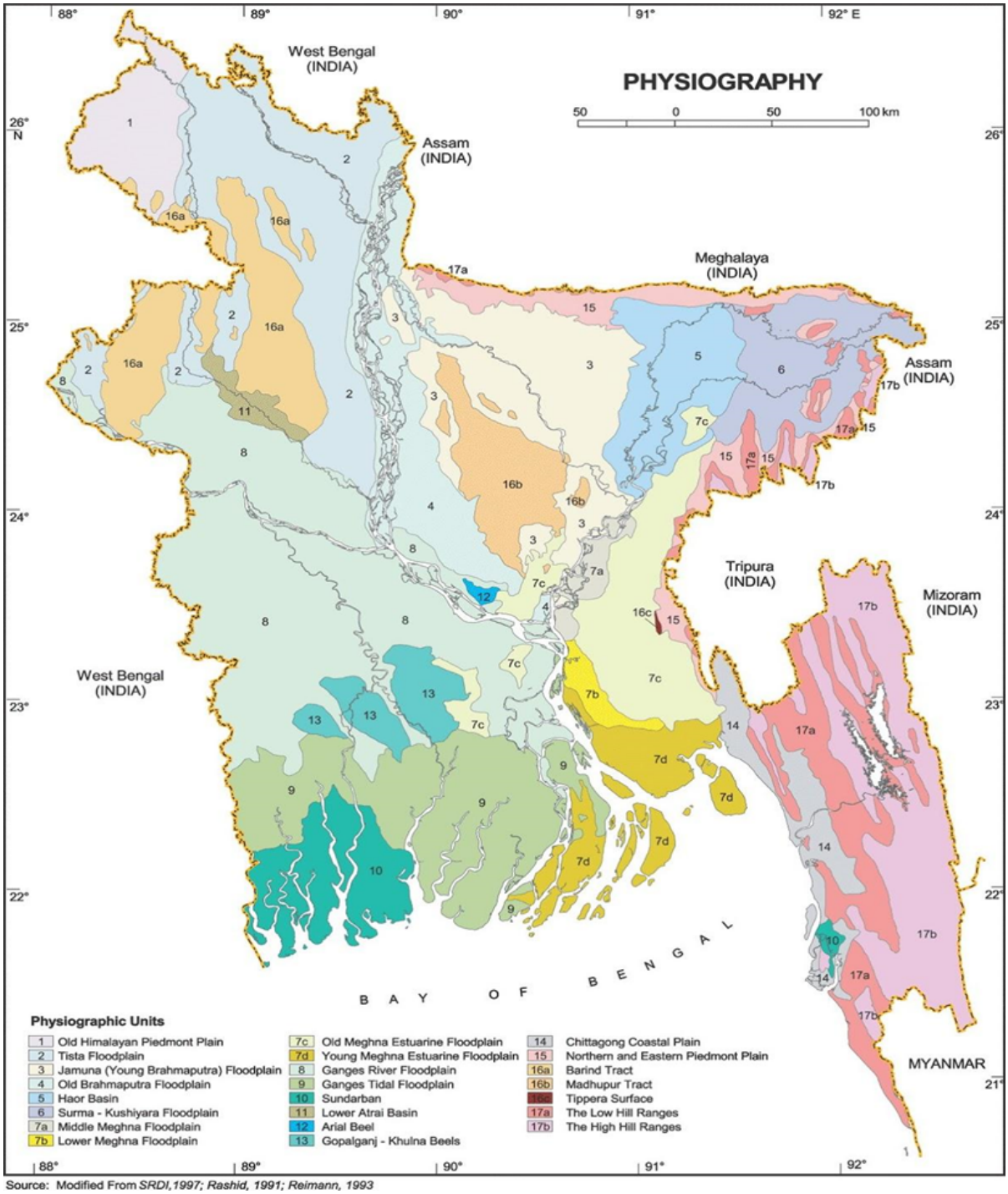
1.3 Background

1.3.1 Landform

Bangladesh is located at the lowermost position of three giant river system - the Ganges – Padma river system, Brahmaputra – Jamuna river system and Surma – Meghna river system. Quaternary Sediments deposited from these three-river systems has formed this delta plain through which numerous rivers and distributaries of the three-river system runs. Most of the country is below 10 m contour line. As such, the water from melting ice of the Himalayas goes through the rivers of Bangladesh, and to the Bay of Bengal, located south of the country. In terms of physiography the country has been divided into three distinct regions - (a) floodplains, (b) terraces, and (c) hills. These regions have been divided into 24 sub regions and 54 units. The major sub-regions are as follows:

1. Old Himalayan Piedmont Plain
2. Tista Floodplain
3. Old Brahmaputra Floodplain
4. Jamuna (Young Brahmaputra) Floodplain
5. Haor Basin
6. Surma-Kushiyara Floodplain
7. Meghna Floodplain
8. Ganges Tidal Floodplain
9. Sundarbans
10. Lower Atrai Basin
11. Arial Beel
12. Gopalganj-Khulna Peat Basin
13. Chittagong Coastal Plain
14. Northern and Eastern Piedmont Plain
15. Pleistocene Uplands
16. Northern and Eastern Hill

Patuakhali and Barguna district fall in the Ganges tidal floodplain (**Figure 1-2**). PDO – ICZMP (Project Development Office-Integrated Coastal Zone Management) classified the coastal areas of Bangladesh under two broad categories viz. interior coast and exterior coast (Ahsan, 2013). Amtali, Taltali, Barguna Sadar, and Patharghata upazila of Barguna district and Galachipa, Rangabali, and Kalapara upazilas of Patuakhali district are among the exposed areas (**Figure 1-1**).



Source: Modified From *SRDI,1997; Rashid, 1991; Reimann, 1993*

Figure 1-2: Physiographic Map of Bangladesh

The tidal landscape of the Ganges Tidal Floodplain has a low ridge and a basin relief crossed by innumerable tidal rivers and creeks. Local differences in elevation generally are less than 1m compared with 2-3m on the Ganges floodplain (**Figure 1-2**). The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks and in a transitional zone in the east adjoining the lower Meghna.

As the upazilas are low-lying coastal areas, they are at risk of being affected by the sea level rise due to climate change (Brammer, 2014). The rivers going through the districts are The Andharmanik, Agunmukha, Payra, Lohalia, Patuakhali, and Tentulia of Patuakhali and Payra, Bishkhali, Khagdum and Baleshwar of Barguna.

1.3.2 Physical Profile of the Planning Area

Patuakhali District

Patuakhali district is one of the coastal districts of Barisal Division and is located at the fringe of the Bay of Bengal. It became a sub-division of Barisal (former Bakerganj) district in 1871 and a district in 1969. Former Patuakhali district was constituted with two sub-division viz. Patuakhali Sadar and Barguna. In 1983 Patuakhali Sadar subdivision was upgraded to Zila (BBS, 2011).

Opinions about the origin of the name "Patuakhali" varies from different sources. The most accredited belief is that the name originated from the Portuguese Canal which flows through the district. It is said that the Portuguese pirates used to make regular incursions through this canal at the beginning of the seventeenth century. Subsequently, the canal was named "Patuakhali" and the area was named after it.

Area and Location

The total area of Patuakhali district is 3,221.31 sq. km. It lies between 21°48' and 22°36' north latitudes and between 90°08' and 90°41' east longitudes. The district is bounded on the north by Barisal district, east by Bhola district, south by the Bay of Bengal and west by Barguna district. The total population of the Patuakhali district is 1,535,854 according to the Population Census of 2011 (BBS, 2011).

Administration

The district consists of 8 upazilas, 71 unions, 571 mauzas, 878 villages, 5 paurashavas, 45 wards, and 82 mahallas (**Table 1-1**). The upazilas are Bauphal, Dashmina, Dumki, Galachipa, Kalapara, Mirzaganj Patuakhali Sadar and Rangabali.

Tourist Attractions

Kuakata Sea beach, located at Kalapara upazilas, is a major tourist attraction of Bangladesh. The "Jhaubon" of Kuakata and Red Crab Island pulls many tourists each year. The government of Bangladesh has incorporated all these features and assigned the tagline "Kuakata Ananya Patuakhali Sagorkanya" to this district (District Administration Patuakhali, 2017).

Table 1-1: Number of Administrative Units of Patuakhali District

Administrative/ Geographic Unit	Total
Upazilas	8
Union	71
Mauza	571
Village	878
Paurashava	5
Paura Ward	45
Mahalla	82

(Source: BBS, 2011)

Barguna District

Barguna, another of the coastal district of Bangladesh was previously a part of Patuakhali district and was upgraded to district status in 1984. There are no specific sources regarding the name of the district. However, different sources suggest that wood traders from the northern part of the country used to travel en route this route to collect wood from the Sundarbans. Businessmen used to transit at Khagdum River and used to wait for a favorable tide locally known as "BoroGon". As such, the place was called "Boro Gona". Another source mentions that the place is named Barguna as the boats had to wait at this place of present district headquarters for "Baragun" meaning large rope to pull their boats against the strong current of the Khagdum River.

Area and Location

The total area of the zila is 1,831.31 sq. km of which 399.74 sq. km is riverine and 97.18 sq. km is under forest. It is bounded on the north by Barisal Zila, Jhalokati Zila, and Patuakhali Zila, on the east by Patuakhali Zila, on the south by the Bay of Bengal and on the west by Pirojpur Zila and a part of Sundarbans under Bagerhat Zila. It lies between 21°48’ and 22°29’ north latitudes and between 89°52’ and 90°22’ east longitudes. The total population of Barguna district is 892,781 according to the Population Census 2011 (BBS, 2011).

Table 1-2: Number of Administrative Units of Barguna District

Administrative/ Geographic Unit	Total
Upazilas	6
Union	42
Mauza	257
Village	563
Paurashava	4
Paura Ward	36
Mahalla	50

(Source: BBS, 2011)

Administration

Barguna district consists of 6 upazilas, 42 unions, 257 mauzas, 563 villages, 4 paurashavas, 36 wards, and 50 mahallas (**Table 1-2**). The names of the upazilas are Amtali, Bamna, Barguna Sadar, Betagi, Patharghata, and Taltali.

1.3.3 Land Use and Land zoning

Data of upazila-wise land area distribution are presented in **Table 1-3**. Kalapara has the highest percentage of land area compared to its total area. Patharghata has lowest land area. Rivers are seen mostly in Galachipa upazila as it has a 44.89% river area. Amtali upazila also has the highest percentage (53.14%) of reserve forest area among the seven Upazilas. Lowest reserve forest is in Galachipa Upazila.

Table 1-3: Land Area Distribution of the Upazilas (sq. km)

Upazila	Land Area	(%)	Reserve Forest	(%)	River Area	(%)
Galachipa	463.06	(51.79)	29.68	(3.32)	401.31	(44.89)
Kalapara	467.11	(94.96)	21.05	(4.28)	3.73	(0.76)
Rangabali	260.4	(69.57)	20.6	(5.5)	93.32	(24.93)
Patharghata	234.11	(17.54)	37.29	(38.37)	115.96	(29.01)
Barguna Sadar	311.67	(23.36)	8.26	(8.5)	134.45	(33.63)
Amtali	539.3	(40.42)	51.64	(53.14)	129.81	(32.47)

Most part of the planning area falls under medium land meaning its flat (**Figure 1-3**). Galachipa upazila stands out as the flattest area having no high or low land. Amtali and Taltali upazila's some part are low lying areas, while Amtali has the largest area of high land among the seven upazilas. Other upazilas are mostly flat with little or no high or low land.

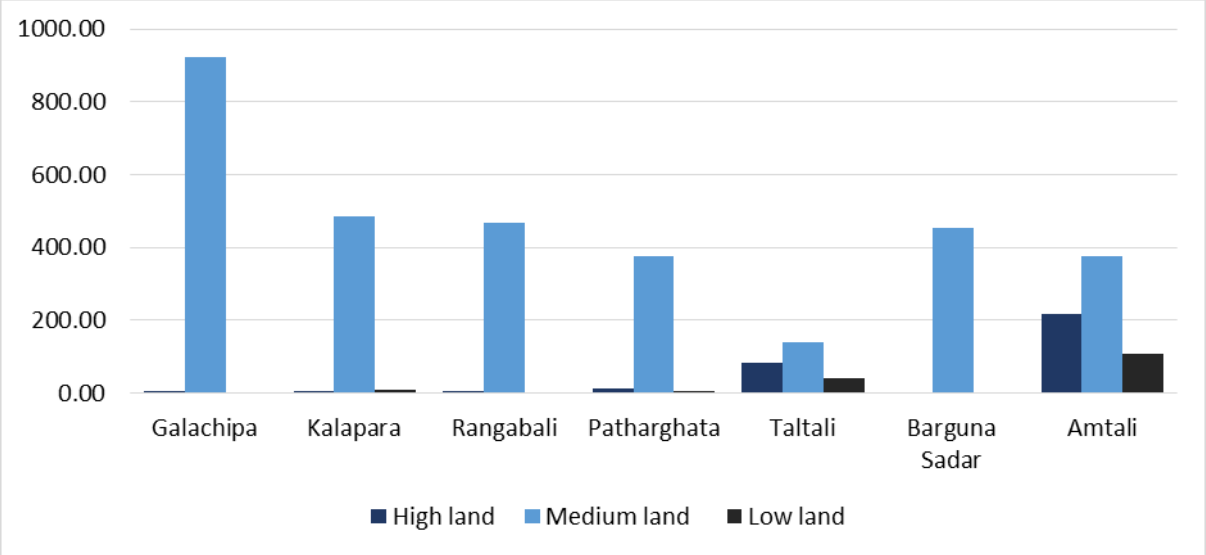


Figure 1-3: Area of High, Medium and Low Land

(Source: BBS, 2011)

Land Use

Figure 1-5 shows upazila-wise existing land use while **Table 1-4** presents percentage distribution of areas by land use. **Table 1-4** shows that more than 99% of the land in all the seven upazilas are used for non-urban use that includes parts of Bay of Bengal, Boro T-Aman, fallow land, mangrove forest, pond, Rabi, river/canal, Robi T-Aman, settlement with homestead forest, T-Aman, tidal flood plain, and tidal flat/sea beach. Around 1% of the land is used as urban area in Patharghata and Taltali; whereas, urban area in Amtali and Galachipa is about 0.70% of the total land. Only few portions of the total land are used as urban area in Kalapara (0.41%) and Barguna Sadar (0.15%).

Table 1-4: Land Use in Planning Area

Land Use	Upazila						
	Amtali	Barguna Sadar	Galachipa	Kalapara	Patharghata	Rangabali	Taltali
Bay of Bengal	0.00	0.82	0.00	2.66	1.92	2.70	4.57
Boro T-Aman	20.84	21.84	0.00	0.00	47.94	11.15	7.86
Fallow Land	1.65	0.00	2.32	2.53	0.00	2.52	3.07
Mangrove Forest	0.00	1.10	11.39	2.11	0.87	15.65	4.11
Pond	9.26	0.00	0.00	2.15	0.00	0.00	1.82
Rabi	27.03	28.57	0.00	0.00	29.08	0.00	43.50
River/Canal	21.38	10.80	9.92	21.39	7.62	14.69	14.81
Robi T-Aman	0.00	0.00	0.00	20.03	0.00	0.00	0.00
Settlement with Homestead Forest	18.33	36.27	61.94	21.76	9.69	36.00	15.07
T-Aman	0.75	0.00	10.68	22.08	0.00	9.44	0.00
Tidal Flood Plain	0.00	0.00	3.05	0.00	0.00	7.86	0.00
Tidal Flat/Sea Beach	0.00	0.26	0.00	4.85	0.00	0.00	2.97
Urban Area	0.75	0.15	0.70	0.42	0.96	0.00	1.00
Undefined Use	0.00	0.18	0.00	0.00	1.92	0.00	1.23
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Land Zone

Figure 1-5 shows upazila-wise land zones of the study area prepared by the Ministry of Land. These zones show the areas for recommended land use. **Table 1-5** shows the land zones in terms of acres. This table is prepared by conducting necessary calculation from the digitized map. According to the **Table 1-5**, around 85% of the land in Amtali falls under agriculture zone and only 3.69% of the land falls under urban and commercial zone. In addition, 4.04% of the land falls in urban and commercial zone in Barguna Sadar. Furthermore, Galachipa (1.37%), Kalapara (1.78%), and Patharghata (2.91%) have very little area under urban and commercial zone. **Figure 1-6** presents the agro-based land zoning proposed by Urban Development Directorate (UDD). This can be considered as the revised version of land zoning by Ministry of Land with same land zones delineated at a more disaggregated or micro level.

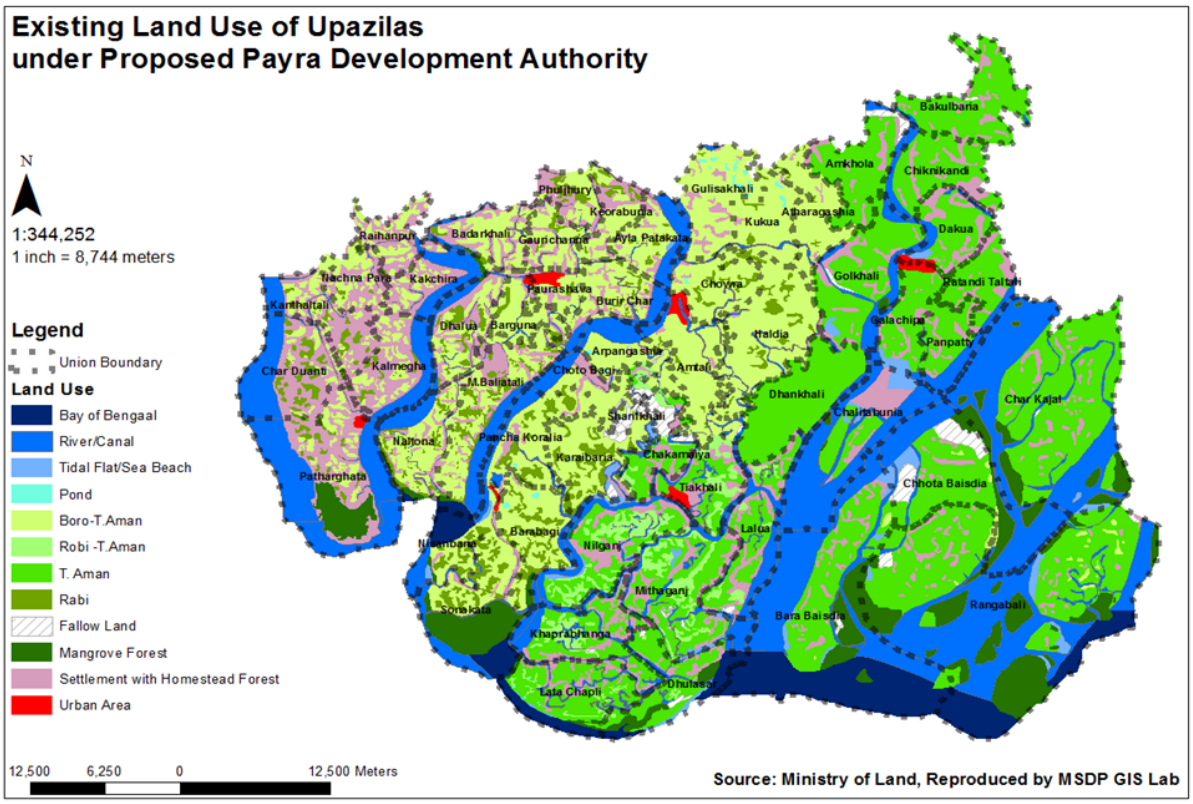


Figure 1-4: Existing Land Use of Upazilas

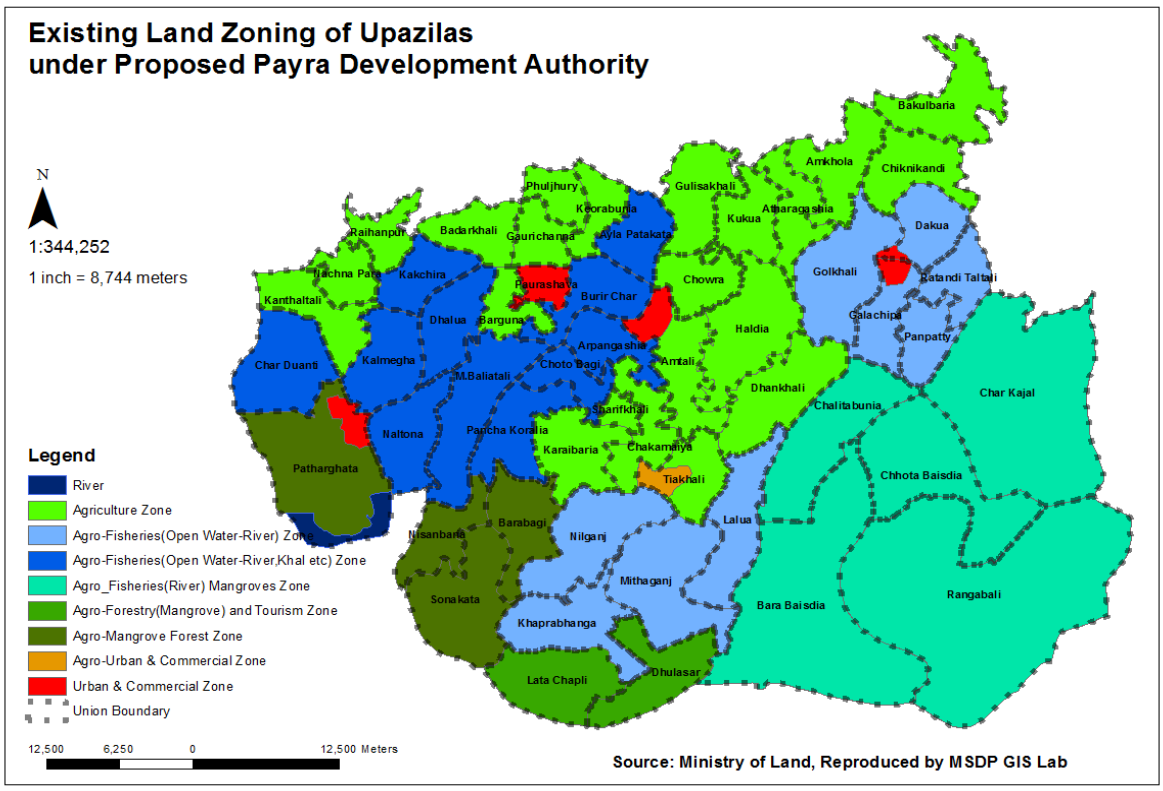


Figure 1-5: Existing Land Zoning of Upazilas by Ministry of Land

Table 1-5: Land Zoning in Planning Area

Land Zone	Upazila-wise land zone (acre)							Total
	Amtali	Barguna Sadar	Galachipa	Kalapara	Patharghata	Rangabali	Taltali	Area (acre)
Agriculture	85.67	33.86	26.22	25.20	25.76	0.00	19.80	196488.95
Agr-Fisheries (River) Mangrove Forest	0.00	0.00	37.06	51.51	0.00	0.00	0.00	221830.03
Agro-Fisheries (Open Water-River)	0.00	0.00	35.35	0.00	0.00	100.00	0.00	111527.06
Agro-Fisheries (Open Water-River/Khal)	10.44	62.10	0.00	0.00	40.35	0.00	24.82	114665.05
Agro-Forestry (Mangrove) and Tourism	0.00	0.00	0.00	21.51	0.00	0.00	0.00	26589.54
Agro-Mangrove Forest	0.00	0.00	0.00	0.00	26.61	0.00	55.38	60129.17
Agro-Urban & Commercial	0.00	0.00	0.00	1.78	0.00	0.00	0.00	2203.30
Urban & Commercial	3.89	4.04	1.37	0.00	2.91	0.00	0.00	10869.72
Undefined Zone	0.00	0.00	0.00	0.00	4.37	0.00	0.00	3719.33
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	748022.17

1.3.4 Soil

Soil structure of the planning area is classified into four categories – Doash, Bele, Etel, Kankar and Others. Most parts of the planning area have Doash soil with highest areas in Galachipa and Amtali upazilas (**Figure 1-7**). Amtali and Taltali upazilas contain some Bele soil. Other upazilas are mostly characterized by Doash and Etel soil.

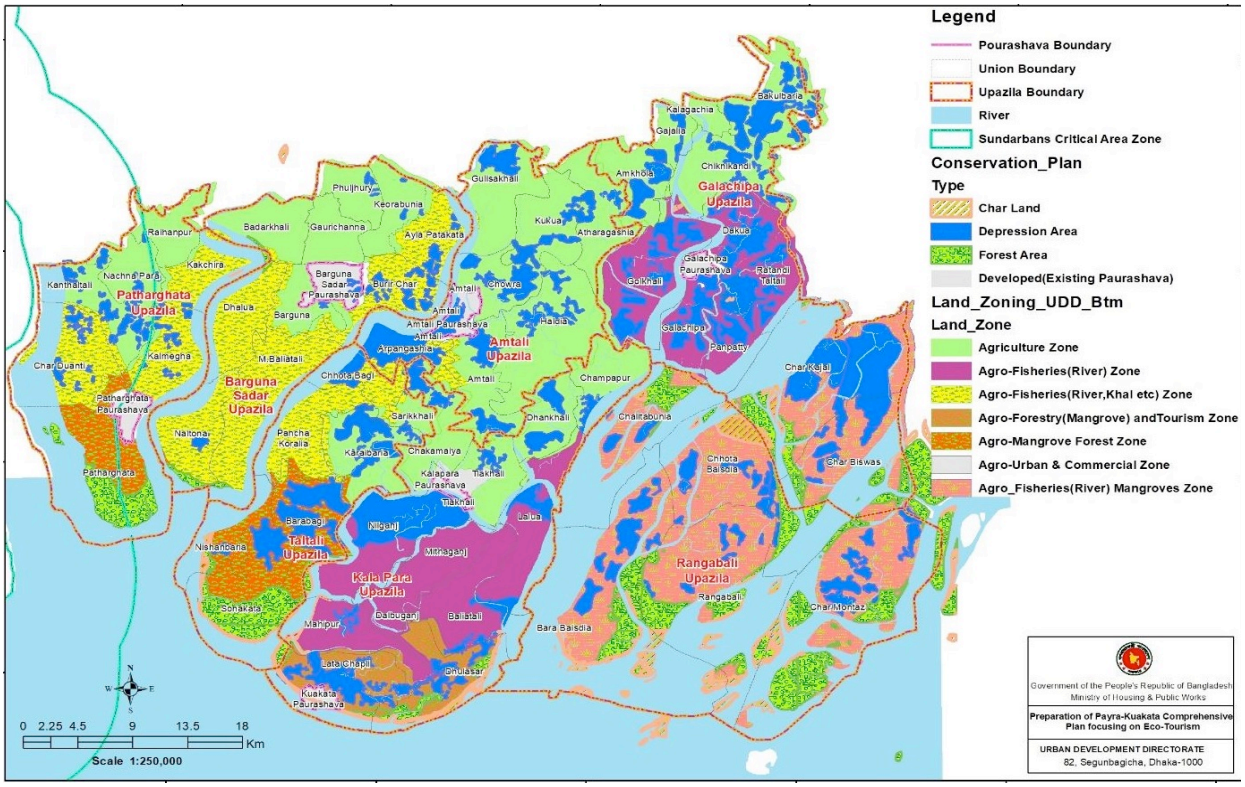


Figure 1-6: Agro-Based Land Zoning Proposed by Urban Development Directorate

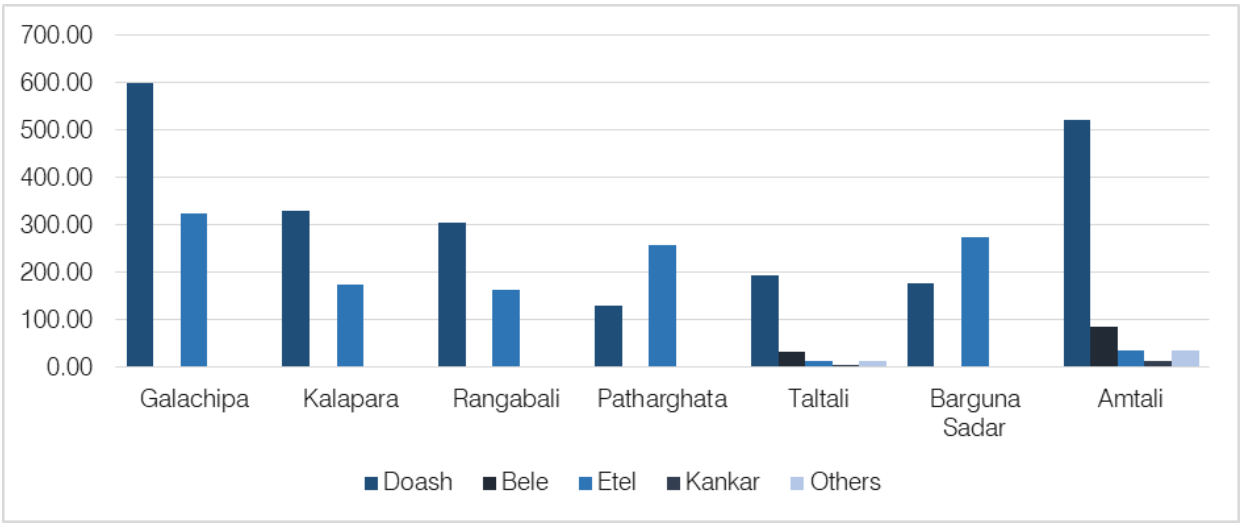


Figure 1-7: Broad Soil Classification

(Source: BBS, 2011)

1.3.5 Demographic Profile

Population and Area

According to the population census of 2011, Barguna Sadar is the largest upazila among the seven followed by Galachipa Upazila (**Table 1-6**). Together these two upazilas comprise 6.2% of the total population of Barisal Division. The smallest upazila is Taltali, which was created in 2012 by dividing Amtali into Amtali and Taltali Upazilas. Barguna Sadar is also the most

densely populated upazila while Rangabali is the least populated (**Table 1-6**). The average population of the seven upazilas is 185,060.

Table 1-6: Distribution of Population by Sex and Area of Residence

Upazila	Area (sq. km.)	Population	Growth Rate	Popⁿ Density (per sq. km.)
Galachipa	925.08	258515	0.81	279.45
Kalapara	492.10	237831	1.64	483.30
Rangabali	470.12	103003	1.72	219.10
Patharghata	387.36	163927	0.11	423.19
Taltali	258.94	88004	-0.94	339.86
Barguna Sadar	454.38	261343	0.94	575.16
Amtali	720.75	182798	1.15	253.62

(Source: BBS, 2011)

As seen from **Table 1-6**, Galachipa is the largest of the upazilas with respect to area. The upazilas sorted in order of decreasing area are, Galachipa, Amtali, Kalapara, Rangabali, Barguna Sadar, Patharghata, and Taltali.

Kalapara shows a growth rate of 1.72, highest among the seven, from 2001 to 2011. All upazilas show a positive growth rate except Taltali, for which a decrease in population was seen from 2001 to 2011.

Distribution of Population by Sex and Area of Residence

The proportion of urban population ranges between 10% and 15% with Galachipa (10%), Amtali (11.9%), Barguna Sadar (12.3%) and Kalapara (14.9%). Only Patharghata has an urban population of over 15%. There is no urban population in Rangabali and Taltali upazilas (**Figure 1-8**). The distribution of the male and female population shows no significant variation in urban and rural areas (**Figure 1-9**).

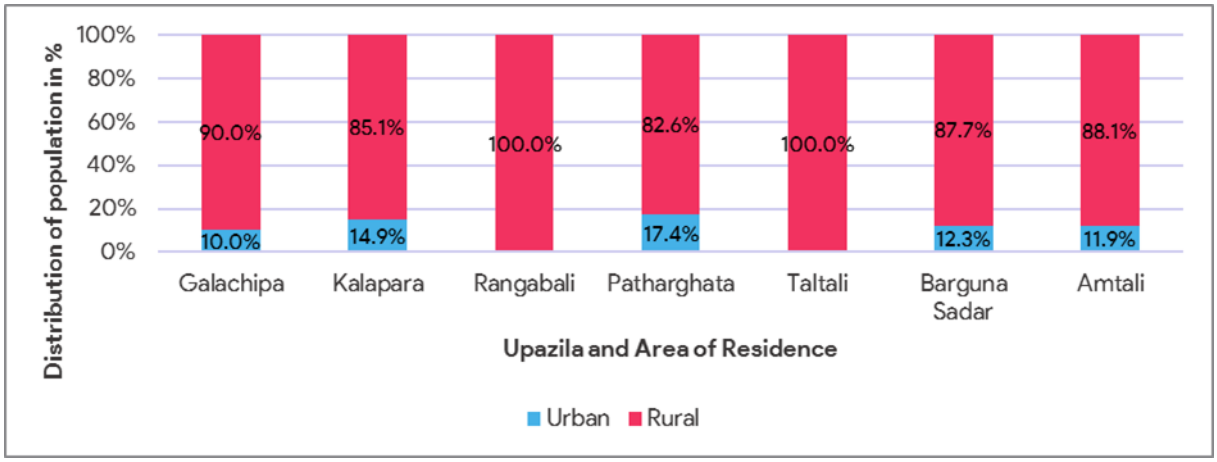


Figure 1-8: Distribution of Population by Area of Residence

(Source: BBS, 2011)

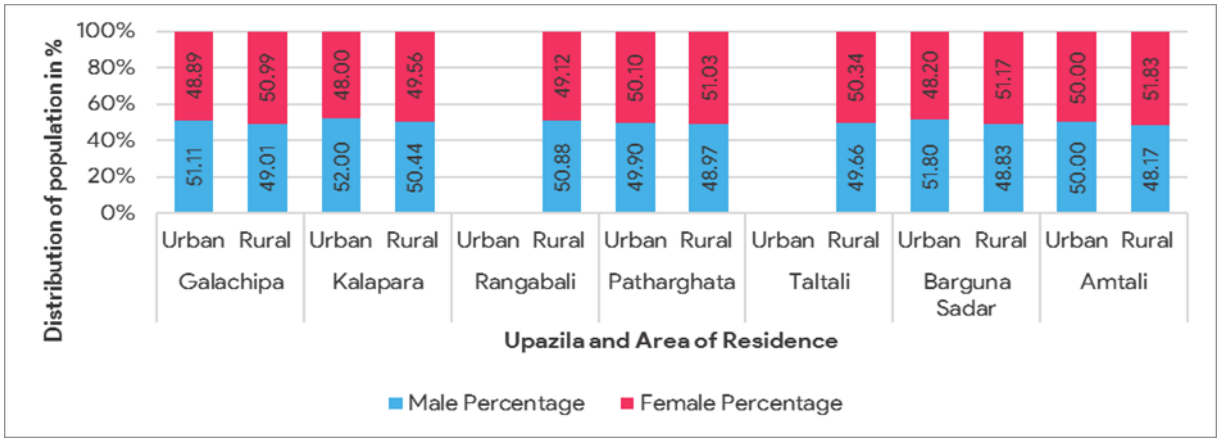


Figure 1-9: Distribution of Population by Sex and Area of Residence

Both districts contain some number of ethnic populations, largely people from Rakhain, Chakma and Marma tribes (**Table 1-7**). Largest placement of the ethnic population is in Kalapara who are mostly from Rakhain tribe from the Arakan State.

Table 1-7: Distribution of Ethnic Population by Upazilas

Upazila	Ethnic Population
Galachipa	4
Kalapara	1213
Rangabali	108
Patharghata	3
Taltali	999
Barguna Sadar	122
Amtali	999

(Source: BBS, 2011)

Population by Age Group and Sex

The distribution of population by sex does not vary significantly among the seven upazilas. Population is classified into three age groups, namely, 5 – 9 years, 10 – 14 years and 14+ years. When compared to each other it is seen that the third group includes most of the population indicating a large number of working age population (**Figure 1-10**).

Barguna Sadar is the most populated area in terms of population of 14+ years and above (**Figure 1-11**). Highest population of age 5 – 9 years and 10 – 14 years is found in Galachipa upazila. Taltali has the lowers populated in all three categories.

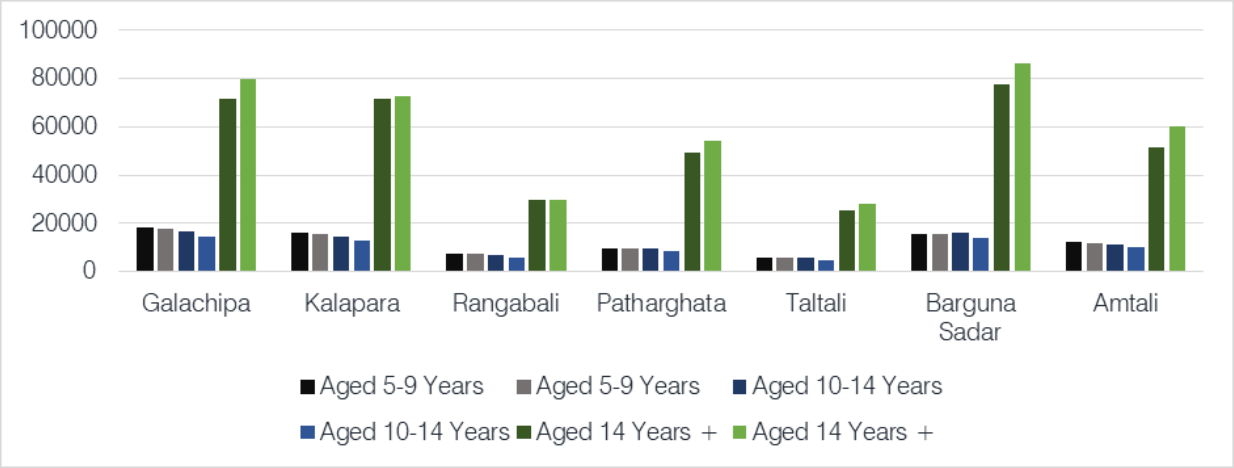


Figure 1-10: Distribution of Population by Age Group and Sex

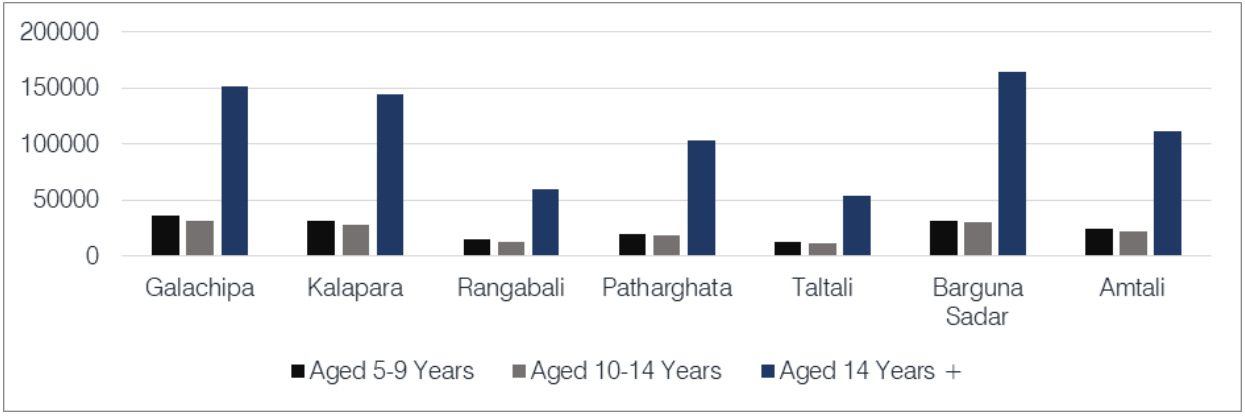


Figure 1-11: Distribution of Population by Age Groups

Population Growth Rates

Kalapara shows a growth rate of 1.72, highest among the seven, from 2001 to 2011 (**Table 1-8**). All upazilas show a positive growth rate except Taltali, for which a decrease in population was seen from 2001 to 2011.

Table 1-8: Annual and Decadal Growth Rates

Upazila	Growth Rate	1981-1991	1991-2001	2001-2011
Galachipa	0.81	16.55%	16.45%	8.43%
Kalapara	1.64	27.55%	15.53%	17.69%
Rangabali	1.72	16.55%	6.43%	18.64%
Patharghata	0.11	16.96%	20.34%	1.17%
Taltali	-0.94	37.93%	4.75%	5.76%
Barguna Sadar	0.94	14.81%	8.14%	9.99%
Amtali	1.15	37.93%	7.00%	3.54%

(Source: BBS, 2011)

Population Projection for 20 Years

Population projection was done for all the seven upazilas for 20 years (**Table 1-9**). From the projected population data, it is seen that Galachipa Upazila continues to grow fast from 2011 to 2041. The population grows to 346342 in 2041 from 258515 in 2011, a 34% increase in 20 years. However largest increase is seen in Kalapara Upazila where population rises 41% in 20 years. Lowest increase is projected for Barguna Sadar Upazila, only 26%.

Table 1-9: Population Projection for 20 Years for the Upazila

Upazila	Population				Projected Population		
	1981	1991	2001	2011	2021	2031	2041
Galachipa	175661	204733	238416	258515	289893	318117	346342
Kalapara	137138	174921	202078	237831	270301	303225	336148
Rangabali	69991	81574	86819	103003	111417	121845	132274
Patharghata	115113	134635	162025	163927	187383	204766	222149
Taltali	57591	79436	83208	88004	100812	110313	119814
Barguna Sadar	191384	219729	237613	261343	284458	307234	330010
Amtali	119626	165002	176549	182798	211259	231366	251472

1.3.6 Social Profile

Literacy Rate

In both urban and rural areas, the literacy rate of males is higher than female for the seven upazilas except in the rural areas of Patharghata and Kalapara (**Figure 1-12**). The literacy rate of females is equal to or greater than male literacy in these two areas. Existence of a large number of schools in these areas might be a reason for this.

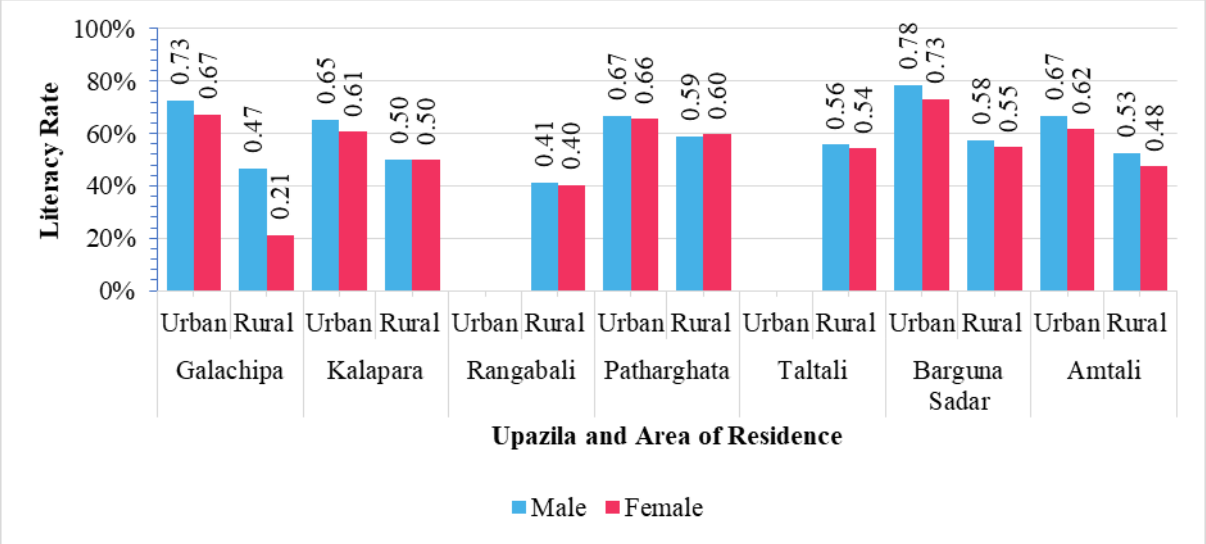


Figure 1-12: Literacy Rate of the Upazilas by Sex and Area of Residence

Population by Levels of Education

The distribution of population at different levels of education namely – Primary, Secondary and Tertiary are given below. It is seen that Barguna Sadar upazila, being a central area of the planning area and more urbanized, has the highest number of primary, secondary and tertiary students (**Table 1-10**, **Table 1-11**, and **Table 1-12**). Galachipa and Amtali upazilas are also ahead of others in these three categories. Although, there is a fair number of students in primary level in Rangabali, their entrance into secondary and tertiary levels is very low. Taltali has the lowest number of students in primary level.

Table 1-10: Distribution of Population at Primary Education Level

Upazila	Male	Female	Total
Galachipa	21871	21152	43024
Kalapara	1777	16688	34460
Rangabali	8715	8428	17142
Patharghata	9775	9311	19090
Taltali	4374	4290	8664
Barguna Sadar	26265	27056	53321
Amtali	9086	8910	17996

Table 1-11: Distribution of Population at Secondary Education Level

Upazila	Male	Female	Total
Galachipa	5074	5075	8080
Kalapara	4912	3345	8257
Rangabali	2022	2022	3220
Patharghata	3664	4612	8276
Taltali	2067	2529	4794
Barguna Sadar	7755	11287	19042
Amtali	4295	5254	9957

Table 1-12: Distribution of Population at Higher Secondary Education Level

Upazila	Male	Female	Total
Galachipa	1359	1216	2574
Kalapara	2187	1513	3700
Rangabali	541	484	1026
Patharghata	1560	1605	3165
Taltali	945	815	1760
Barguna Sadar	2454	1298	3752
Amtali	1962	1694	3656

After comparing the number of students in the three levels of education (**Figure 1-13**), it is seen that Barguna Sadar Upazila is ahead in all three categories. A large number of students enroll in primary and their entrance to secondary level is highest among the seven upazilas. A significant number of students is enrolled first in secondary level. Rangabali and Taltali

upazilas are lagging behind in education sector failing to provide the population with the facilities.

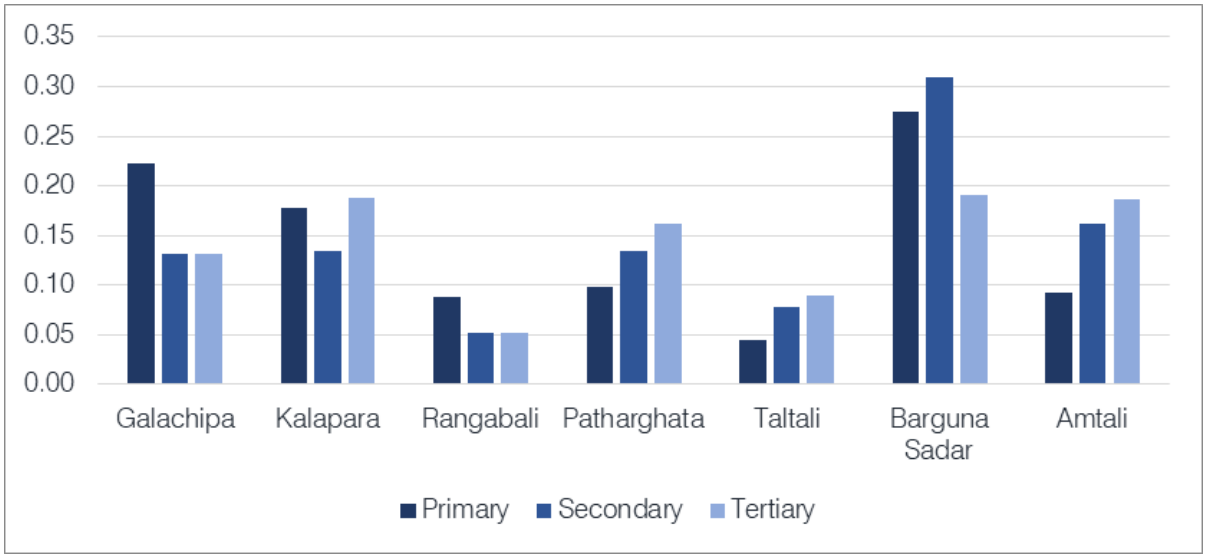


Figure 1-13: Percentage Distribution of Students in Levels Education

Housing Structure

The distribution of the main house of the general households by type of structure and residence is shown in **Figure 1-14**. It is seen that the overwhelmingly large percentage of the households have kutcha houses. Most of the Pucca houses of the households are in the urban area, Barguna Sadar having the largest percentage (14.3%) followed by Galachipa (8.35%). Structures of Rangabali mostly consist of Kutcha and Jhupri structure indicating a very low-level urbanization rate. Rangabali has the highest percentage of jhupri structures, little over than 36%. Rural areas have the most kutcha structures and lowest number of pucca structures.

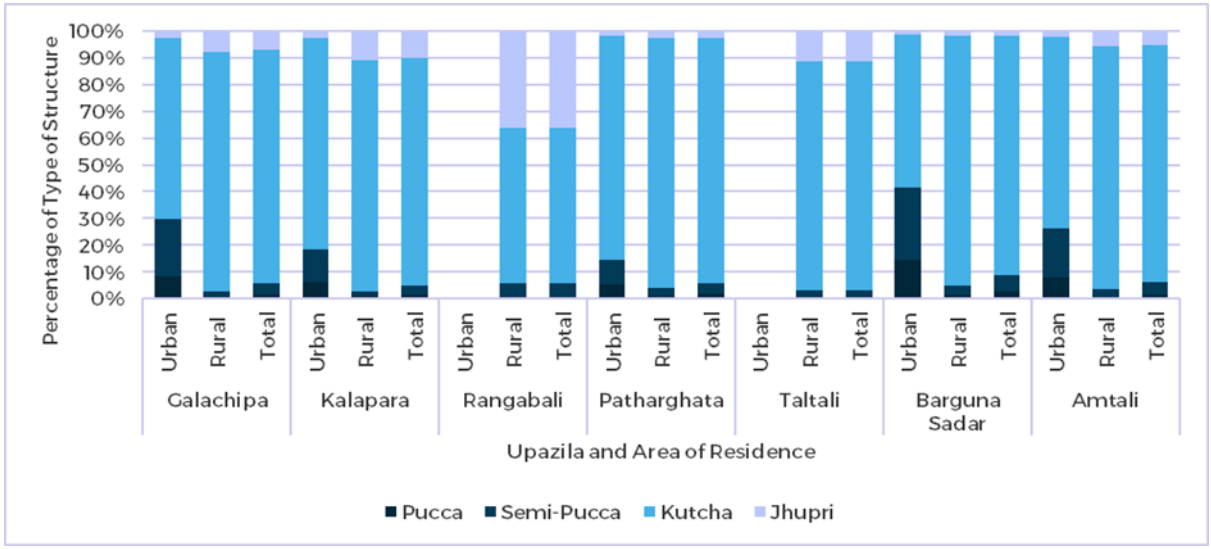


Figure 1-14: Distribution of Households by Type of Structure and Area of Residence

Sources of Drinking Water

Source of drinking water has been classified into three categories namely tap, tube-well, and others. According to census data of 2011, the upazilas are mainly served by Tube-Well for the purpose of drinking water in both urban and rural areas (**Figure 1-15)**. The facilities of tap water are found confined to the urban area only. Tube-Well is used in 83.32% of the households whereas tap water only in 1.79%. 91% of all water sources in rural areas are tube-well.

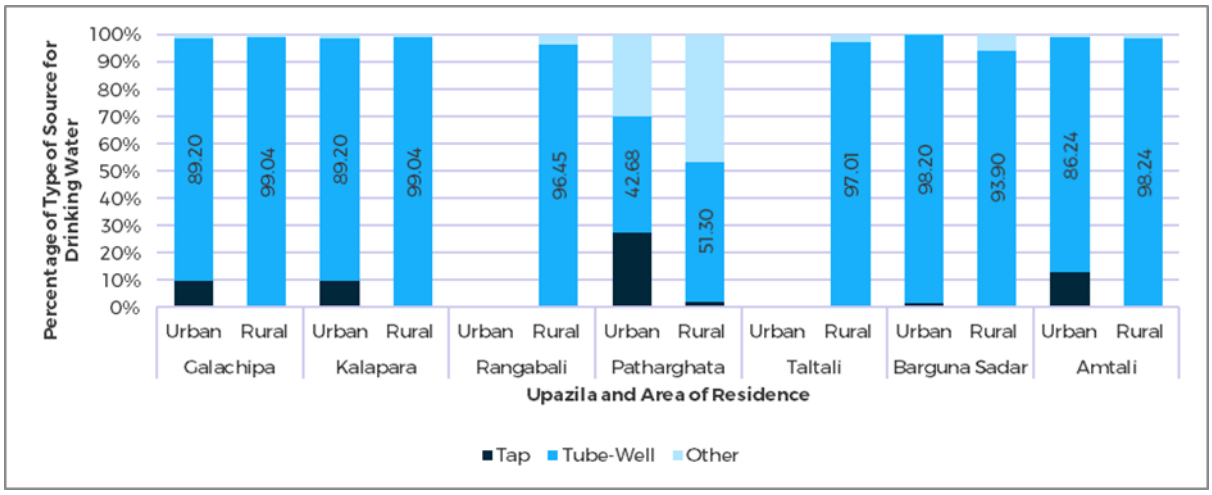


Figure 1-15: Distribution of Type of Sources of Drinking Water by Area of Residence

Toilet Facilities

Both urban and rural areas suffer from a lack of sanitary toilet facilities to some extent. In the case of urban areas, the percentage is equal to or lower than 1% (**Figure 1-16**). However, in rural areas, the situation deteriorates. 13% of the general households of Rangabali upazila do not have any toilet facilities. 6% households of Galachipa, 5% of households of Kalapara, 4% of households of Taltali, 3% of households of Barguna Sadar, and 1% of households of Patharghata do not have toilet facilities. Most toilet facilities in both urban and rural areas seem to be sanitary with no water seal.

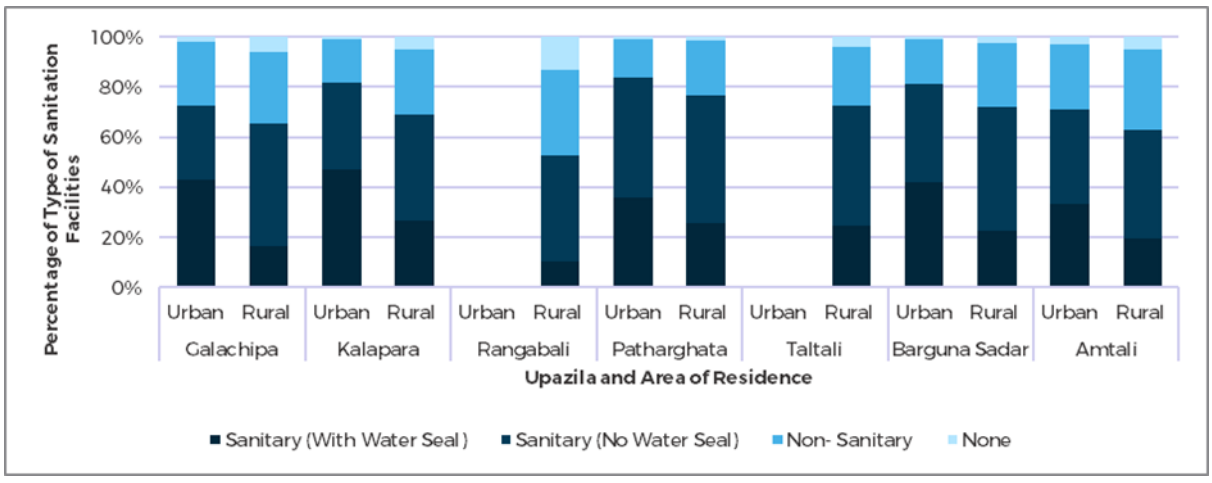


Figure 1-16: Distribution of General Households by Toilet Facilities

Electricity Connection

The disparity between urban and rural areas of Patuakhali and Barguna district gets apparent when the percentage of households with electricity connection in urban and rural areas are compared with each other (**Figure 1-17**). 66% of the households in urban areas have electricity connection while only 22% of the households in rural areas have that facility. Barguna Sadar has the highest percentage of urban electricity connection (84%) while Patharghata upazila has the lowest (54%). In rural areas, Kalapara has the highest percentage of electricity connections (32%) while Galachipa and Amtali both have only 17% of the households with electricity connection.

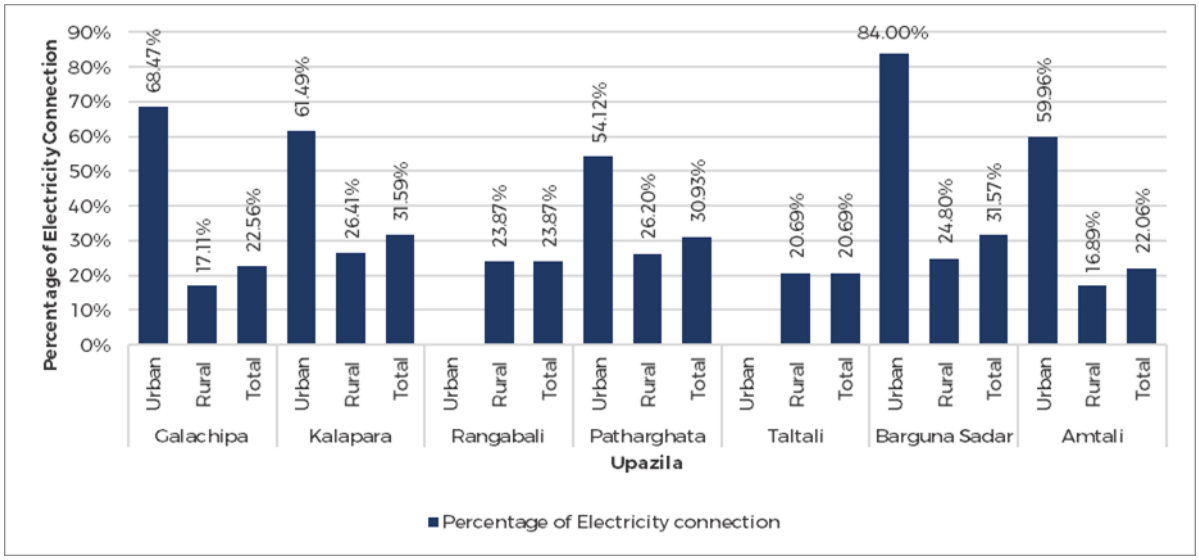


Figure 1-17: Distribution of Household by Electricity Connection and Area of Residence

Educational Institutions

The highest number of education institutes is in Barguna Sadar (**Table 1-13**), the reason of this upazila being ahead in education facilities. Galachipa comes second and Kalapara third. When the population per educational institutes is examined, it is apparent that colleges in the planning area are not adequate to serve the population. Especially Rangabali and Taltali upazilas are the most neglected having no colleges.

Table 1-13: Number of Educational Institutions and Per Institution Population

Upazila	Primary	Secondary	College	Popⁿ per primary school	Popⁿ per secondary school	Popⁿ per college
Galachipa	175	40	10	1476	6456	25852
Kalapara	161	33	6	1477	7207	39639
Rangabali	70	16	0	1476	6456	N/A
Patharghata	138	29	5	1188	5653	32785
Taltali	67	19	0	1321	4751	N/A
Barguna Sadar	205	59	6	1275	4430	43557
Amtali	138	38	7	1321	4751	26114

Technical and Vocational Institutions

The number of technical and vocational institutions is negligible in the planning area (**Table 1-14**). There are only four in Barguna Sadar upazila, three in Kalapara and one in Galachipa.

Table 1-14: Number of Technical and Vocational Institutions

Upazila	Technical and Vocational
Galachipa	1
Kalapara	3
Rangabali	0
Patharghata	0
Taltali	0
Barguna Sadar	4
Amtali	0

Health Care Facilities

Barguna Sadar upazila has the largest government health complex with 100 beds and the greatest number of staffs (**Table 1-15**).

Table 1-15: Number of Government Health Complex and Health Personnel 2011

Upazila	Number of beds	Number of doctors	Number of nurses	Number of technicians	Number of other staffs
Amtali	80	4	15	12	11
Barguna Sadar	100	9	23	8	20
Patharghata	50	7	7	2	9
Galachipa	50	7	24	1	5
Kalapara	72	13	18	6	135

There are not many private health facilities in the planning area (**Table 1-16**). Barguna Sadar upazila has seven private hospitals and clinics and Patharghata has only three. Other upazilas do not have any private health facilities.

Table 1-16: Number of Private Hospitals/ Clinics

Upazila	Number of centers	Number of beds	Number of doctors	Number of nurses	Number of technicians	Number of other staffs
Amtali	0	0	0	0	0	0
Taltali	0	0	0	0	0	0
Barguna Sadar	7	30	6	11	12	37
Patharghata	3	30	0	3	3	9
Galachipa	0	0	0	0	0	0
Rangabali	0	0	0	0	0	0
Kalapara	0	0	0	0	0	0

1.3.7 Economic Profile

Population by Categories of Employment

From **Figure 1-18**, it is seen that females do most of the household work while the participation of male population is at minimum. Male population is largely occupied with jobs outside house. Participation of females in outside employment is very low. 77% of the male population is occupied outside the house while only 5% of the females are employed outside their home. Totally opposite is seen in household work where participation of females is 74% while that of male is only 4%.

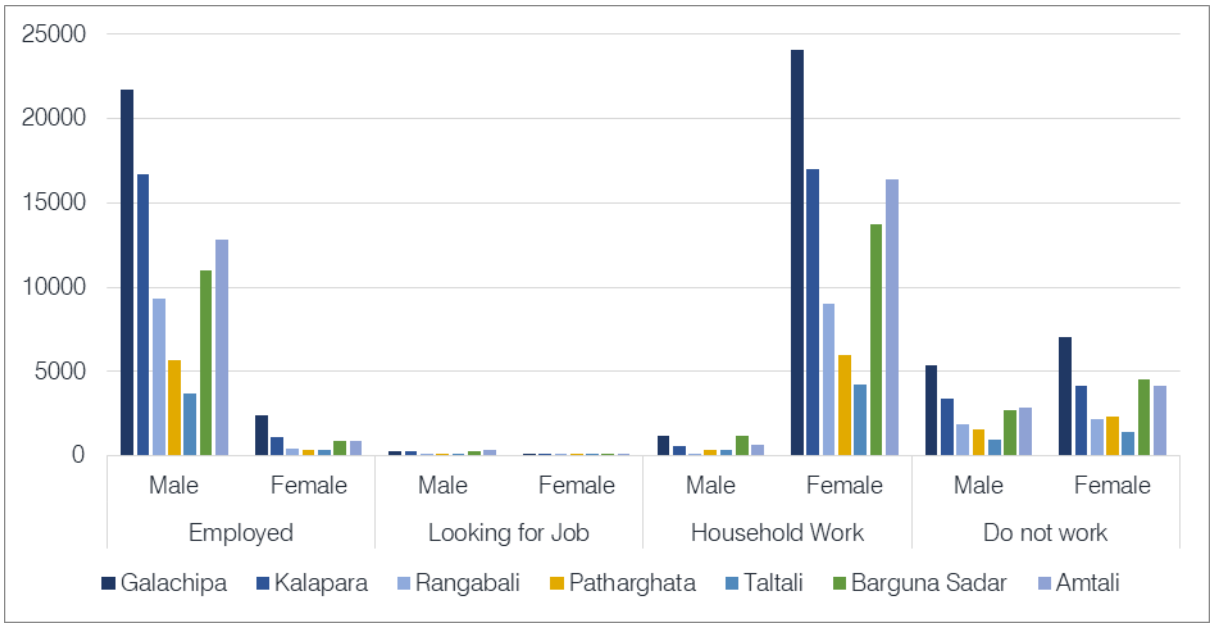


Figure 1-18: Employment Status of Working Population by Sex

Comparing overall working status of the upazilas (**Figure 1-19**), it is seen that large proportion of the population is employed. Highest unemployment rate is seen in Patharghata, Barguna Sadar and Taltali upazilas. Kalapara and Rangabali upazilas have the highest employment rate. Household work as expected is high in all upazilas.

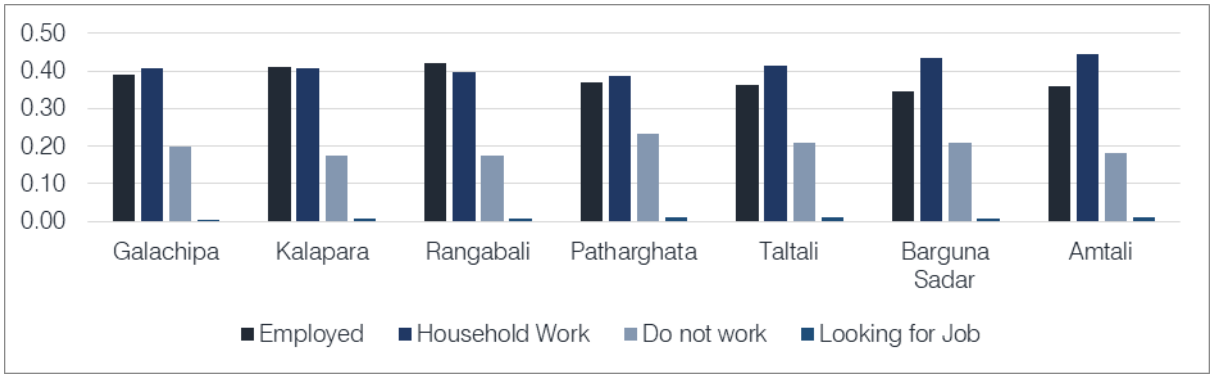


Figure 1-19: Employment Status of Working Population

According to the Economic Census of 2013, the non-farm economic activities (excluding the Section-T (Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use) and Section-U (Activities of extraterritorial organizations and bodies)) of Bangladesh have been divided into 18 broad economic sectors (BBS, 2013). At the time of the previous Economic Census in 2003, the number of sectors was 13. As such, for the purpose of comparing employment data from the 2003 and 2013 census, the sectors of 2013 were reclassified to match that of 2003. Total Persons Engaged (TPE) was taken as the employment data for the sectors. The distribution of employment, represented with the Total Persons Engaged (TPE) is shown in the table below:

Table 1-17: Employment Distribution of the Planning Area by Upazila

Upazila	Mining and Quarrying	Manufacturing	Electricity, Gas and Water	[illegible]	Wholesale and Retail Trade	Hotel and Restaurant	Transportation, Storage, and Communication	Bank, Insurance and	Real Estate and renting	Public Administration and [illegible]	Education	Health and Social Work	Community, Social and [illegible]
Galachipa	2	1705	0	9	10465	3390	765	705	0	531	2952	235	4320
Kalapara	13	2247	102	2	5180	1816	233	898	13	811	2823	229	1987
Rangabali	0	426	0	0	4362	1227	189	302	0	168	882	69	1123
Patharghata	0	1622	108	0	3894	1317	144	601	0	443	1734	219	1964
Taltali	0	292	0	0	2792	522	113	412	0	120	1002	81	1148
Barguna Sadar	0	2365	129	46	4850	2263	231	1693	46	1119	3542	490	2415
Amtali	0	1699	22	0	4168	1807	200	914	0	600	2348	329	2227

(Source: Economic Census, 2013)

Examining the data for employment of the upazilas and comparing it with national employment, it was found that Galachipa upazila contributes most to the national employment among the seven. It constitutes 0.1% of the whole national employment with its total TPE count of 25,079. The lowest contributor is Taltali upazila (0.03%) (TPE – 6,482). The sorted list in decreasing order of total employment is Galachipa, Barguna Sadar, Kalapara, Amtali, Patharghata, Rangabali, and Taltali.

Upazila Employment Comparison

Lowest number of employment compared to upazila total is seen in four sectors namely Mining and Quarrying, Electricity, Gas and Water Supply, Construction, and Real Estate and Renting. Among the seven upazilas employment is under 0.08% in Mining and Quarrying sector (National: 0.26%), in Electricity, Gas and Water Supply under 0.7% with only Patharghata above it (National: 0.29%), in Construction under 0.3% (National: 34%), and in Real Estate and Renting under 0.3% which is however more than national employment percentage of 0.18% (**ANNEXURE-I**: **Table-5**).

Wholesale and Retail Trade sector holds the highest percentage of employment (34.94%) among the seven upazilas (figure 1.18) followed by Education sector (14.95%), Community, Social and Personal Services sector (14.86%), Hotel and Restaurant sector (12.07%), and Manufacturing sector (10.13%) (**ANNEXURE-I: Table-6**).

Galachipa upazila has the highest employment in the Wholesale and Retail Trade sector (29%), Community, Social and Personal Services sector (28%), and Hotel and Restaurant sector (27%). Highest employment in both Education and Manufacturing sector is in Barguna Sadar upazila (23%). Lowest employment in these sectors are: Taltali upazila in Wholesale and Retail Trade sector (8%), Rangabali upazila in Education sector (6%) and Community, Social and Personal Services sector (7%), Taltali in both Hotel and Restaurant sector (4%) and Manufacturing sector (3%) (**ANNEXURE-I: Table-6**).

From **Table 1-18**, which shows the top and bottom upazilas in the sectors constituting the highest number of employment. It is apparent from the table that Taltali and Rangabali have the lowest number of employment in these sectors.

Table 1-18: Top and Bottom Upazilas in Terms of Employment

Sectors	Top 2 Upazila in terms of employment	Bottom 2 Upazila in terms of employment
Wholesale and Retail Trade	Galachipa, Kalapara	Taltali, Patharghata
Education	Barguna Sadar, Galachipa	Rangabali, Taltali
Community, Social and Personal services	Galachipa, Barguna Sadar	Rangabali, Taltali
Hotel and Restaurant	Galachipa, Barguna Sadar	Taltali, Rangabali
Manufacturing	Barguna Sadar, Kalapara	Taltali, Rangabali

Sectoral Employment Comparison

To understand how employment is distributed in the economic sectors, each upazila has to be explored individually. Galachipa upazila of Patuakhali district, which has the highest employment among the seven, has the highest employment in Wholesale and Retail Trade (41.73%), followed by Community, Social and Personal services (17.23%), Hotel and Restaurant (13.52%), and Education (11.77%) (**Figure 1-20**).

Employment in Wholesale and Retail Trade for Kalapara upazila is lower than Galachipa (31.67%). Education constitutes 17.26% and Manufacturing 13.74% of the total employment of Kalapara Upazila.

Wholesale and Retail Trade sector accounts for almost 50% of the total employment of Rangabali upazila. Other notable sectors are Hotel and Restaurant (14.03%) and Community, Social and Personal Services (12.84%).

About 32% of Patharghata upazila's employment fall in Wholesale and Retail Trade sector. Community, Social and Personal Services, Education, and Electricity, Gas and Water Supply are among the notable sectors.

Taltali upazila has the highest employment in Whole Sale and Retail Trade (43%), also followed by Community, Social and Personal services (18%), and Education (15%) (**Figure 1-20**).

Percentage Employment in Wholesale and Retail Trade sectors is 25% in Barguna Sadar upazila highest among all the sectors, however the lowest among the seven upazila. Other sectors' percentage share of the upazila's total employment is below 20%.

Amtali upazila has 29% employment in Wholesale and Retail Trade, 16% of employment in Education and Community, Social and Personal services sector and 12% in Manufacturing.

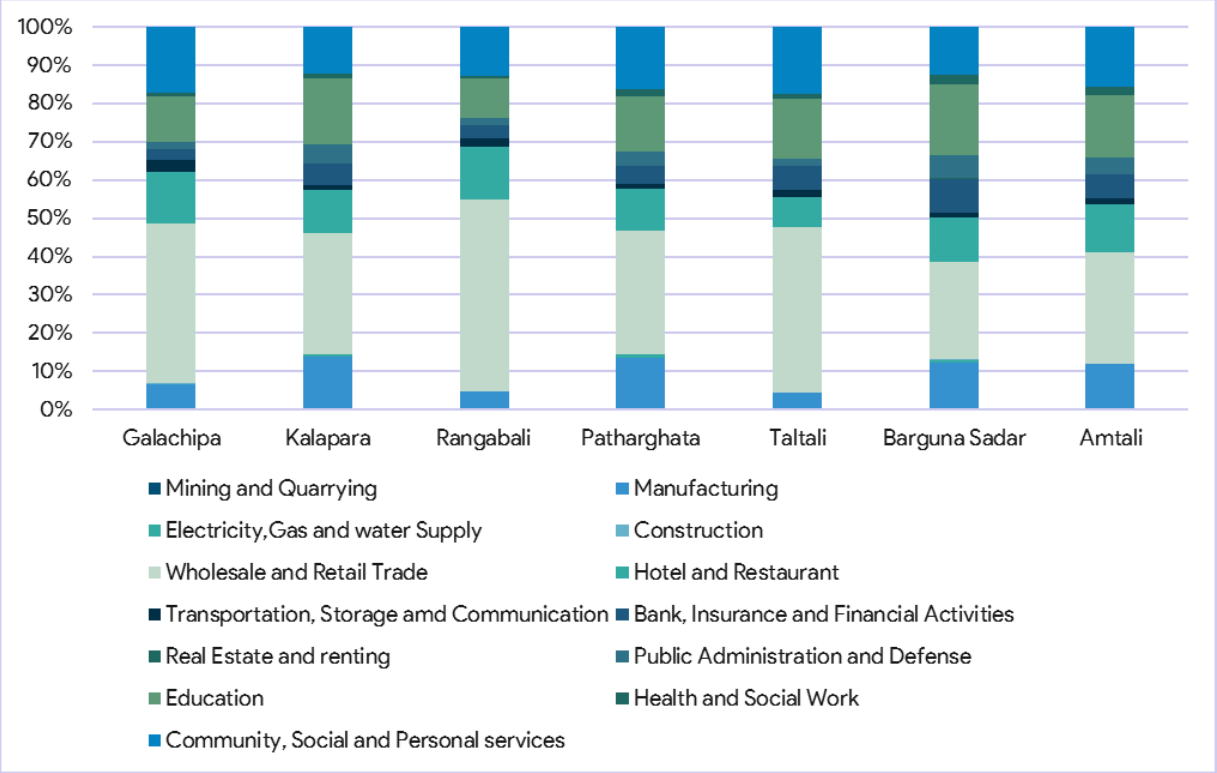


Figure 1-20: Composition of Employment in the Planning Area

1.3.8 Agricultural Profile

Bangladesh is predominantly an agricultural country (BBS, 2015). Most people earn their living from agriculture (Bureau of South and Central Asian Affairs, 2008). The contribution to the national GDP of agriculture for the fiscal year of 2017-2018 was 13.82%, third largest among all the sectors. The growth rate of this sector was 11.02% in the fiscal year of 2017-2018 (BBS, 2018). As such, it is essential to study the agricultural profile of an area for preparing a regional plan.

Agricultural Land Use

A look at the land use of the upazilas reveals that Kalapara has the most single cropped area among the seven followed by Taltali (**Figure 1-21**). Galachipa comes first in terms of double-cropped area and in second is Kalapara followed by Rangabali and Patharghata. Barguna Sadar upazila is contained the most triple cropped area followed by Rangabali upazila. Net cropped area is highest in Kalapara followed by Rangabali and Galachipa.

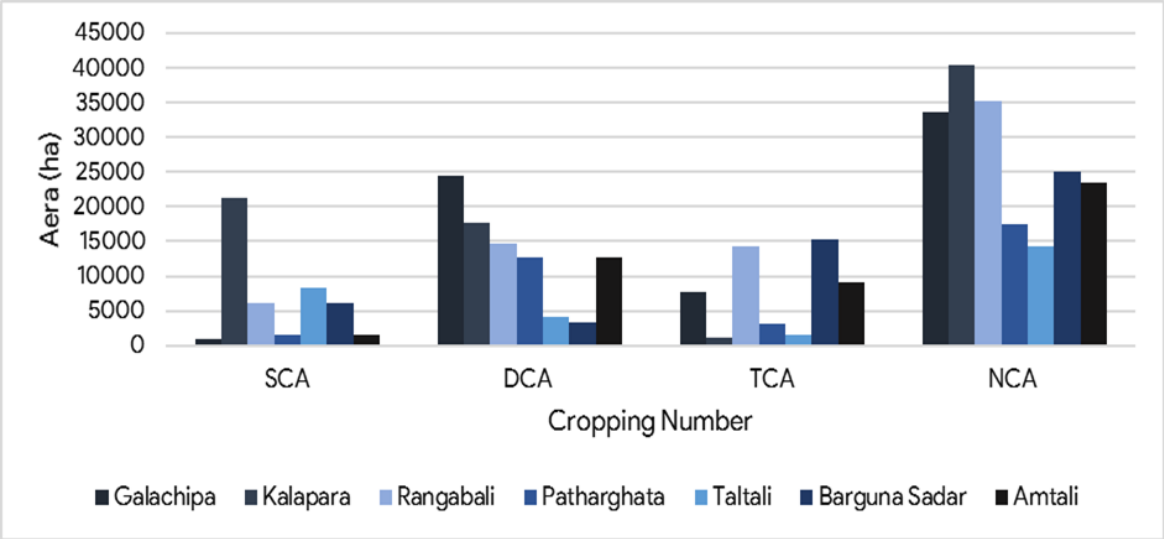


Figure 1-21: Agricultural Land Use of the Planning Area

Dominant Crop Pattern

Cropping pattern is the pattern of crops for a given piece of land or cropping pattern means the proportion of area under various crops at a point of time in a unit area or it indicates the yearly sequence and spatial arrangements of crops followed in an area.

Single T. Aman is the most dominant crop in the Barisal Region. The highest area under T. Aman cropping in Barisal Region is recorded in Kalapara upazila where it constitutes 53.12% of its NCA (**Table 1-19**). However, Taltali upazila of Barguna district has allocated its highest area for the single T. Aman pattern and it is 57.50% of its NCA. Lowest T. Aman cropping is in Galachipa upazila. Soil salinity has long been a problem in these upazilas along with other saline-prone areas which is a limiting factor for crop intensification.

Table 1-19: Dominant Crop Area of the Upazilas

Upazila	Area (ha)	% of upazila Net Cropped Area (NCA)
Galachipa	1000	3.04
Kalapara	21300	53.12
Rangabali	6200	18.18
Patharghata	1500	8.54
Taltali	8200	57.5
Barguna Sadar	6100	24.42
Amtali	1500	6.39
(Fallow–Fallow– T. Aman cropping pattern)		

(Source: Ibrahim, Zaman, Mostafizur, & Shahidullah, 2017)

Cropping Diversity and Cropping Intensity

Cropping Diversity indicates the percentage of total cropped area to the total area. Formula for calculating the index of Cropping Diversity is as follows:

$$Cropping\ Diversity = \frac{Gross\ Cropped\ Area}{\frac{Total\ Area}{N}} \times 100$$

Intensity of Cropping is the percentage of total cropped area in comparison with net cropped area. Cropping intensity refers to increase of a number of crops from the same field during one agriculture year. It can be calculated with the following formula:

$$Cropping\ Intensity = \frac{Total\ Cropped\ Area}{Net\ Cropped\ Area} \times 100$$

The highest number of crop pattern is detected in Kalapara upazila and lowest in Taltali upazila (**Table 1-20**). Diversity index is inversely related to the crop pattern. The upazilas having a lower number of cropping patterns were related to either salinity or waterlogging or both (FAO, 1988). The lowest diversity index is seen in Taltali upazila and highest in Galachipa.

Table 1-20: Crop Pattern, Diversity Index and Crop Intensity

Upazila	No. of the identified pattern	No. of crop	Diversity index for cropping pattern	Crop diversity index (CDI)
Galachipa	28	17	0.918	0.965
Kalapara	31	19	0.662	0.821
Rangabali	18	13	0.836	0.925
Patharghata	10	9	0.712	0.865
Taltali	8	8	0.598	0.786
Barguna Sadar	15	11	0.745	0.884
Amtali	15	13	0.887	0.95

(Source: Ibrahim, Zaman, Mostafizur, & Shahidullah, 2017)

Cropping intensity is the highest in Barguna Sadar upazila (236%) compared to the Barisal Region, meaning that the total cropped area is used more than 2.36 times for cropping and harvesting (**Figure 1-22**). Amtali is second in terms of Cropping Intensity. Lowest cropping intensity is seen in Kalapara and Taltali upazila.

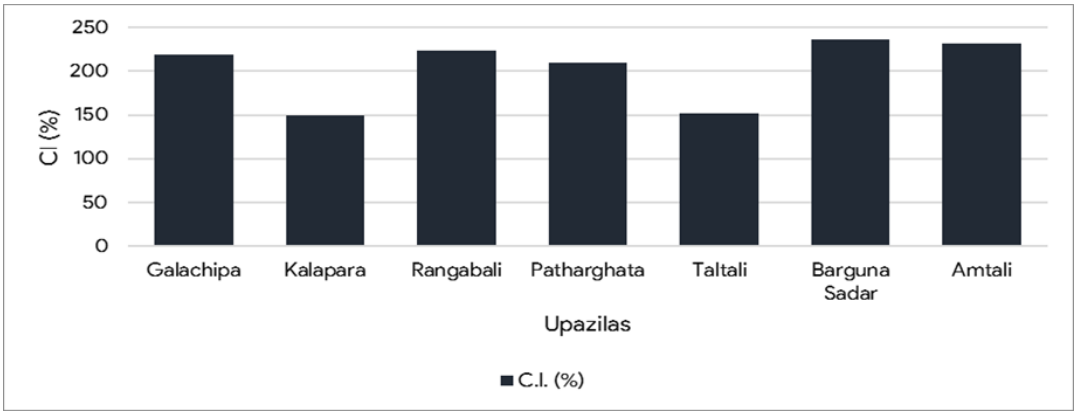


Figure 1-22: Cropping Intensity of the Planning Area

2. VULNERABILITIES AND CHALLENGES

2.1 Introduction

The vulnerability context may be explained in terms of problems that people face, which affect their asset base and their choices and income. One unique feature of the Payra-Kuakata region is its distinct vulnerabilities that many people face. These are more varied and intensive than those faced by even poorer and more vulnerable inland communities. These vulnerabilities are important manifestations of the poverty found in the coastal zone. People here live in an extremely dynamic estuarine environment facing such threats as: cyclone and storm surge, land erosion, flood, drainage congestion, salinity intrusion, drought, tectonic process and deteriorating coastal ecosystems. Besides, there are threats of climate change and upstream land and water uses. These threats affect almost every aspect of life and limit livelihood choices of the people. These vulnerabilities create a context of insecurity, which in turn, discourage investments, limit economic activities and squeeze employment opportunities. Scarce public, private and community resources are consumed in mitigation efforts and not much is left for expanding economic activities and generating employment.

2.2 Cyclone and Storm Surge

Records of last 200 years show that at least 70 major cyclones hit the coastal belt of Bangladesh. The Khulna/Sundarban and Barisal-Noakhali coasts received about 30 percent of the cyclones. **Figure 2-1** shows the cyclone affected areas in Bangladesh. Payra-Kuakata region falls in the high risk area. In order to minimize fatal consequences of cyclones, construction of cyclone shelters commenced in the 1960s and subsequently increased following the severe cyclone in 1991. The existing shelter capacity can accommodate only about a quarter of the population at risk. In the backdrop of increasing population, 100 additional cyclone shelters are needed annually. An effective disaster warning system is being developed. A comprehensive disaster management program (CDMP), under the auspices of the Disaster Management Bureau (DMB) and the Bangladesh Red Crescent Society, is being implemented.

2.3 Land Erosion

Land erosion is a common natural phenomenon in the coastal zone. Massive changes have occurred in the coastline over the last two centuries due to land erosion, coupled with land accretion. Boundaries of islands undergo major changes due to land erosion and simultaneous accretion. Erosion victims are a disadvantaged group in coastal areas subject to both social and economic distress. Besides the erosion of the riverbanks, the foreshore and the embankment systems are posing a continuous problem in the coastal areas. This exposes interior lands to the threats of cyclone surges and salt-water intrusion. River erosion has taken a serious turn in Patuakhali and Barguna, districts, and many families have become homeless. Some 30,000 houses, many commercial establishments, hundreds of educational institutions, and over thousands of hectares of cropland have been devoured by different rivers in the southern districts during last 10 years.

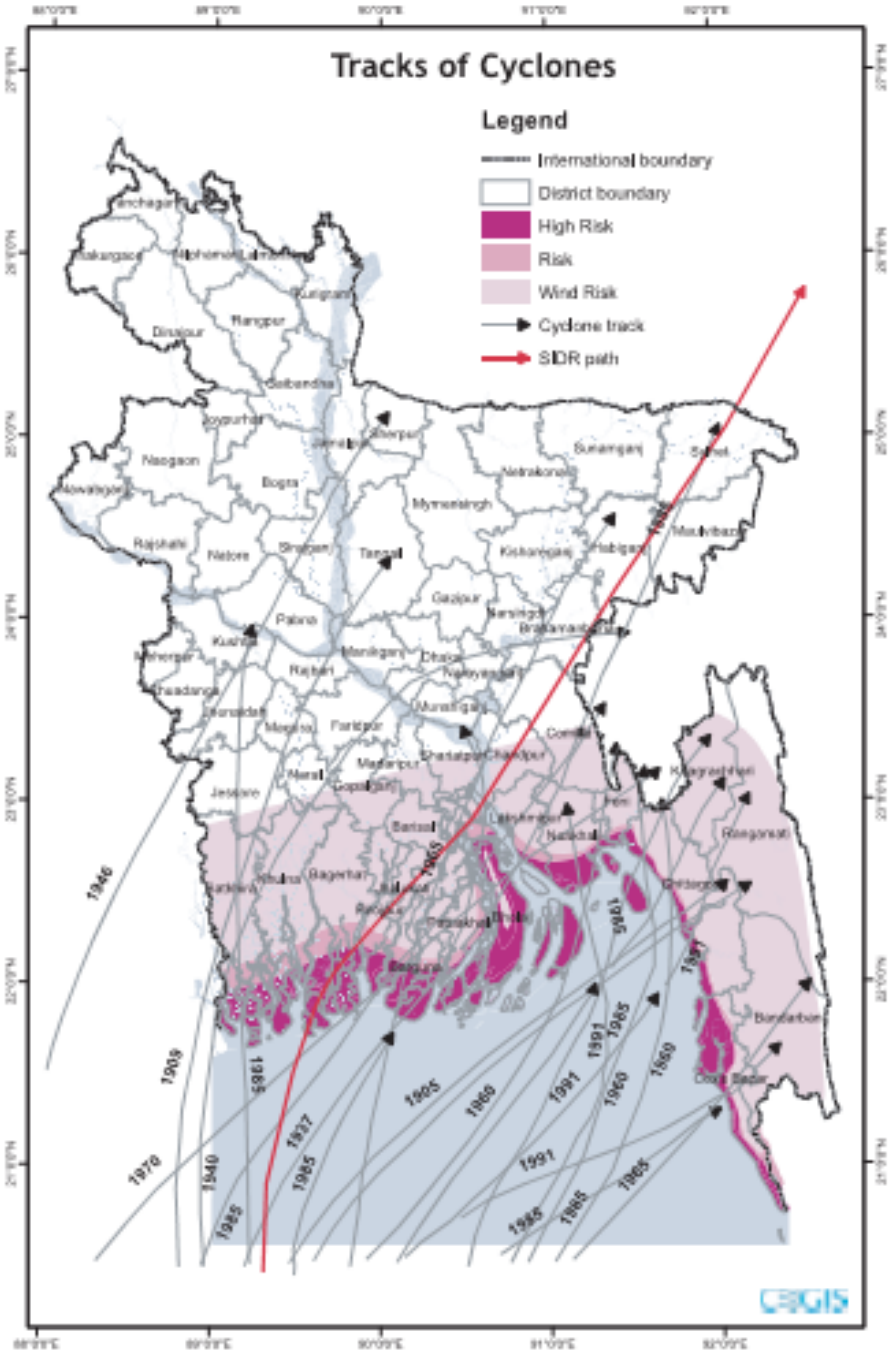


Figure 2-1: Cyclone Affected Areas with Risk Levels

(Source: BCCSAP, 2009)

2.4 Water Logging and Drainage Congestion

Water logging is especially experienced in the southwest (Khulna-Jessore) and south- central (Noakhali-Lakshmipur) areas. In the southwest, Khulna-Jessore Drainage Rehabilitation Project (KJDRP) was taken to reduce drainage congestion. The concept of Tidal River Management (TRM) has been reinforced from this project. Localized drainage congestions are reported throughout the coastal zone. All congestions affect livelihoods because of crop damage, water borne diseases, etc. Most affected districts are Bhola, Patuakhali, Pirojpur and Barguna.

2.5 Salinity Intrusion

Water and soil salinity is a common hazard in many parts of the coastal zone. Agricultural activities suffer greatly. Seventy percent of 2.35 million hectares within the Khulna and Barisal Divisions is affected by different degree of soil salinity. This reduces the crop area. It restricts the cultivation of aus (summer rice), boro (dry season rice) and other rabi (dry season) crops. There is a seasonal salinity interface in the estuaries, with the threshold limit for agriculture moving further inward from the coast in May in the southern part of the coastal zone.

In the southwest region, surface water salinity has been accentuated by the reduction in the dry season upland flows entering the Gorai distributaries. Salinity now reaches as far as Khulna city, creating problems to normal agricultural practices and affecting the supply of clean water for industrial use.

Coastal polders were designed to prevent salt-water intrusion. Many polders have lost their function because of both undesired breaching causing crop damage, and "desired breaching" facilitating shrimp farming. Land use conflicts exist in the area. Salinity intrusion inhibits industrialization. For example, a number of industrial units in Khulna are facing shortage of fresh water during the dry season. As a consequence, no new heavy industry has been set up in the recent years in the Khulna region despite increasing infrastructure facilities (road, seaport, etc.).

2.6 Drinking Water & Arsenic Contamination

Lack of safe drinking water has been identified as the number one issue in the daily life of the coastal population. The water supply sector has achieved commendable success over the last few decades; overall about 95 percent of the population now has access to water from tube-wells, taps or ring-wells. Rural water supply is mainly dependent on tube-wells. Pond water is also in use, especially where groundwater is either saline or beyond affordability. There are 316,686 tube-wells in the coastal zone, which is 29 percent of total tube-wells in the country. According to latest DPHE data (unpublished DPHE database), the tubewell-population ratio is slightly higher in the coastal zone: 111 persons per running tubewell, compared to 115 nationally. The districts in the region, that is, Patuakhali and Barguna have lower than average density of tube-wells nationally. But in recent years, groundwater-based water supply in coastal areas is suffering from a number of major problems, main ones being arsenic contamination, lowering of the water table, salinity, and non-availability of suitable aquifers.

Most of the coastal districts are affected by arsenic contamination. The UNICEF-funded DPHE program tested 51,000 tubewells in 61 districts and found arsenic in 48 districts. Around 29 percent tube-wells were contaminated with arsenic above the permissible level. The Government has initiated extensive program of tubewell testing and public awareness of the possible danger. Low-cost preventive measures are known but yet to be available at the household level all over the coast. Rainwater harvesting and pond sand filtering (PSF) are being advocated and are practiced in some areas.

2.7 Ecosystem Degradation

The coastal zone of Bangladesh experiences extensive ecosystem degradation. Some of the interventions to cause degradation are: drainage for agriculture; dredging and canalization for navigation and flood protection; filling for solid waste disposal; land use for commercial, industrial or residential purposes; conversion of land for aquaculture; construction of dykes for flood control and irrigation; discharge of pesticides and herbicides; domestic and industrial waste; agricultural runoff and sediment; deep channels and other structures; hydrological alternation by canals; roads and other structures; and subsidence due to extraction of groundwater.

Although the rate of destruction of mangroves is less as compared to the overall destruction of forests, comparison of aerial photographs from mid-eighties to early nineties shows destruction at annual rate over 2,000 ha (UNEP website). Factors responsible for the destruction of the mangrove forests are the removal of forest products for fuel, high pressure of grazing, haphazard fishing activities, human settlement, salt production and shrimp farming. Some initiatives have been taken for conservation and restoration of the ecosystems. But these are not linked with livelihoods of traditional users. Comprehensive ecosystem management plan does not exist.

2.8 Climate Change

Given the extremely low elevation of the coastal zone, the threat of sea level rise is high. The likely impacts of climate change are:

- change in water levels and induced inundation and water logging
- increased salinity in ground and surface water, and corresponding impact on soil salinity
- increased coastal morphological dynamics (subsidence, erosion and accretion)
- increased incidence of natural hazards.

Drainage congestion may become an even more serious threat than higher flood risks. Due to siltation and poor maintenance of the drainage channel networks in many parts of the coastal zone, drainage congestion is already a grave problem, and the problem is likely to increase considerably.

Saline water intrusion is highly seasonal. It is at its minimum during the monsoon (June-October) when the main rivers discharge about 80 percent of the annual fresh water flow. In dry season months, the saline front begins to penetrate inland, and the affected areas rise sharply from 10 percent in the monsoon to over 40 percent. Extreme weather events induced by climate change, especially low flow conditions in the dry season, will accentuate the saline intrusion in the coastal areas.

Climate change is expected to increase the intensity of cyclones, resulting in the penetration of storm surges further inland, causing higher damages. Coastal polders offer the first line of defense against sea level rise. But maintenance of sea dykes of polders has to be continued.

3. NATIONAL POLICIES AND STRATEGIES FOR COASTAL AREA DEVELOPMENT AND MANAGEMENT

3.1 Introduction

Coastal zone of Bangladesh includes 19 districts facing the Bay of Bengal or near to the Sea, and the Bay's exclusive economic zone (EEZ) is commonly seen as a region with many vulnerabilities. The Government of Bangladesh has already identified the zone as "vulnerable to adverse ecological processes" (ERD, 2003). But the zone possesses immense possibility. Coastal zones are rich in natural resources and its economy is mainly natural resources based. To reduce the free-riding problem of natural resources of this zone, the government has developed several strategies, plans, policies and acts. The following are a brief on strategy, plan, policy and acts related to the coastal area management.

3.2 Perspective Plan 2021-2041

'Making Vision 2041 a reality: Perspective Plan of Bangladesh 2021-2041' (PP2041) is a long term Development Vision charting a path for two decades of transformation towards becoming an upper middle income country by 2031 and a prosperous country by 2041. The vision document consists of twelve chapters- including topics ranging from governance, human development, industry and trade, agriculture, power and energy to ICT and climate change and environment. The Strategic Goals and milestones of the Plan include industrialization with export-oriented manufacturing; paradigm shifts in Agriculture to enhance productivity, a service sector of the future-providing the bridge for the transformation of the rural agrarian economy to a primarily industrial and digital economy; the urban transition - an essential part of the strategy to move to a high-income economy primarily motivated by the agenda of the government -"our village, our town"; efficient energy and infrastructure; building a Bangladesh resilient to climate change and other environmental challenges; and establishing Bangladesh as a knowledge hub country. It also includes macroeconomic framework which gives targets in each financial year of important macro indicators in more detail.

The PP2041 recognizes that urbanization and economic growth will go together in the future because of high positive correlation between urbanization and development. The strategic objectives of the plan for the urban sector are to have an urban physical environment where there is a proper balance between ecology, the natural environment and needs of the urban population as well as an urban service industry that provides quality urban infrastructure and urban services on demand and in good quality. The PP2041 Vision for the environmental sector is to ensure a proper balance between ecology, the natural environment and needs of the population. In particular, the productivity of land is preserved, forest resources are conserved and enriched, bio-diversity is improved and water resources are properly managed to prevent flooding and water shortages, and the country is equipped to respond fully and quickly to any incidence of natural disasters.

3.3 8th Five Year Plan (July 2020-June 2025)

The Eighth Five Year Plan centers around six core themes, which are (i) rapid recovery from COVID-19; (ii) GDP growth acceleration, employment generation and rapid poverty reduction; (iii) a broad-based strategy of inclusiveness; (iv) a sustainable development pathway that is resilient to disaster and climate change; (v) improvement of critical institutions necessary to lead the economy to Upper Middle Income Country status by 2031; and (vi) attaining SDGs targets and mitigating the impact of LDC graduation. The plan document has been organized around two broad parts. The first part delineates the macroeconomic framework for the plan period (July 2020-June 2025) along with strategic directions and policy framework for promoting inclusiveness, reducing poverty and inequality. It also describes the resource envelop and overall fiscal management tools of the government and specifies the Development Results Framework (DRF) for proper monitoring and evaluation. The second part sets out the sectoral strategies for thirteen sectors (except defense) with some specific targets to attain by FY 2025. The ministries/divisions are expected to follow these sectoral strategies and action measures while preparing their sector specific projects and programs to achieve their respective targets set in the Eighth Five Year Plan.

In the area of urban development, the focus of the plan is on promoting balanced urbanization with particular attention to secondary cities, promotion of Economic Development Corridor (EDC), development of infrastructure and services through public-private partnerships, and urban land development and management to promote sustainable land-use planning. The Eighth Plan also envisions a sustainable development agenda, and highlights the need to address the environment, climate change adaptation and mitigation, and disaster risk reduction in a broader development context, recognizing the environmental concerns as an added challenge to reducing poverty, hunger, diseases and facilitating growth.

3.4 Bangladesh National Conservation Strategy (2016-2031)

This strategy is the key government document to guide natural resource use and conservation. The main goal of this strategy is to foster development through conservation, development and enhancement of natural resources in the country within the framework of Sustainable Development Goals (SDG). Sectors under this strategy are human resources, gender, health and sanitation, disaster and disaster management, environment and international obligations, environmental education and awareness, information and communication technology, monitoring and coordination mechanism for NCS implementation, legal aspects of NCS etc.

3.5 Perspective Plan 2010-2021

The government has developed a Perspective Plan covering the period from 2010 to 2021. The aim of this plan is to implement Vision 2021. Ensuring food security and environment-friendly development have been particularly given emphasized in the Perspective Plan. This would be translated through successive five-year plans. Priority attention has also been given on coastal agriculture.

3.6 7th Five Year Plan (7thFYP) 2016-2021

The 7th Five Year Plan (7thFYP) has been developed as a strategic and indicative plan that provides strategy, framework and guidelines for reducing regional disparity, developing human capacity, managing land constraints, using natural resources, increasing agricultural productivity, household income and employment, and ensuring food security. "Ensuring food security" has been outlined as a key strategy in the 7thFYP. In the case of food production, climate change adaptation strategy in the agriculture sector will be prioritized. Particular attention would be given to develop and adopt technologies and improved agricultural practices in ecologically vulnerable areas such as saline prone areas, flood-prone locations, and drought-prone locations. Special emphasis is given to the development of agro-processing and non-farm economic activities in the backward regions. Master Plan for agricultural development in the southern region of Bangladesh has particularly been mentioned for integrated development in agriculture in southern regions.

3.7 Country Programming Framework (CPF) 2010

The specific objectives of the CPF are to identify country-level priority areas of work, assistance needs and investment opportunities. Priority sectors under this framework are reducing poverty and enhance food security and nutrition (access and utilization); enhancing agricultural productivity through diversification/intensification, sustainable management of natural resources, use of quality inputs and mechanization; improving market linkages, value addition, and quality and safety of the food system; further improve technology generation and adaptation through better producer extension-research linkages and increase resilience of communities to withstand 'shocks' such as natural disasters, health threats and other risks to livelihoods. The southern part of Bangladesh is identified as an ecologically stressed and economically deprived area in the CPF and considered it as a thrust area for agricultural development and food security.

3.8 Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009

BCCSAP aims to formulate a strategy for pro-poor, climate-resilient and low carbon development. Key pillars of this action plan are: (a) food security, social protection and health; (b) comprehensive disaster management; (c) infrastructure development; (d) research and knowledge management; (e) mitigation and low carbon development; and (f) capacity building and institutional strengthening.

3.9 National Adaptation Programme of Action (NAPA) 2009

NAPA has recognized the necessity of addressing the environmental issue and natural resource management with the participation of stakeholders in bargaining over resource use, allocation and distribution. This action plan identified 15 priority activities including general awareness-raising, capacity building, and project implementation in vulnerable regions with special focus on agriculture and water resources and identified 45 adaptation measures with 18 immediate and medium-term adaptation measures.

3.10 National Food Policy 2008

National Food Policy provides strategic guidance on the way to address the key challenges facing Bangladesh in achieving food security in all its dimensions, including food supply and availability, physical, social and economic access to food, as well as nutrition/utilization of food. This policy focus on an adequate and stable supply of safe and nutritious food through the intervention of technology, use and management of water resources, supply and sustainable use of agricultural inputs, crop diversification and market infrastructure development.

3.11 Coastal Development Strategy, 2006

The Coastal Development Strategy (CDS) is based on the approved Coastal Zone Policy (CZPo) 2005. By identifying organizational goals and setting targets, CDS plans for organized priority activities and preparations for their execution. Strategies include ensuring fresh and safe water availability; safety from man-made and natural hazards; optimizing use of coastal lands; promoting economic growth emphasizing non-farm rural employment; sustainable management of natural resources: exploiting untapped and less explored opportunities; improving livelihood conditions of people-especially women; environmental conservation; empowerment through knowledge management; creating an enabling institutional environment.

3.12 Coastal Zone Policy 2005

The Coastal Zone Policy aims to provide a general guidance to all agencies and institutions concerned for the management and development of the coastal zone in a manner that provides a secure and conducive environment for coastal communities to pursue their life and livelihoods. Sustainable use of coastal resources is one of the recommended measures, limiting harvesting, extraction or utilization to the corresponding regeneration cycles. Efforts will be given to make sustainable use of natural resources.

3.13 Land Use Policy 2001

The Ministry of Land enacted the Land Use Policy in 2001 focusing on importance of afforestation, environment and mutual sustainability of land use. The main objective is to ensure best possible use of laud resources and delivery of land related services to the people through modernized and efficient land administration for sustainable development with accelerated poverty reduction. It especially highlighted the need for land zoning in the coast. Subsequently, the Ministry of Land has taken up a pilot project on the study of detailed coastal land zoning in two districts of plain land.

3.14 The Environmental Court Act 2000

The Environmental Court Act 2000 recommends the establishment of environmental courts for the trial of offenses relating to environmental pollution. It includes protocols for the establishment of the court, and defines the court's jurisdiction, appropriate penalties, powers of search and entry, and procedures for investigation, trial and appeal.

3.15 National Agriculture Policy 1999

This policy emphasized on regional agriculture development. It states that target-oriented research and extension programs would be conducted for region-wise adaptations. It supports climate change adaptation investment in agriculture to mitigate the environmental vulnerability. Subsequently, the Ministry of Agriculture has prepared a Draft National Agriculture Policy 2012. The draft policy emphasizes agricultural marketing linkage, infrastructure development and many other areas.

3.16 National Water Policy, 1999

The National Water Policy, 1999 has about 50 clauses relevant to the environment and it anticipates that compliance with the policy will ensure protection, restoration and preservation of natural habitats, particularly wetlands, mangroves, other forests and endangered species that depend on them. It considers framing rules, procedures and guidelines for combining water use and land use planning for agriculture. It highlights the importance of preparing and implementing sub-regional and local level water management plans. It calls for the improvement of resource utilization through conjunctive use of all forms of surface water and groundwater.

3.17 National Environmental Management Plan, 1995

The National Environmental Management Plan (NEMAP) activities attempt to lead to better management of scarce resources, reducing the rate of environmental degradation, improving the natural and manmade environment, conserving habitats and biodiversity, promoting sustainable development and improving quality indicators of human life. NEMAP proposed actions and interventions for government agencies, NGOs and wider civil society and included activities relating to fisheries and agriculture.

3.18 Environmental Conservation Act, 1995

The Bangladesh Environmental Conservation Act and the accompanying Rules are arguably the most important legislative documents for addressing industrial water pollution. The Act is dedicated to the "conservation, improvement of quality standards, and control through mitigation of pollution of the environment". The Environmental Conservation Act (1995) deals mainly with processes and activities that result in pollution. This Act also makes provision for the protection of ecosystems. Under the Act, the government can declare "ecologically critical areas" in any area likely to reach environmentally critical conditions and can specify operations and processes that cannot be initiated or continued in those areas. The Act also confers power to the DoE to order corrective measures to be taken by any person believed to be responsible directly or indirectly for causing damage to the ecosystem.

3.19 Environment Policy and Implementation Plan 1992

The Ministry of Environment and Forest pronounced the environment policy and implementation program in 1992. Consideration was given in the policy to favor investment to adaptation for coping with adverse impacts of natural calamity, salinity intrusions in rivers,

land erosion, rapid reduction of forest area, variable climate and weather conditions and other environmental problems.

3.20 National Environmental Policy, 1992

This Policy aims to provide protection and sustainable management of the environment. The Policy emphasized maintaining the ecological balance and overall development through protection and improvement of the environment; identifying and regulate polluting and environmentally degrading activities; ensuring environmentally sound development; ensuring sustainable and environmentally sound use of all-natural resources and actively remaining associated with all international environmental initiatives.

3.21 Coastal Environmental Management Plan for Bangladesh 1988

In the late 1980s, the Economic and Social Commission for Asia and the Pacific (ESCAP) took the first initiative to formulate a coastal management policy in Bangladesh. A report titled "Coastal Environmental Management Plan for Bangladesh" was produced that addressed the most obvious problems of the coastal zone. The integration of socio-economic considerations into environmental issues was one aspect of the study.

3.22 Bangladesh Delta Plan 2100

BDP 2100 seeks to integrate the medium to long term aspirations of Bangladesh to achieve upper middle income (UMIC) status and eliminate extreme poverty by 2030 and being a prosperous country beyond 2041 with the longer-term challenge of sustainable management of water, ecology, environment and land resources in the context of their interaction with natural disasters and climate change. The mission of this plan is to ensure long term water and food security, economic growth and environmental sustainability while effectively reducing vulnerability to natural disasters and building resilience to climate change and other delta challenges through robust, adaptive and integrated strategies and equitable water governance. The whole of Bangladesh has been divided into six zones termed as Hotspots. Coastal Zone is one of the six hotspots. This plan provides specific strategies for solving the problems and addressing the challenges of the Coastal Zone. Those strategies are effective management of existing polders, increase drainage capacity and reduce flood risks, balancing water supply and demand for sustainable growth, reclaim new land in the coastal zone, Sundarbans conservation, increasing supply of freshwater through the restoration of rivers. This plan also puts emphasis on advancing the blue economy.

4. CURRENT SCENARIOS AND DEVELOPMENT POTENTIALS

4.1 Current Scenario

In this chapter an attempt is made to provide a visual presentation of current scenarios with respect to population, existing land use, availability of socio-economic facilities, availability of infrastructure (road), and distribution of cyclone centers in different upazilas of the region. In addition, attempt is also made to analyze the development potentials of different upazilas at union level. Suitable locations of eco-towns are also identified on the basis of a number of environmental criteria.

Table 4-1 presents upazila-wise information on area, population, infrastructure (road), buildings and various types of socio-economic facilities. Union-wise information on these aspects is shown in **ANNEXURE-I**. **Table 4-1** shows that Rangabali is the largest upazila in terms of area while Barguna Sadar is the largest upazila in terms of population. Density of population is also the highest in Barguna Sadar. Kalapara, on the other hand, has the highest road length, the highest number of structures and the highest number of socio-economic facilities. Maps showing density of population, road network, socio-economic facilities, and density of structures by Upazilas are shown in **Figure 4-1, Figure 4-2, Figure 4-3,** and **Figure 4-4**.

Table 4-1: Area, Population, Roads, Structure, and Socio-Economic Facilities by Upazilas

Upazila	Area (sq. km.)	Population (thousand)	Density of Population (per sq. km.)	Road Length (km.)	Structure Number	Facility Number
Amtali	303.71	182.8	602	878.71	27104	167
Barguna Sadar	363.88	261.36	718	1008	35928	83
Galachipa	548.91	258.52	471	1063.3	35973	119
Kalapara	501.44	248.69	496	1093.6	37399	286
Patharghata	346.04	163.92	474	635.42	28046	91
Rangabali	616.88	96.13	156	402.02	13566	42
Taltali	353.62	94.88	268	578.39	16733	82

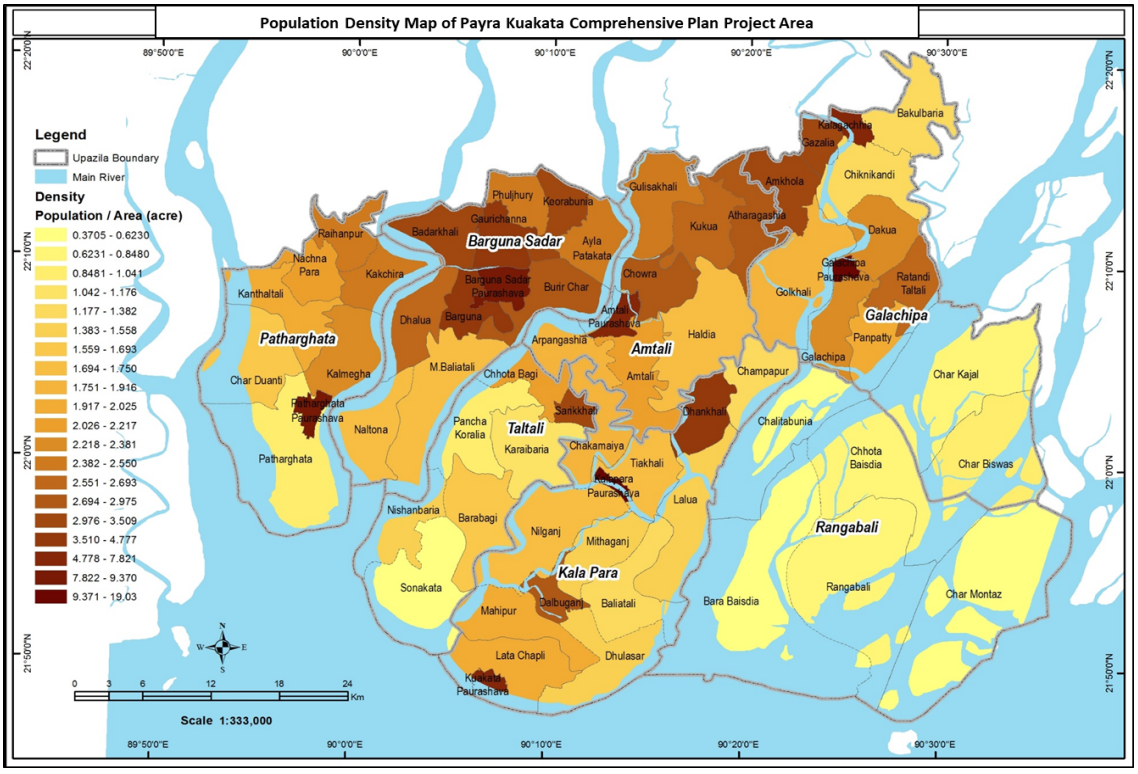


Figure 4-1: Density of Population in Different Upazilas

Figure 4-2: Existing Roads in Different Upazilas

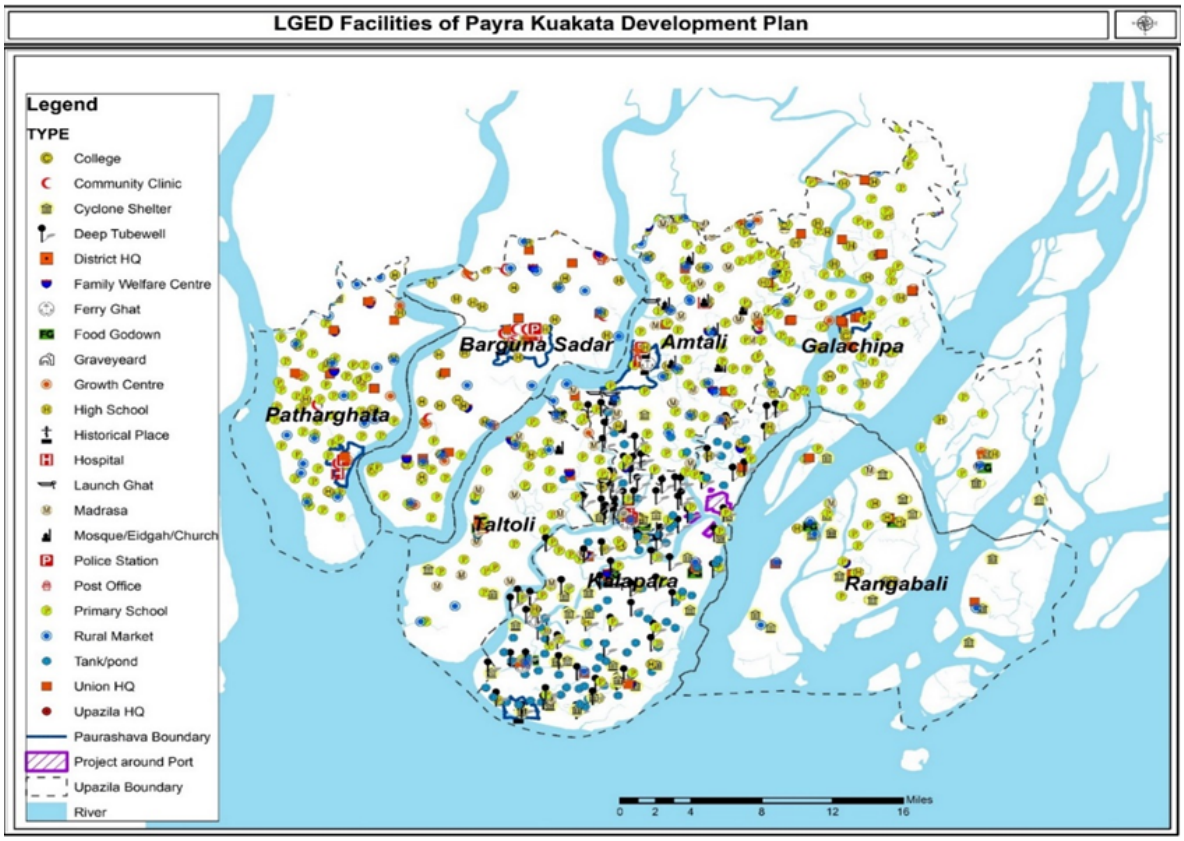


Figure 4-3: Various Socio-Economic Facilities in Different Upazilas

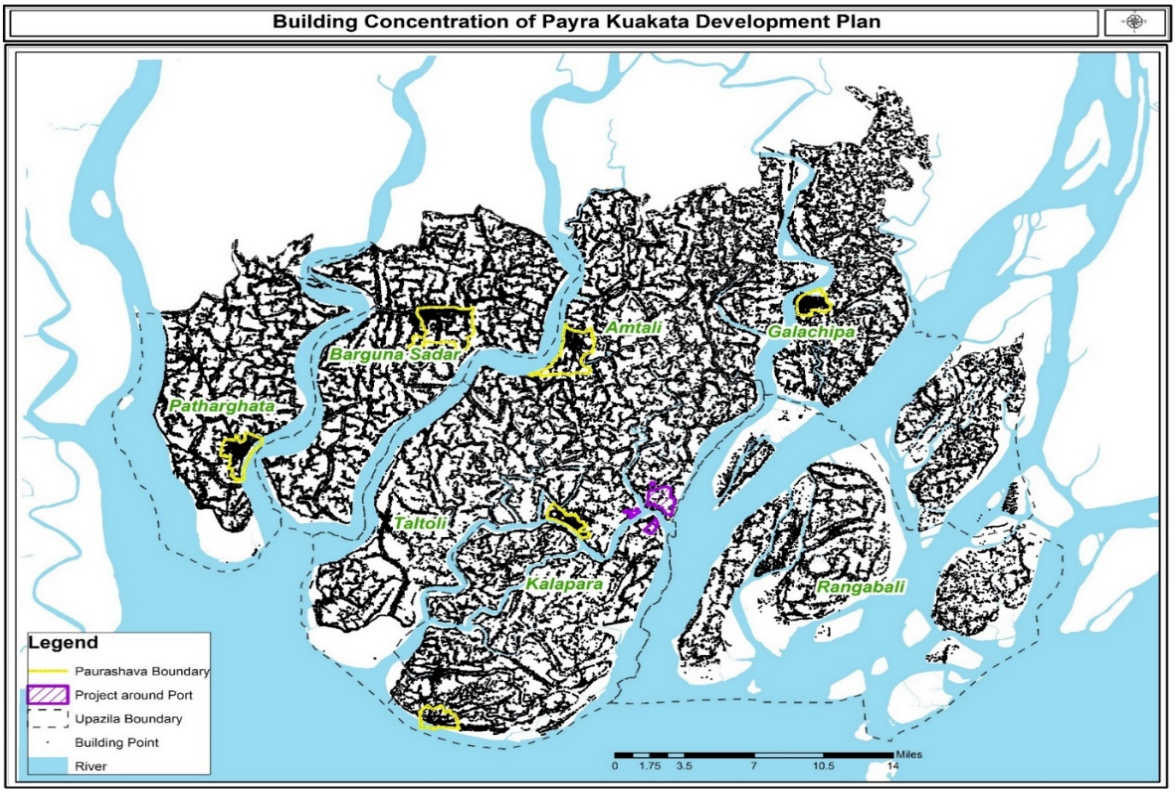


Figure 4-4: Concentration of Structures in in Different Upazilas

4.2 Identification of Potential Areas for Development: A Union Level Analysis

In this section unions of different upazilas have been ranked on the basis of their potentials for development. The following variables have been considered for the analysis:

- Road length in the union
- Structure frequency in the union
- Number of various socio-economic facilities available in the union
- Population density of the union

In the project area, there are 60 Unions and 6 Paurashavas. At first, data on the above-mentioned aspects are synchronized according to Unions and Paurashavas. To sum up the comparative analysis, Composite Indicators or Index has been applied from where we can know the potentiality of the Unions and Paurashavas.

For constructing the index at first each indicator is developed. After calculating the index of each indicator average of the indexes is done dividing the sum of the index values by the number of indicators. The equation used for the construction of the index is given below both for positive and negative variables. This index system is adapted from the study of Wang (2007).

For positive indicators (the indicators whose higher values indicate a higher level of potentiality like population size, population growth, industrial employment, service employment, area of economic zone etc.) the index is calculated by following equation.

$$\mathbf{i^{th}\ city = (V_i - V_{min}) / (V_{max} - V_{min})} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(1)}$$

For the negative variables (the indicator whose higher values indicate a lower level of potentiality like distance of the Economic Zone from the city) the index is calculated by following equation.

$$\mathbf{i^{th}\ city = (V_{max} - V_i) / (V_{max} - V_{min})} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(2)}$$

In these two equations –equation (1) and equation (2), the symbols used are:

V_i = The value of the i^{th} city on a specific indicator

V_{max} = The highest value of that specific indicator among the cities

V_{min} = The lowest value of that specific indicator among the cities

The **Composite Index (CI)** value of potentiality is calculated by averaging the index value of the indicators for a specific region. In the present case index values of four indicators are summed up and then divided by 4 to get the composite index of potentiality of a Union or Paurashava.

In general, the index shows the relative position of each region in overall as well as in different indicators. The composite index indicates the overall position of the region and its specific rank. **Table 4-2** shows the distribution of unions by index values based on individual criterion and composite index values based on all the criteria. Also see: **Figure 4-5, Figure 4-6, Figure 4-7,** and **Figure 4-8**.

Table 4-2: Distribution of Unions by Index Values

Sl. No.	Upazila	Union	Road_CI	Structure CI	Density_CI	Facility_CI	Overall CI (%)	Development Level
1	Galachipa	Amkhola	0.56	0.75	0.17	0.42	47.59	Moderate
2	Amtali	Amtali	0.52	0.80	0.24	0.25	45.19	Moderate
3	Amtali	Amtali Paurashava	0.73	0.17	0.00	0.78	42.19	Moderate
4	Amtali	Arpangashia	0.40	0.68	0.58	0.21	46.52	Moderate
5	Amtali	Atharagashia	0.62	0.70	0.42	0.32	51.44	Moderate
6	Barguna Sadar	Ayla Patakata	0.35	0.62	0.17	0.28	35.39	Poor
7	Barguna Sadar	Badarkhali	0.51	0.73	0.08	0.38	42.42	Moderate
8	Galachipa	Bakulbaria	0.53	0.60	0.31	0.13	39.42	Poor
9	Kalapara	Baliatali	0.37	0.38	0.40	0.14	32.26	Poor
10	Rangabali	Bara Baisdia	0.01	0.02	0.20	0.02	6.40	Very Poor
11	Taltali	Barabagi	0.28	0.44	0.40	0.18	32.28	Poor
12	Barguna Sadar	Barguna	0.65	0.94	0.00	0.46	51.43	Moderate
13	Barguna	Barguna Sadar Paurashava	1.00	0.44	0.19	0.91	63.52	Good
14	Barguna Sadar	Burir Char	0.51	0.73	0.01	0.35	40.29	Moderate
15	Kalapara	Chakamaiya	0.43	0.59	0.65	0.20	46.69	Moderate
16	Rangabali	Chalitabunia	0.00	0.00	0.22	0.00	5.54	Very Poor
17	Kalapara	Champapur	0.44	0.57	0.42	0.13	38.89	Poor
18	Galachipa	Char Biswas	0.10	0.24	0.20	0.09	15.77	Very Poor
19	Patharghata	Char Duanti	0.18	0.53	0.32	0.17	29.91	Poor
20	Galachipa	Char Kajal	0.09	0.20	0.10	0.06	11.07	Very Poor
21	Rangabali	Char Montaz	0.01	0.01	0.08	0.01	2.88	Very Poor
22	Rangabali	Chhota Baisdia	0.40	0.56	0.25	0.25	36.40	Poor
23	Taltali	Chhota Bagi	0.15	0.16	0.47	0.06	20.89	Poor
24	Galachipa	Chiknikandi	0.45	0.58	0.26	0.14	35.62	Poor
25	Amtali	Chowra	0.51	0.56	0.26	0.32	41.27	Moderate
26	Galachipa	Dakua	0.44	0.58	0.27	0.26	38.69	Poor
27	Kalapara	Dalbuganj	0.32	0.42	0.26	0.34	33.50	Poor
28	Barguna Sadar	Dhalua	0.45	0.67	0.11	0.30	38.35	Poor
29	Kalapara	Dhankhali	0.41	0.53	0.24	0.45	40.52	Moderate
30	Kalapara	Dhulasar	0.13	0.30	0.43	0.15	25.26	Poor
31	Galachipa	Gazalia	0.27	0.52	0.20	0.41	34.99	Poor

Sl. No.	Upazila	Union	Road_CI	Structure CI	Density_CI	Facility_CI	Overall CI (%)	Development Level
32	Galachipa	Galachipa	0.37	0.55	0.19	0.27	34.56	Poor
33	Galachipa	Galachipa Paurashava	0.98	1.00	1.00	0.00	74.58	Good
34	Barguna Sadar	Gaurichanna	0.63	1.00	0.06	0.59	56.94	Moderate
35	Galachipa	Golkhali	0.40	0.54	0.38	0.20	37.97	Poor
36	Amtali	Gulisakhali	0.44	0.56	0.37	0.28	41.58	Moderate
37	Amtali	Haldia	0.49	0.58	0.54	0.18	44.85	Moderate
38	Patharghata	Kakchira	0.30	0.52	0.10	0.28	30.05	Poor
39	Galachipa	Kalagachhia	0.33	0.58	0.08	1.00	49.53	Moderate
40	Kalapara	Kalapara Paurashava	0.90	0.60	0.99	1.00	87.26	Very Good
41	Patharghata	Kalmegha	0.48	0.78	0.22	0.26	43.58	Moderate
42	Patharghata	Kanthaltali	0.39	0.68	0.39	0.21	41.97	Moderate
43	Taltali	Karaibaria	0.51	0.50	0.44	0.11	38.92	Poor
44	Barguna Sadar	Keorabunia	0.49	0.78	0.05	0.36	41.96	Moderate
45	Kalapara	Kuakata Paurashava	0.58	0.00	0.07	0.94	39.63	Poor
46	Amtali	Kukua	0.68	0.72	0.38	0.31	52.12	Moderate
47	Kalapara	Lalua	0.32	0.41	0.53	0.16	35.51	Poor
48	Kalapara	Lata Chapli	0.38	0.66	0.38	0.22	40.87	Moderate
49	Barguna Sadar	M.Baliatali	0.44	0.68	0.31	0.18	40.39	Moderate
50	Kalapara	Mahipur	0.49	0.84	0.67	0.22	55.46	Moderate
51	Kalapara	Mithaganj	0.40	0.43	0.78	0.15	43.69	Moderate
52	Patharghata	Nachna Para	0.55	0.84	0.16	0.24	44.72	Moderate
53	Barguna Sadar	Naltona	0.36	0.57	0.25	0.18	34.19	Poor
54	Kalapara	Nilganj	0.33	0.49	0.48	0.19	37.03	Poor
55	Taltali	Nishanbaria	0.13	0.24	0.06	0.15	14.69	Very Poor
56	Taltali	Pancha Koralia	0.39	0.47	0.43	0.09	34.36	Poor
57	Galachipa	Panpatty	0.41	0.53	0.17	0.22	33.09	Poor
58	Patharghata	Patharghata	0.07	0.30	0.24	0.09	17.71	Very Poor
59	Patharghata	Patharghata Paurashava	0.79	0.71	0.23	0.57	57.41	Moderate
60	Barguna Sadar	Phuljhury	0.61	0.58	0.16	0.29	40.97	Moderate
61	Patharghata	Raihanpur	0.69	0.96	0.17	0.28	52.66	Moderate
62	Rangabali	Rangabali	0.07	0.11	0.18	0.06	10.63	Very Poor
63	Galachipa	Ratandi Taltali	0.52	0.51	0.06	0.31	34.90	Poor
64	Taltali	Sarikkhali	0.77	0.70	0.32	0.40	54.82	Moderate

Sl. No.	Upazila	Union	Road _CI	Structure CI	Density _CI	Facility _CI	Overall CI (%)	Development Level
65	Taltali	Sonakata	0.13	0.15	0.25	0.03	14.31	Very Poor
66	Kalapara	Tiakhali	0.48	0.79	1.00	0.18	61.27	Good

Figure 4-5: Delineation of Areas by Road Composite Index Values

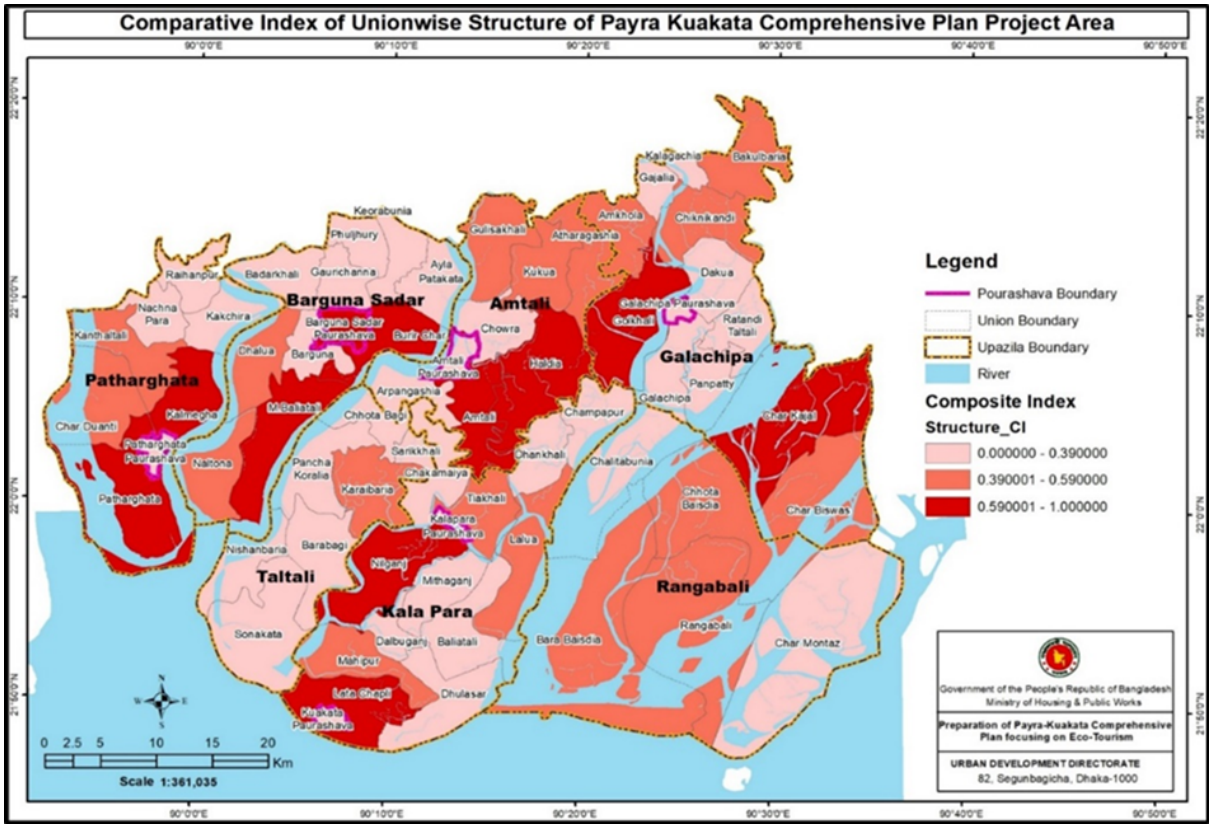


Figure 4-6: Delineation of Areas by Structure Composite Index Values

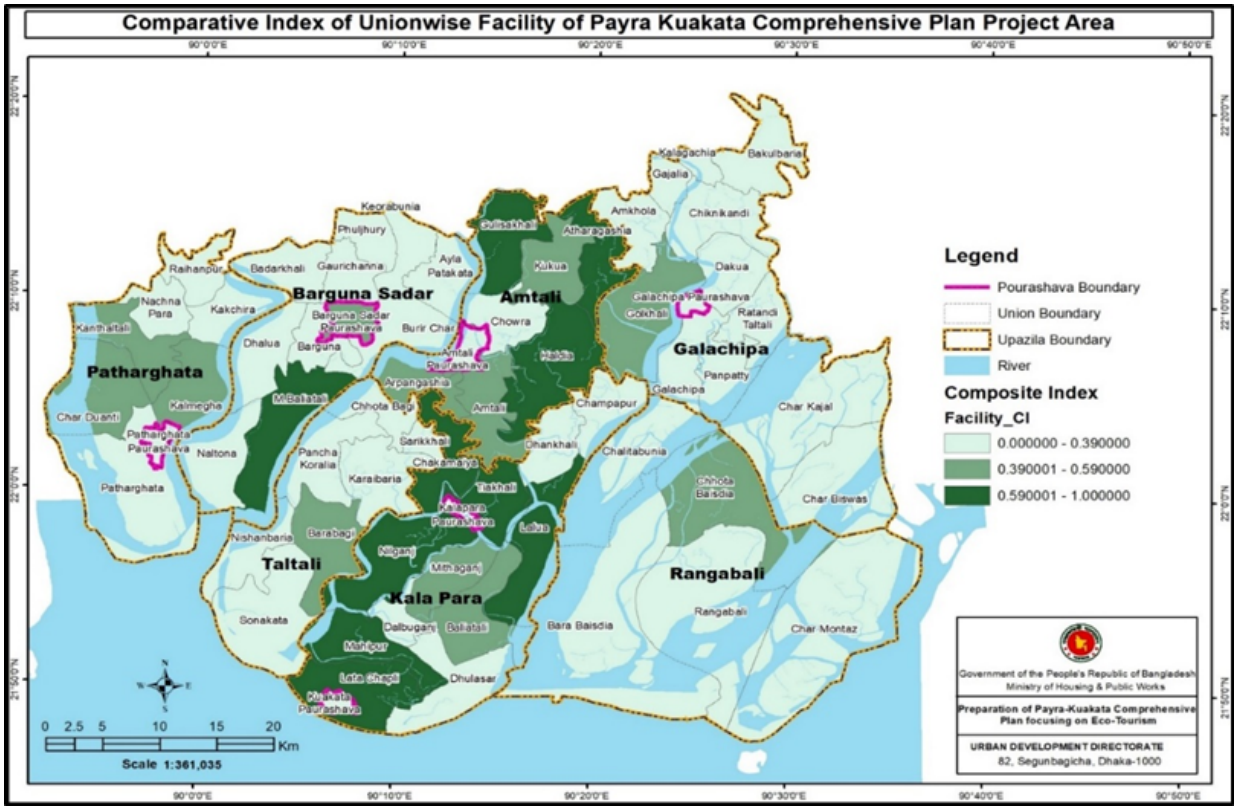


Figure 4-7: Delineation of Areas by Facility Composite Index Values

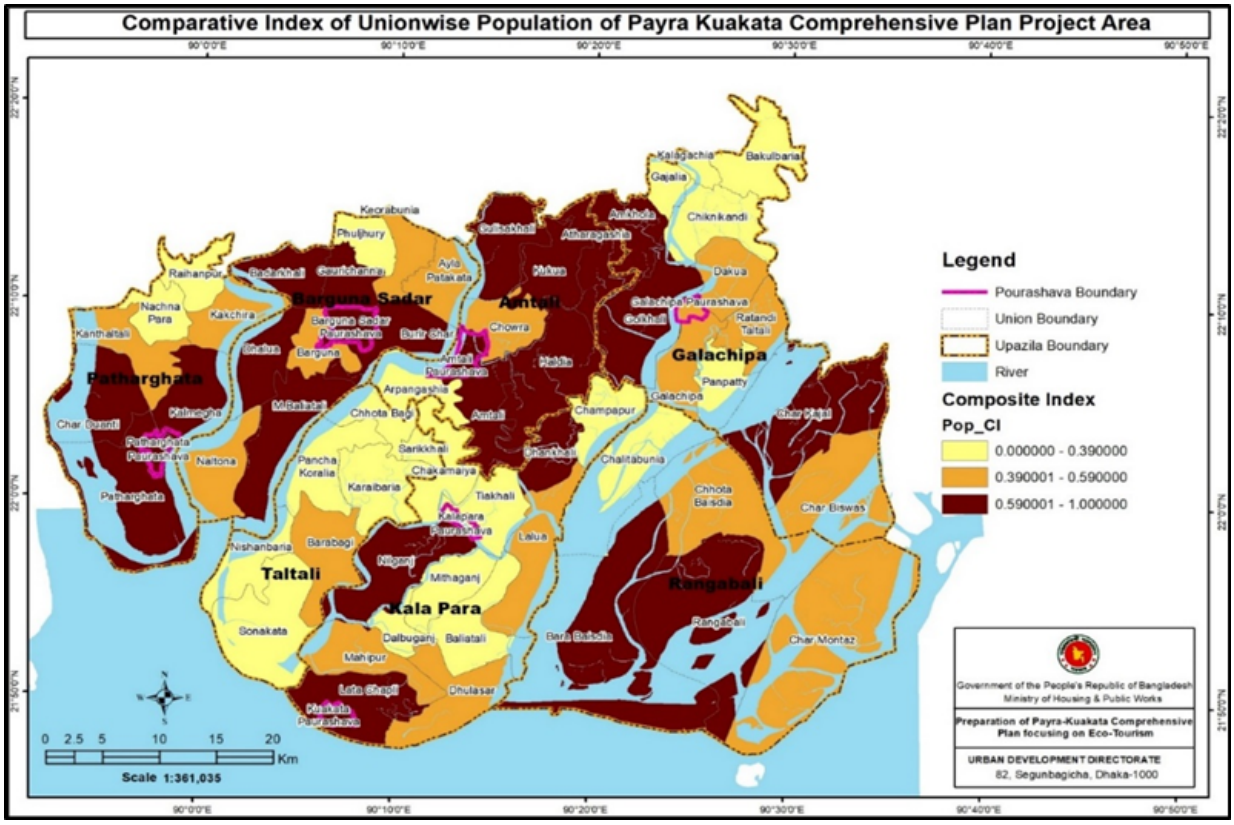


Figure 4-8: Delineation of Areas by Index Values of Population Density

On the basis of the composite index values the Unions or Paurashavas can be divided into three levels of development by different aspects of development (Road, Structures, Density of population and various socio-economic facilities) as shown below (**Table 4-3**).

- High Level of Development (Index Value 0.60 and above)
- Moderate Level of Development (Index value 0.40 to less than 0.60)
- Low Level of Development (Index value less than 0.40)

Table 4-3: Distribution of Unions and Pourashavas by Levels of Development

variables	Upazila	Amtali	Barguna Sadar	Galachipa	Kalapara	Patharghata	Rangabali	Taltali
	Development Level	Number of Unions and Pourashavas						
Road	High	3	4	2	0	2	0	1
	Moderate	5	5	7	7	2	1	1
	Low	0	2	4	7	4	4	5
Structure	High	4	8	3	4	5	0	1
	Moderate	3	3	8	7	2	1	3
	Low	1	0	2	3	1	4	3
D e	High	0	0	0	5	0	0	0

	Moderate	3	0	1	5	0	0	4
	Low	5	11	12	4	8	5	3
Facility	High	1	1	1	2	0	0	0
	Moderate	0	2	2	1	1	0	1
	Low	7	8	10	11	7	5	6
Total Number of Unions within Upazila		8	11	13	14	8	5	7

Taking the average index values of all the aspects and multiplying by 100, a composite score can be obtained for each union and pourashava. This composite score represents the development potential of a union or pourashava. This potential can be divided into the following categories:

- Very High Development Potential (Composite Score 80 and above)
- High Development Potential (Composite Score 60 to less than 80)
- Moderate Development Potential (Composite Score 40 to less than 60)
- Low Development Potential (Composite Score 20 to less than 40)
- Very Low Development Potential (Composite Score less than 20)

The assumption behind this division is that a union or pourashava with very high development potential is in a position to offer better facilities in terms of road, structure, population density, and various socio-economic facilities for development to take place compared to a union or pourashava with high, moderate, low or very low development potential. Similarly, a union or pourashava with moderate development potential is in a better position to facilitate development compared to a union or pourashava with low or very low development potential and so on. **Table 4-4** below shows the distribution of unions and pourashavas by development potentials in different Upazilas.

Table 4-4: Distribution of Unions and Pourashavas by Development Potentials

Upazila	**Development Potential**					
	Very Good	**Good**	**Moderate**	**Poor**	**Very Poor**	**Total**
Amtali	0	0	8 (100)	0	0	8 (100)
Barguna Sadar	0	1 (9.10)	7 (63.60)	3 (27.30)	0	11 (100)
Galachipa	0	1 (7.70)	2 (15.40)	8 (61.50)	2 (15.40)	13 (100)
Kalapara	1 (7.14)	1 (7.14)	5 (35.72)	7 (50.00)	0	14 (100)
Patharghata	0	0	5 (62.50)	2 (25.00)	1 (12.50)	8 (100)
Rangabali	0	0	0	1 (20.00)	4 (80.00)	5 (100)
Taltali	0	0	1 (14.30)	4 (57.10)	2 (28.60)	7 (100)
	1	3	28	25	9	66 (100)

*Figures in the brackets indicate percentages

In Amtali, Barguna Sadar and Patharghata Upazilas most of the areas (Unions and Pourashavas) have moderate development potential while in Kalapara, Taltali and Galachipa Upazilas 50%, 57% and 62% of the areas (Unions and Pourashavas) have poor development potential (**Figure 4-9**). In Rangabali Upazila, however, 80% of the Unions are very poor and 20% of the Unions are poor in terms of development potentiality. **Figure 4-10** shows the geographic distribution of areas by different levels of development potentiality.

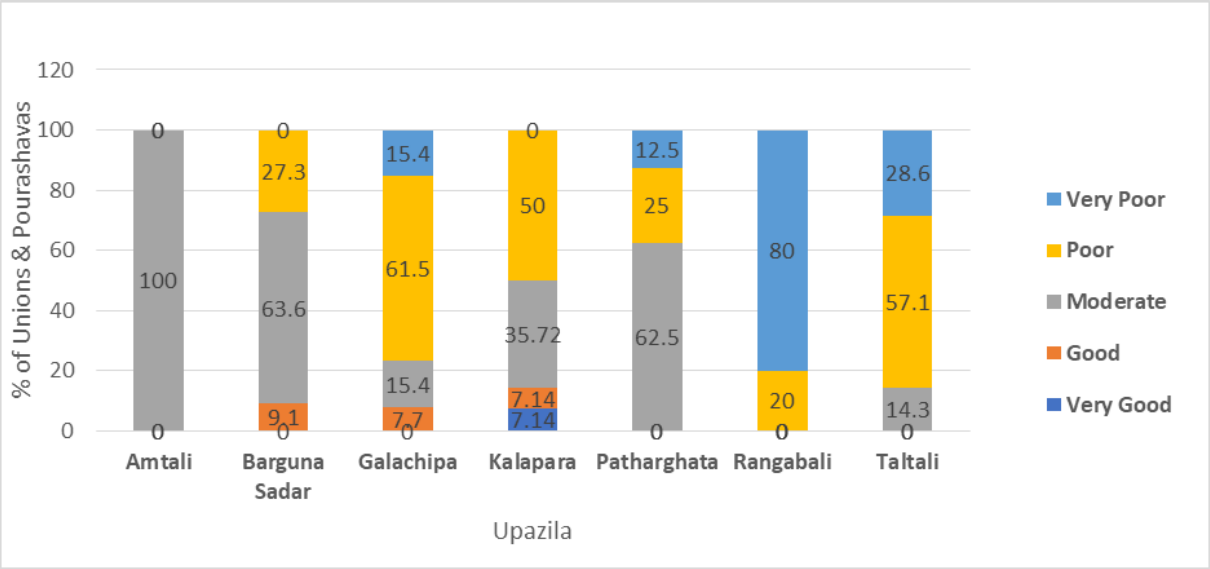


Figure 4-9: Distribution of Unions and Pourashavas by Development Potential

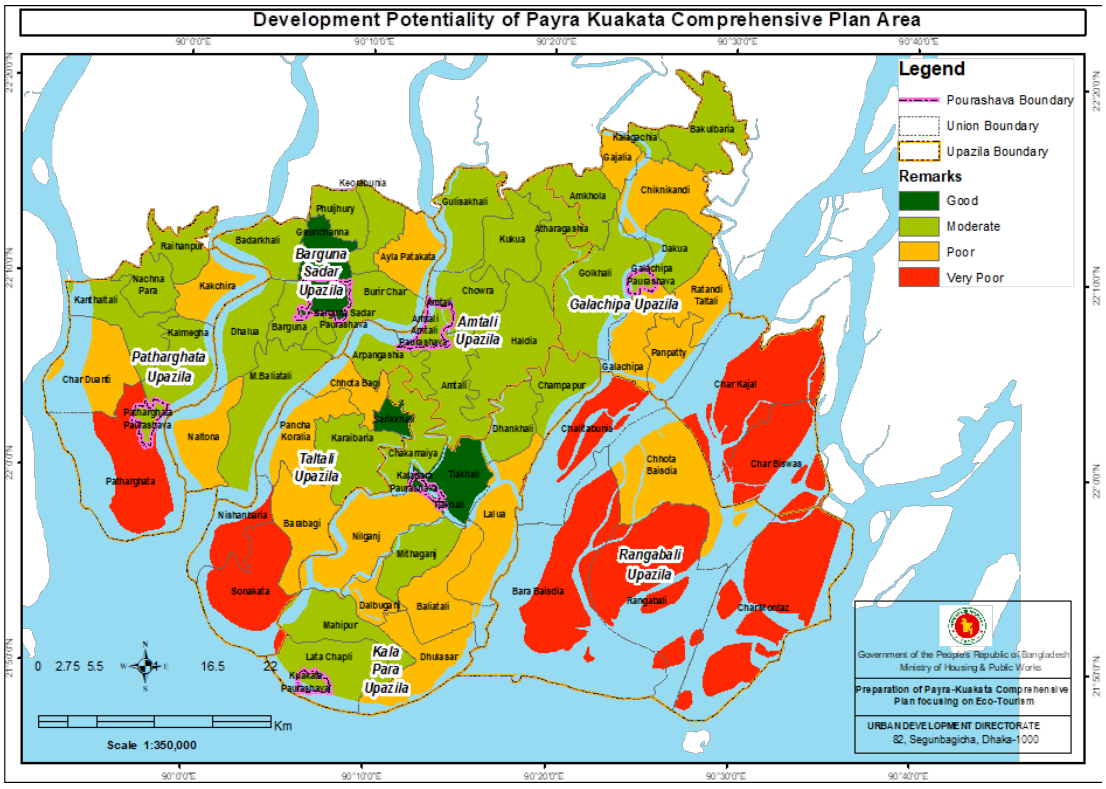


Figure 4-10: Delineation of Areas by Levels of Development Potentiality

4.3 Multi-Criteria Analysis to Identify Potential Location for Eco-Town Development

An eco-city is a city built off the principles of living within the means of the environment (Ali & Rafique, 2015). Eco-cities aim to eradicate all carbon waste, to produce energy completely through renewable sources, and to integrate the environment into the city; however, eco-cities also have the intentions of stimulating economic growth, reducing poverty, organizing cities to have higher population densities, and therefore higher efficiency, and improving health (Ecocities, 2015). Such cities also includes energy efficient buildings, renewable energy, resource efficient infrastructure and proximity to employment and services (Kalan, 2011). Eco-towns must also address social and economic factors if they are to be successful.

All eco-towns should comply with planning policy statements including those relating to sustainable development such as: climate change adaptation, pollution control, open space, biodiversity, transport, and flooding, housing and economic development. To identify potential location for eco-town development multicriteria analysis has been conducted. For multicriteria analysis seven indicators has been selected, they are

1. Location of Paurashava area
2. Location of Growth center
3. Existing major road network
4. Existing transport facilities
5. Locations facilitated with embankment
6. Forest area
7. Cyclone disaster

4.3.1 Potential Area Considering Paurashava Area

Area between two or more Paurashava is suitable for establishment of eco-town. But adjacent to Paurashava or existing location is less suitable. Following is the above-mentioned principle, a single criterion analysis has been done to identify suitable location for eco-town development (**Figure 4-11**).

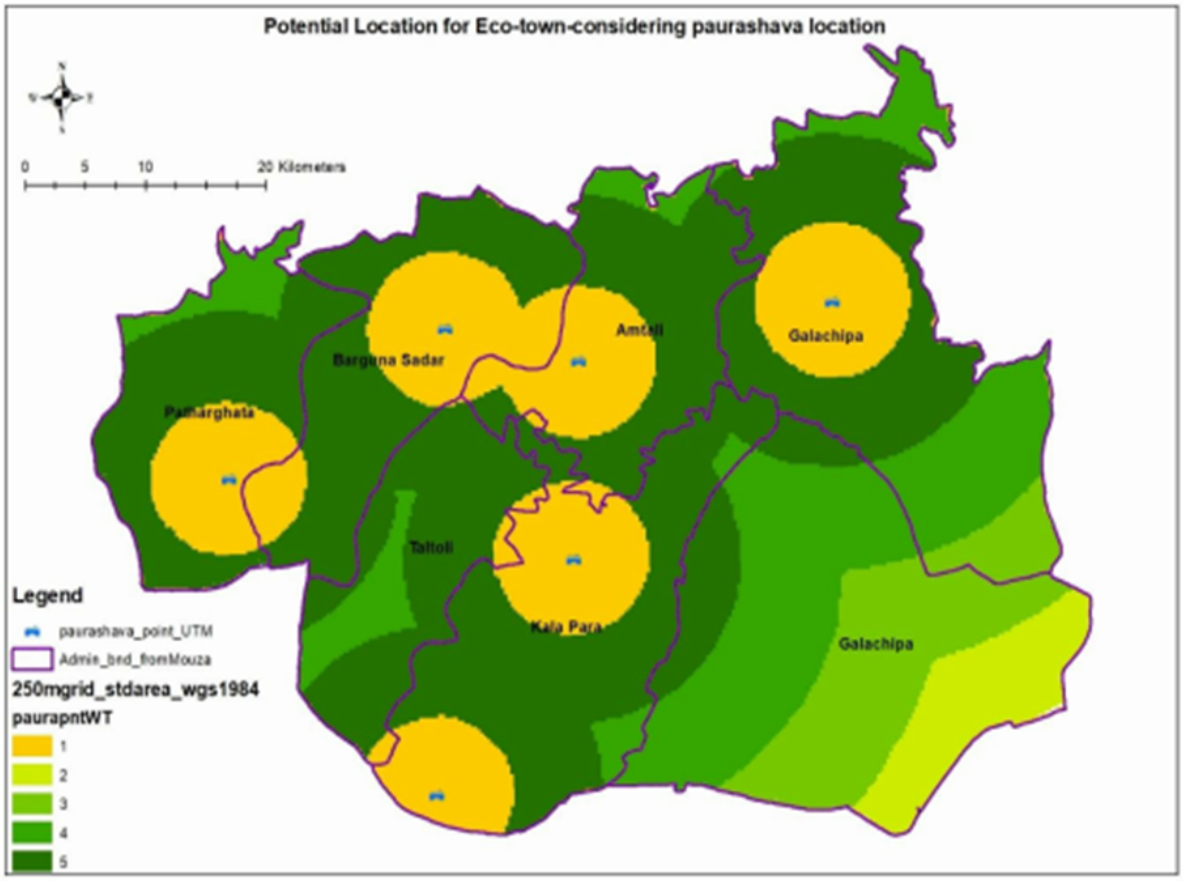


Figure 4-11: Locational Suitability of Eco-town Based on Paurashava Location

4.3.2 Potential Area Considering Growth Center

Location connecting or between one or more existing growth center are suitable for eco-town establishment. Areas adjacent to a growth center like retail markets or wholesale markets remain crowded in day time and causes sound pollution (**Figure 4-12**).

4.3.3 Potential Area Considering Existing Road Network

Well-connected road network is one of the important requirements for eco-town. To avoid noise pollution and air pollution from vehicle, area adjacent to road are given less score. Following is the outcome of single criteria analysis considering existing road network (**Figure 4-13**).

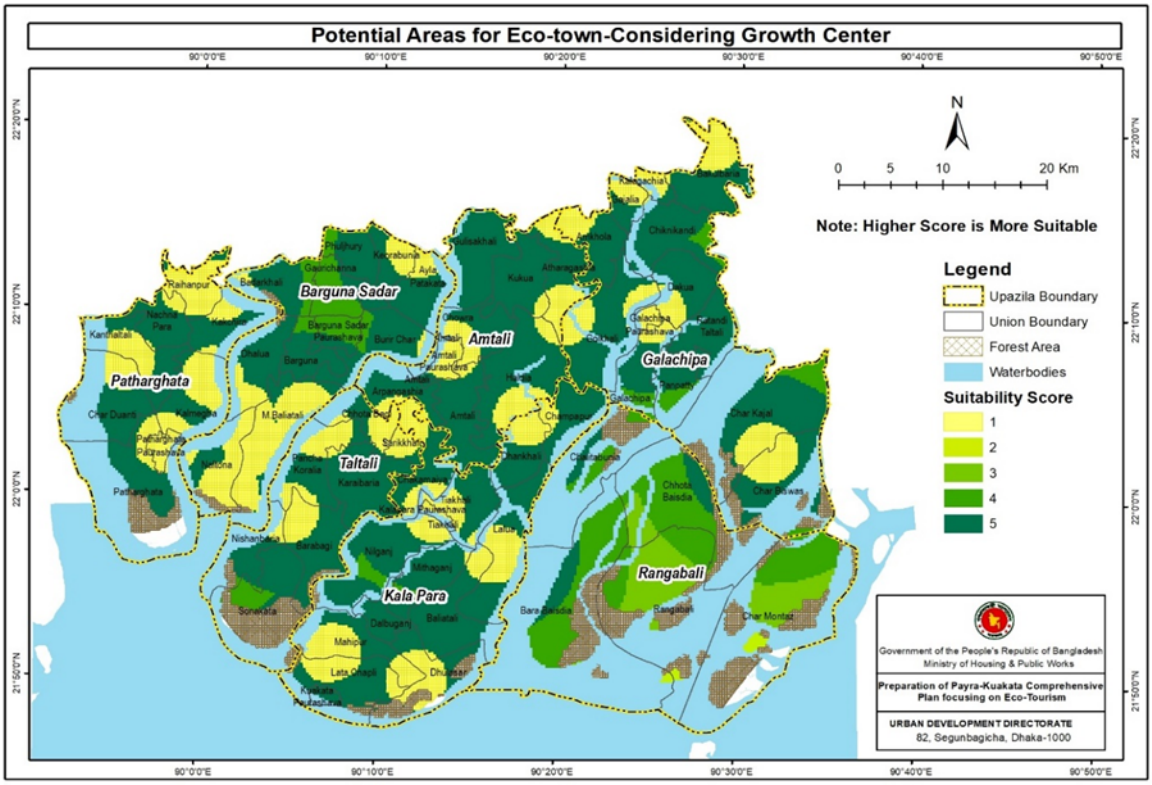


Figure 4-12: Locational Suitability of Eco-town Based on Growth Centre Location

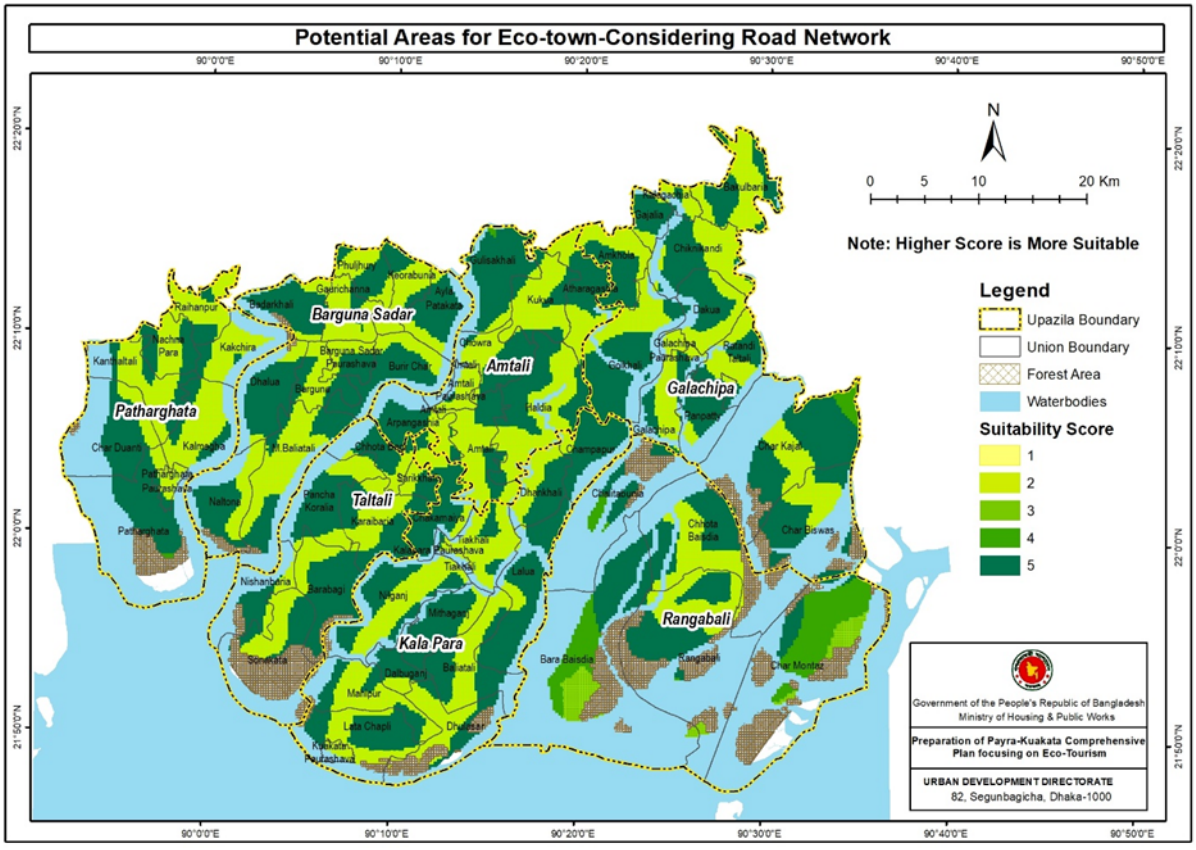


Figure 4-13: Locational Suitability of Eco-town Based on Road Network

4.3.4 Potential Area Considering Transport Facilities

Area close to bus stand, bus terminal, launch terminal or any other transport facility has been given less priority, but 10-minute walking distance from transport facility has been given more priority (**Figure 4-14**).

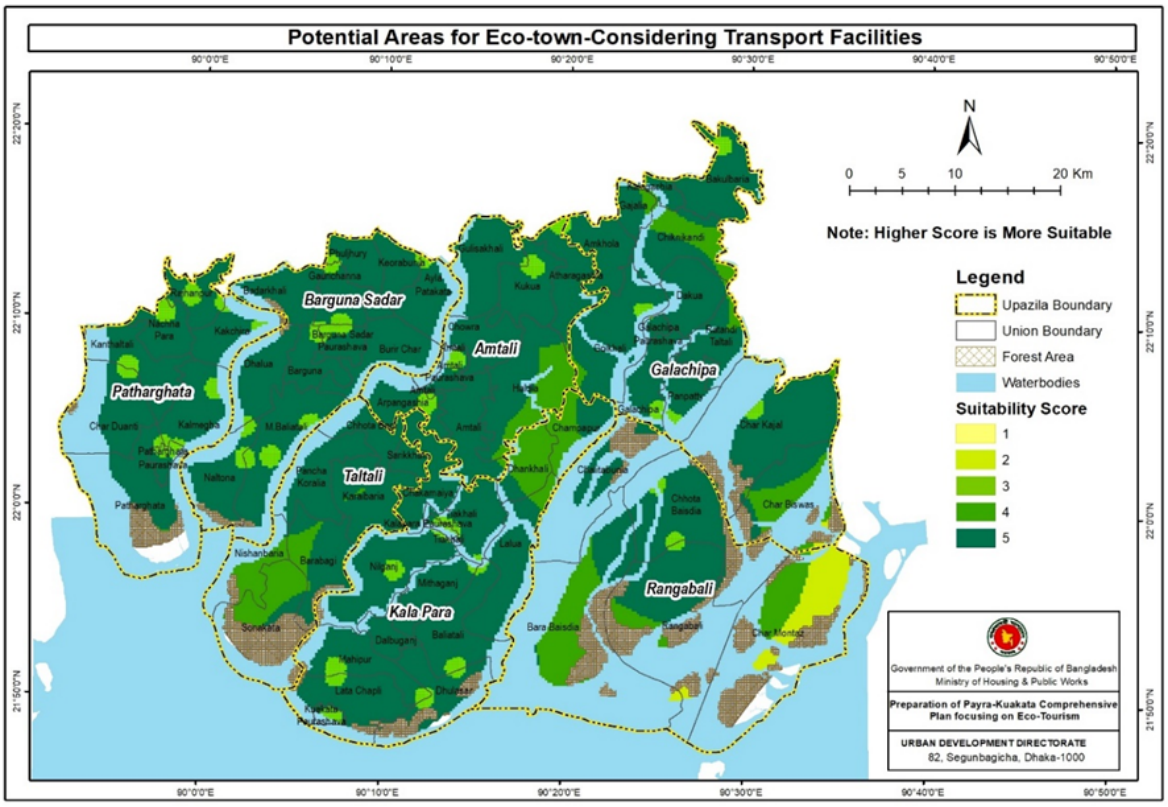


Figure 4-14: Locational Suitability of Eco-town Based on Transportation Facilities (Road and River)

4.3.5 Potential Area Considering Embankment

Area surrounded by embankment has been given priority. The project area is well protected with embankment. Therefore, most of the area have been found suitable for establishment of eco-town (**Figure 4-15**).

4.3.6 Potential Area Considering Forest

Area adjacent to forest has been given more priority for selecting suitable site for eco-town (**Figure 4-16**).

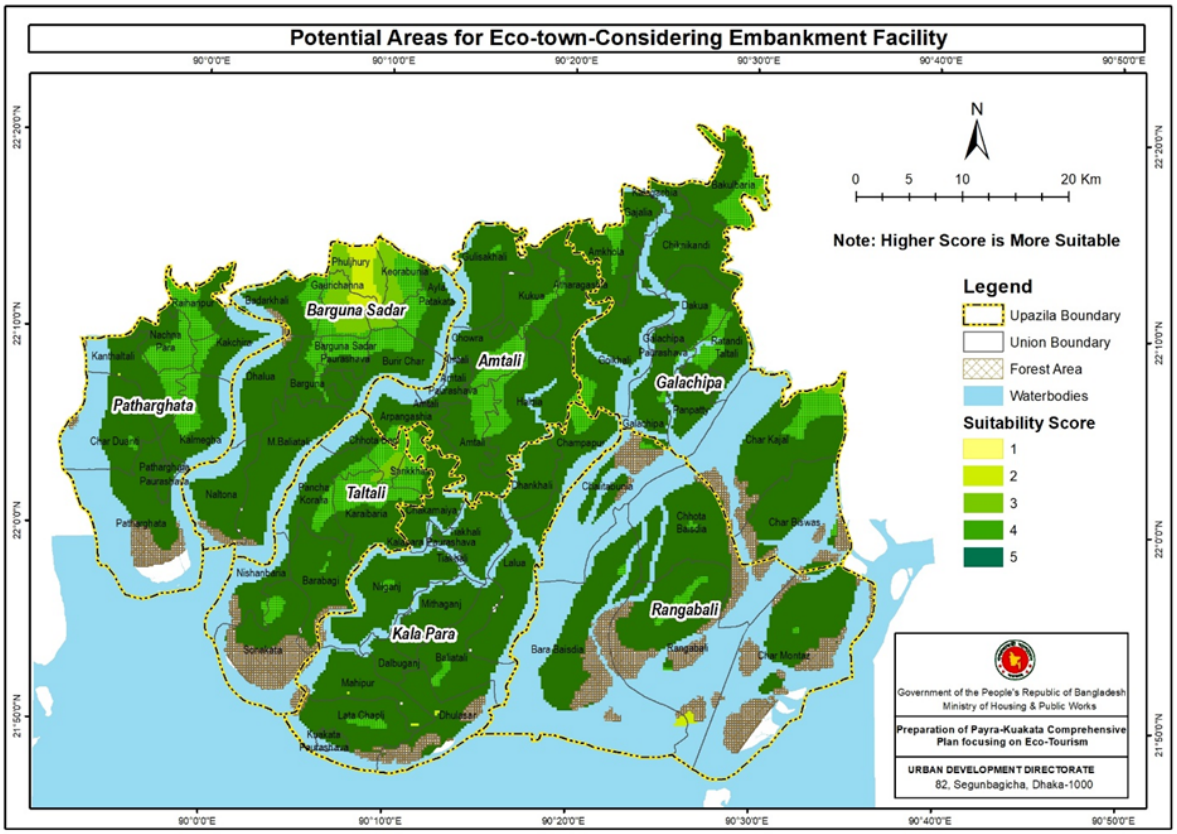


Figure 4-15: Locational Suitability of Eco-town Based on Embankment Facility

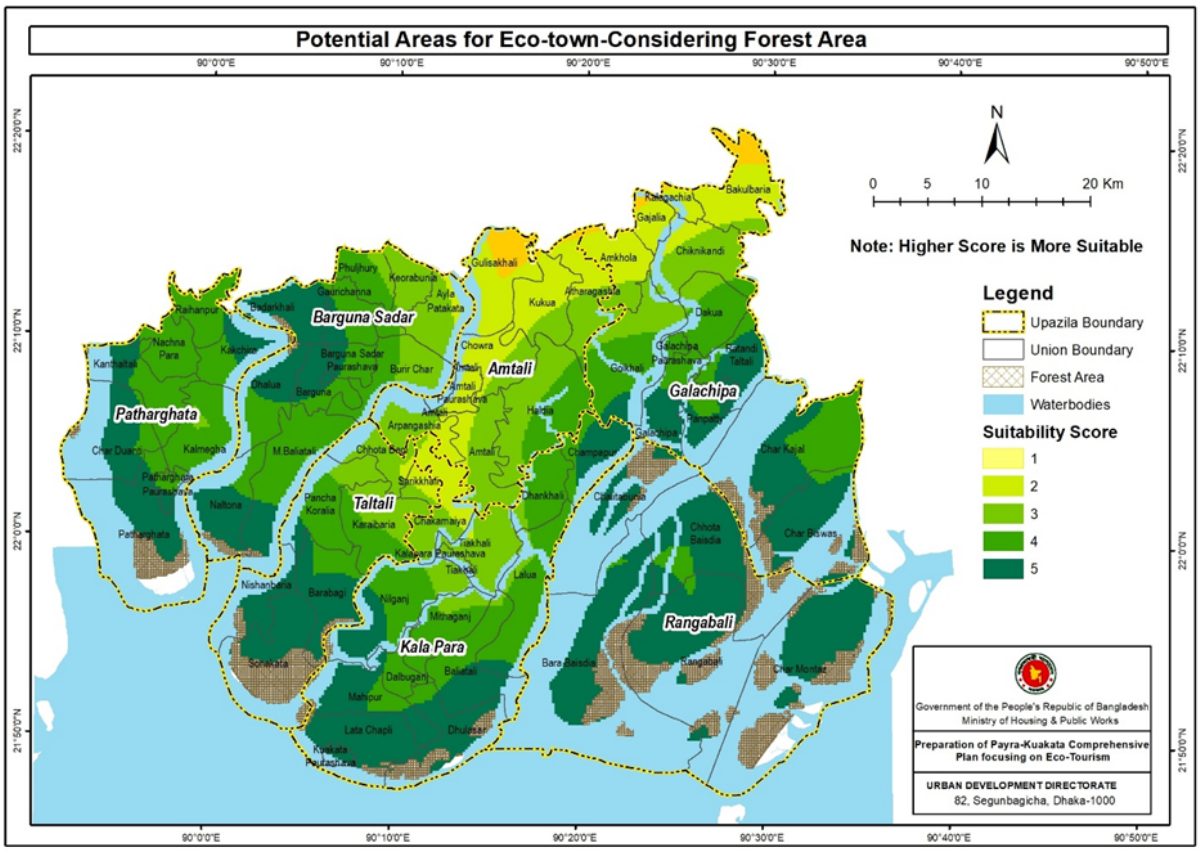


Figure 4-16: Locational Suitability of Eco-town Based on Closeness of Forest Area

4.3.7 Potential Area Considering Disaster Risk Area

All the upazilas of the planning area are prone to disaster risks of various levels. This aspect is particularly important because frequency of extreme disaster events such as cyclone, flood storm surge, thunderstorm etc. would increase due to climate change. This would obviously affect the development efforts. For taking this aspect into consideration, the whole area that has been delineated into very low, low, moderate, high and very high levels of disaster risks (figure 4.17 below) by BBS (2018) has been used to propose locations of eco-towns.

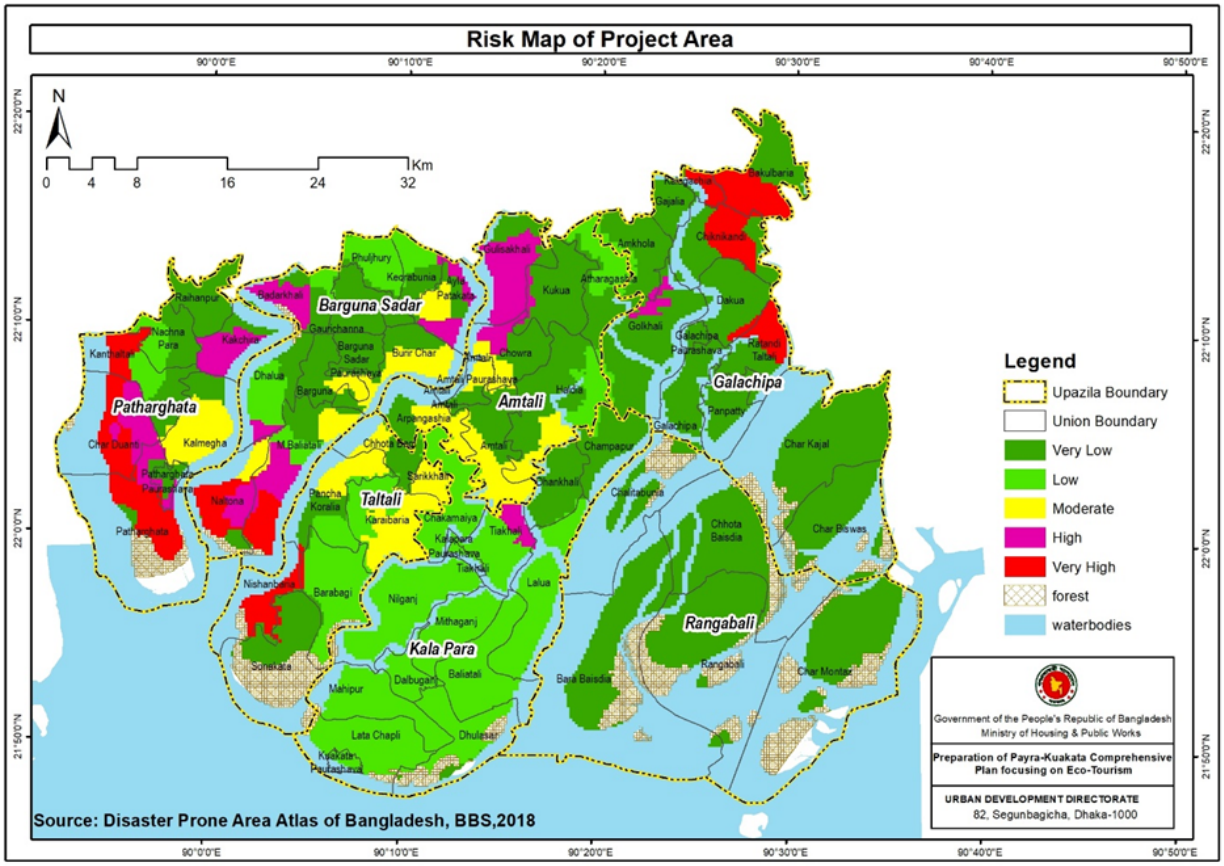


Figure 4-17: Locational Suitability of Eco-town Based on Disaster Risk

4.3.8 Suitable Area Identified for Eco-Town Development

Excluding Payra port area and 10 minutes walking distance buffer area, following suitable areas have been identified through multi-criteria analysis (**Figure 4-18**).

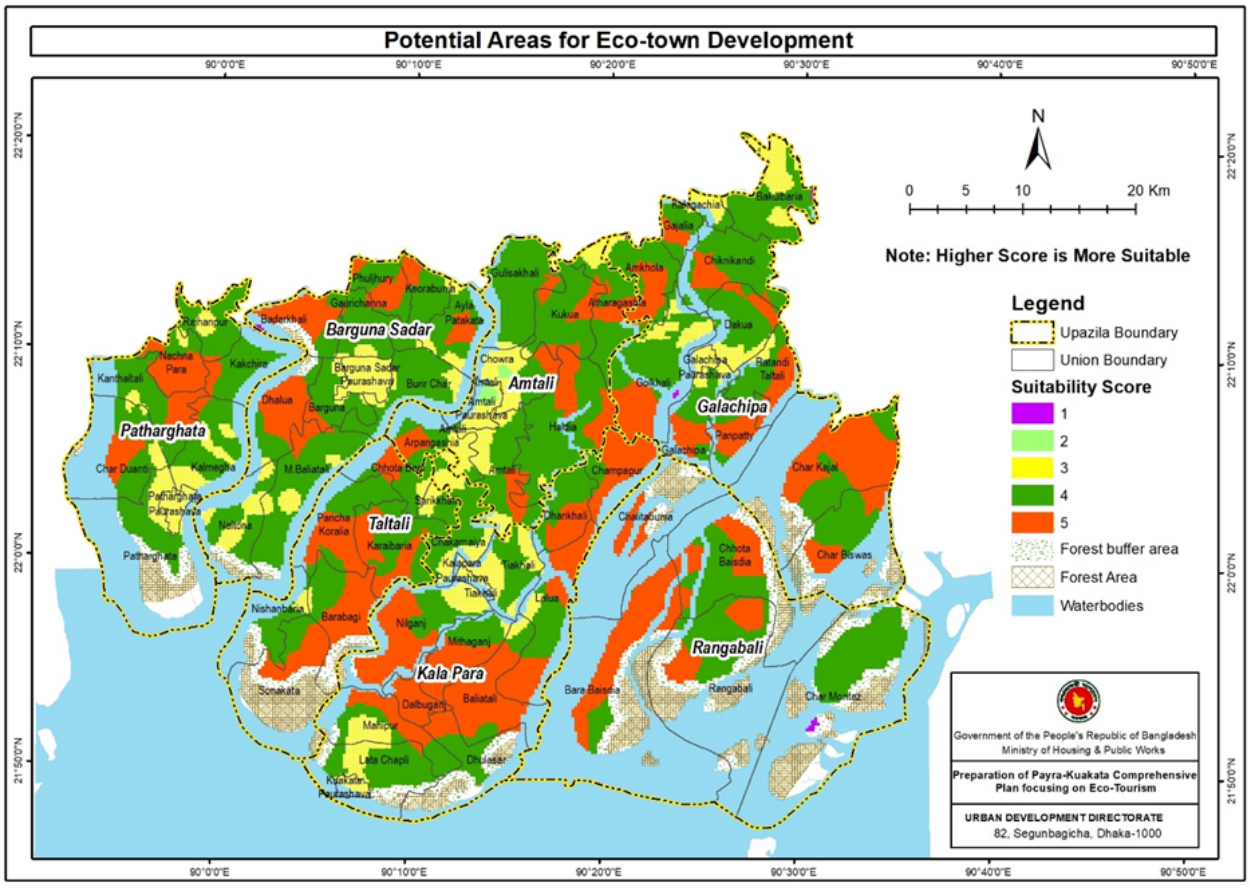


Figure 4-18: Locational Suitability of Eco-town Considering All the Criteria

5. ECONOMIC GROWTH POTENTIAL OF THE REGION: UPAZILA LEVEL ANALYSIS

Any planning approach should involve a closer look at the economic activities of the regions with proper analysis and inference. Any growth of the region may contribute to the national economy or the growth could be influenced by any local or national factor. Industry combination of the nation or the region itself may play a role behind the regional growth also. Economic base and Shift-Share analysis provide an in-depth understanding of the economic activities and the changes in different sectors.

5.1 Economic Base Analysis

Economic base refers to those activities of a community or region which exports goods and services outside the bounds of that community or region or market their good and services to persons coming from outside the region (Andrews, 1953). These activities are the base of the economy of a nation and from a trade-flow viewpoint, are wage earners of the community or region.

An economic base analysis divides the regional economic activities into two categories – basic economic activities and non-basic economic activities. Basic economic activities are a form of regional competitive advantage in which the regional output exceeds the regional needs. Thus, basic activities are a source of economic exports for the area. Non-basic activities, on the other hand, are sources of support for the region's basic economic industries. To build an economic base model, the first step is to identify the industries that make the regional economic base and the industries which are support industries or non-basic economic activities. Location Quotient (LQ) approach is useful to perform this analysis.

Location Quotient is used as an indicator of specialization of any activity of an area or region (Leigh, 1970). The area is thought to be unusually specialized in an activity if the LQ value is found to be greater than unity. LQ is a ratio that compares the region's employment share of an activity to the nation's share (Isserman, 1977).

Economic Base Multiplier can be calculated with the basic and total employment of a region. This is a measure of the increase of non-basic employment for each addition to the basic employment (Siegel, 1966). According to Siegel, basic employment is necessary for the change of non-basic employment because non-basic jobs will not be added unless first basic jobs are added.

5.1.1 Location Quotient

Location Quotient is a statistical technique that measures a region's industrial specialization relative to a larger geographic unit, usually the nation (Indiana Department of Workforce Development, 2006). An LQ is computed as an industry's share of a regional total for some economic statistic (earnings, GDP, employment, etc.) divided by the industry's share of the national total for the same statistic (Glasson, 1974; Miller, Gibson, & Wright, 1991). Location Quotient for each sector of an economy in a region can be derived from the following ratio:

$$LQ_i^r = \frac{e_i/e}{E_i/E}$$

Here,
LQ_i^r = Location Quotient of region 'r' in industry 'i'
e_i = Total employment of region 'r' in industry 'i'
e = Total employment of region 'r'
E_i = Total employment the nation in industry 'i'
E = Total employment of the nation

Location Quotient greater than unity is assumed as Basic Sectors indicating basic or export activities, and the sector offers its products primarily both within a particular region and outside that region as well. Ratios less than unity indicate local or non-basic activities.

5.1.2 Basic Employment

The Location Quotient ratio can be used to estimate the number of employments involved in basic activities in a sector of a particular region. The estimation is done with the following equation:

$$BE_i^r = \frac{LQ_i^r - 1}{LQ_i^r} \times E_i^r$$

BE_i^r = Number of Employment involved in basic activities
LQ_i^r = Location Quotient of region 'r' in industry 'i'
E_i^r = Total number of employments of region 'r' in industry 'i'

5.1.3 Economic Base Multiplier

It is the ratio of the total number of jobs created to the number of basic jobs created. Higher economic base multiplier implies a larger effect of the basic job creator on the total number of jobs.

$$k = \frac{T}{B}$$

k = Economic Base Multiplier
T = Total Employment
B = Total Basic Employment

5.1.4 Analysis of Basic and Non-Basic Employment

Galachipa upazila has the highest number of total employments among the seven upazilas while Taltali upazila has the lowest number (**Table 5-1**). Although from the perspective of percentage increase from 2003 to 2013, Amtali upazila leads with a 174% increase of total employment. Lowest increase was seen in Barguna Sadar, only about 36%. Contrary to the lowest number of total employments, Taltali upazila has grown substantially from 2003 period with the second highest percentage increase in employment (116%). This indicates that Taltali upazila is developing faster than other upazilas in terms of total employment.

Table 5-1: Employment of 2003 and 2013 Comparison among the Upazilas

Upazila	Basic Employ-ment 2003	Total Employment 2003	Basic Employ-ment 2013	Total Employment 2013	Increase of Basic Employ-ment	Increase in Total Employment
Galachipa	3400	13821	7542	25079	122%	81%
Kalapara	2818	11383	4192	16354	49%	44%
Rangabali	1401	5114	2911	8748	108%	71%
Patharghata	1486	6929	3053	12046	105%	74%
Taltali	840	3006	2183	6482	160%	116%
Barguna Sadar	2606	14088	6363	19189	144%	36%
Amtali	1285	5224	4306	14314	235%	174%

(Source: BBS)

The highest basic employment is seen in Galachipa upazila and again the lowest in Taltali (**Figure 5-1**). And as previously seen for total employment the percentage increase of basic employment of Taltali upazila is the second highest (160%). Basic employment in Galachipa upazila only increased by 122%. Amtali has the highest increase of 235%. Basic employment contributes to the total employment in all upazilas but the percentage of share is below 40% for all upazilas. Basic employment constitutes 30% of the total employment in Galachipa upazila, 26% in Kalapara, 33% in Rangabali, 25% in Patharghata, 34% in Taltali, 33% in Barguna Sadar, 30% in Amtali. So, most of the employment is not export-related, although basic employment contributes to non-basic employment which can be identified by the economic base multiplier.

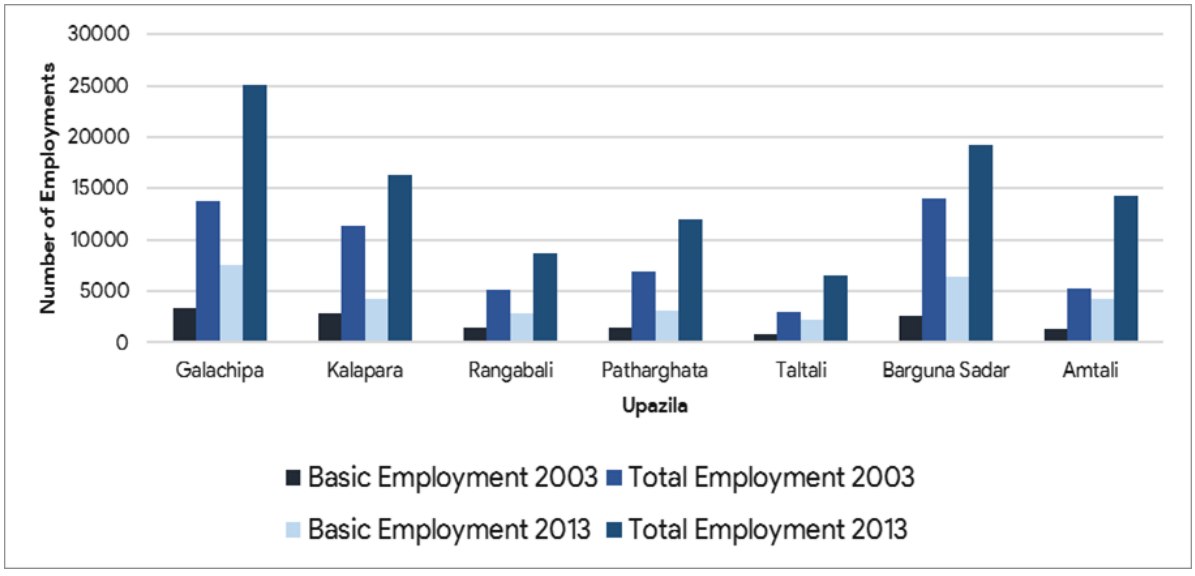


Figure 5-1: Total and Basic Employment in 2003 and 2013

When the basic employment of the sectors is observed, it is seen that the Education sector has the greatest number of basic employment indicating this sector serves people coming from outside the region most among all the sectors (**Table 5-2**). Second in place is Hotel and Restaurant sector, followed by Community, Social and Personal services sector. Upazila and sector wise basic and non-basic employment data of 2003 and 2013 are presented in **Table 5-3, Table 5-4,** and **Table 5-5.**

Table 5-2: Total Number of Basic Employment in 2003 and 2013 in All Upazilas

Sector	Basic Employment in 2003	Basic Employment in 2013
Mining and Quarrying	0	0
Manufacturing	0	0
Electricity, Gas and Water Supply	16	200
Construction	0	10
Wholesale and Retail Trade	3902	3801
Hotel and Restaurant	1279	7276
Transportation, Storage and Communication	0	0
Bank, Insurance and Financial Activities	521	3533
Real Estate and Renting	383	12
Public Administration and Defense	1471	1136
Education	4596	9094
Health and Social Work	405	260
Community, Social and Personal Services	1264	5227

The highest number of basic employments can be seen in Hotel and Restaurant sector of Galachipa upazila followed by Community, Social and Personal Services, Wholesale and Retail Trade, and Education sector. Community, Social and Personal Services increased basic employment by 422%, highest in the upazila from the previous year. Hotel and Restaurant sector comes to second with an increase of 360% (**Table 5-6**). Real Estate and renting, and Public Administration and Defense sector took a dive and as basic employment decreased to 0. Public Administration and Defense sector converted from basic to the non-basic sector.

Community, Social and Personal Services sector in Kalapara upazila is the most flourishing as basic employment in this sector increased a whopping 7556% from 2003 to 2013. Although the Education sector is the stable most sectors in both 2003 and 2013, basic employment in this sector were high. Basic employment in Wholesale and Retail Trade and Real Estate and Renting sectors went to 0 from 2003 to 2013 and converted to the non-basic sector.

Bank, Insurance and Financial Activities and Community, Social and Personal Services sector of Rangabali upazila are the most flourishing sector in the export economy and serving people outside the region as the basic employments have increased by 850% and 743% respectively. No other sector has downgraded from 2003 to 2013. This indicates the upazila can hold a steady economy of its own.

Bank, Insurance and Financial Activities and Hotel and Restaurant sectors are two of the most impactful in Patharghata upazila as the basic employments have increased by 4764% and 2676% respectively between 2003 and 2013. Health and Social Work and Public Administration and Defense sectors saw a decrease in basic employment. Wholesale and Retail Trade sector converted to the non-basic sector.

Prominent sector of Taltali upazila in terms of basic employment is Bank, Insurance and Financial Activities (basic employment increased by 408%). Community, Social and Personal Services sector is notable too with a basic employment percentage increase of 151% between 2003 and 2013. New basic employment has been added to Hotel and Restaurant sector which converted this sector from non-basic to basic.

Basic employment in Community, Social and Personal Services sector in Barguna Sadar upazila has increased 3728%, highest of all sectors. 944% increase was seen in Hotel and Restaurant sector. Basic employment in Bank, Insurance and Financial Activities sector increased 256% between 2003 and 2013. Public Administration and Defense sector's basic employment decreased by 18% from 2003 to 2013. Electricity, Gas and Water Supply and Construction sector converted to basic from non-basic between 2003 and 2013.

Hotel and Restaurant sector in Amtali upazila had the highest increase among all the sectors, 383%. Public Administration and Defense sector increased 289% and Community, Social and Personal Services increased 217% in basic employment. Basic employment of Electricity, Gas and Water Supply sector and Real Estate and Renting sector has gone down to zero. Health and Social Work sector had a 12% decreased in basic employment. Electricity, Gas and Water Supply had a few basic employments in 2003 which became zero in 2013 turning the sector into non-basic sector. However, Bank, Insurance and Financial Activities sector saw a huge increase in basic employment, from 0 to 635 between 2003 and 2013.

Table 5-3: Total Basic Employment in the Sectors in 2013 by Upazilas

	Mining and Quarrying	Manufacturing	Electricity, Gas and Water Supply	Construction	Wholesale and Retail Trade	Hotel and Restaurant	Transportation, Storage, and Communication	Bank, Insurance and Financial Activities	Real Estate and renting	Public Administration and Defense	Education	Health and Social Work	Community, Social and Personal services
Galachipa	0	0	0	0	1868	2147	0	216	0	0	1434	0	1877
Kalapara	0	0	54	0	0	1005	0	579	0	326	1833	0	394
Rangabali	0	0	0	0	1363	793	0	132	0	0	352	0	271
Patharghata	0	0	73	0	0	720	0	366	0	85	1005	13	791
Taltali	0	0	0	0	570	201	0	286	0	0	610	0	517
Barguna Sadar	0	0	73	10	0	1312	0	1319	12	549	2380	162	546
Amtali	0	0	0	0	0	1097	0	635	0	175	1481	84	833

Table 5-4: Total Basic Employment in the Sectors in 2003 by Upazilas

	Mining and Quarrying	Manufacturing	Electricity, Gas and Water Supply	Construction	Wholesale and Retail Trade	Hotel and Restaurant	Transportation, Storage, and Communication	Bank, Insurance and Financial Activities	Real Estate and renting	Public Administration and Defense	Education	Health and Social Work	Community, Social and Personal services
Galachipa	0	0	0	0	942	467	0	73	68	558	933	0	360
Kalapara	0	0	0	0	1574	335	0	0	257	0	646	0	5
Rangabali	0	0	0	0	994	98	0	14	0	0	263	0	32
Patharghata	0	0	0	0	180	26	0	8	0	201	485	203	384
Taltali	0	0	0	0	212	0	0	56	0	0	365	0	206
Barguna Sadar	0	0	0	0	0	126	0	370	5	667	1318	106	14
Amtali	0	0	16	0	0	227	0	0	53	45	586	96	263

Table 5-5: Basic and Non-Basic Sectors of the Upazilas in 2003 and 2013

	Year	Mining and Quarrying	Manufacturing	Electricity, Gas and Water Supply	Construction	Wholesale and Retail Trade	Hotel and Restaurant	Transportation, Storage, and Communication	Bank, Insurance and Financial Activities	Real Estate and renting	Public Administration and Defense	Education	Health and Social Work	Community, Social and Personal services
Galachipa	2003	N/A	Non-Basic	**Non-Basic**	Non-Basic	Basic	Basic	Non-Basic	Basic	**Basic**	**Basic**	Basic	Non-Basic	Basic
	2013	Non-Basic	Non-Basic	**N/A**	Non-Basic	Basic	Basic	Non-Basic	Basic	**N/A**	**Non-Basic**	Basic	Non-Basic	Basic
Kalapara	2003	N/A	Non-Basic	N/A	N/A	**Basic**	Basic	Non-Basic	**Non-Basic**	**Basic**	**Non-Basic**	Basic	Non-Basic	Basic
	2013	Non-Basic	Non-Basic	Basic	Non-Basic	**Non-Basic**	Basic	Non-Basic	**Basic**	**Non-Basic**	**Basic**	Basic	Non-Basic	Basic
Rangabali	2003	N/A	Non-Basic	N/A	**Non-Basic**	Basic	Basic	Non-Basic	Basic	**Non-Basic**	Non-Basic	Basic	Non-Basic	Basic
	2013	N/A	Non-Basic	N/A	**N/A**	Basic	Basic	Non-Basic	Basic	**N/A**	Non-Basic	Basic	Non-Basic	Basic
Patharghata	2003	N/A	Non-Basic	**Non-Basic**	N/A	**Basic**	Basic	Non-Basic	Basic	**Non-Basic**	Basic	Basic	Basic	Basic
	2013	N/A	Non-Basic	**Basic**	N/A	**Non-Basic**	Basic	Non-Basic	Basic	**N/A**	Basic	Basic	Basic	Basic
Taltali	2003	N/A	Non-Basic	N/A	N/A	Basic	**Non-Basic**	Non-Basic	Basic	**Non-Basic**	Non-Basic	Basic	Non-Basic	Basic
	2013	N/A	Non-Basic	N/A	N/A	Basic	**Basic**	Non-Basic	Basic	**N/A**	Non-Basic	Basic	Non-Basic	Basic
Barguna Sadar	2003	N/A	Non-Basic	**Non-Basic**	**Non-Basic**	Non-Basic	Basic	Non-Basic	Basic	Basic	Basic	Basic	Basic	Basic
	2013	N/A	Non-Basic	**Basic**	**Basic**	Non-Basic	Basic	Non-Basic	Basic	Basic	Basic	Basic	Basic	Basic
Amtali	2003	N/A	Non-Basic	**Basic**	N/A	Non-Basic	Basic	Non-Basic	**Non-Basic**	Basic	Basic	Basic	Basic	Basic
	2013	N/A	Non-Basic	**Non-Basic**	N/A	Non-Basic	Basic	Non-Basic	**Basic**	N/A	Basic	Basic	Basic	Basic

Table 5-6: Percentage Change of Basic Employment in the Upazilas

	Mining and Quarrying	Manufacturing	Electricity, Gas and water Supply	Construction	Wholesale and Retail Trade	Hotel and Restaurant	Transportation, Storage and Communication	Bank, Insurance and Financial Activities	Real Estate and renting	Public Administration and Defense	Education	Health and Social Work	Community, Social and Personal Services
Galachipa	0%	0%	0%	0%	98%	360%	0%	197%	-100%	-100%	54%	0%	422%
Kalapara	0%	0%	100%	0%	-100%	200%	0%	100%	-100%	100%	184%	0%	7556%
Rangabali	0%	0%	0%	0%	37%	711%	0%	850%	0%	0%	34%	0%	743%
Patharghata	0%	0%	100%	0%	-100%	2676%	0%	4764%	0%	-58%	107%	-93%	106%
Taltali	0%	0%	0%	0%	168%	100%	0%	408%	0%	0%	67%	0%	151%
Barguna Sadar	0%	0%	100%	100%	0%	944%	0%	256%	152%	-18%	81%	53%	3728%
Amtali	0%	0%	-100%	0%	0%	383%	0%	100%	-100%	289%	153%	-12%	217%

5.1.5 Analysis of Economic Base Multiplier

Economic base multiplier is used to evaluate employment as a measure of activities and can be used for projection purposes. Future total employment of a region can be evaluated by estimating the future prospects of the basic activities in the regional economy and by using a multiplier.

From **Figure 5-2**, it can be seen that the economic base multiplier has increased for all the upazilas from 2003 to 2013. Economic base multiplier is the ratio of total basic and non-basic employment to basic employment. So, the increase in multiplier indicates that the percentage of basic employment to total employment has decreased over 10 years. This means that upazilas are declining in some economic activities and are not able to earn as much from export and outside the region.

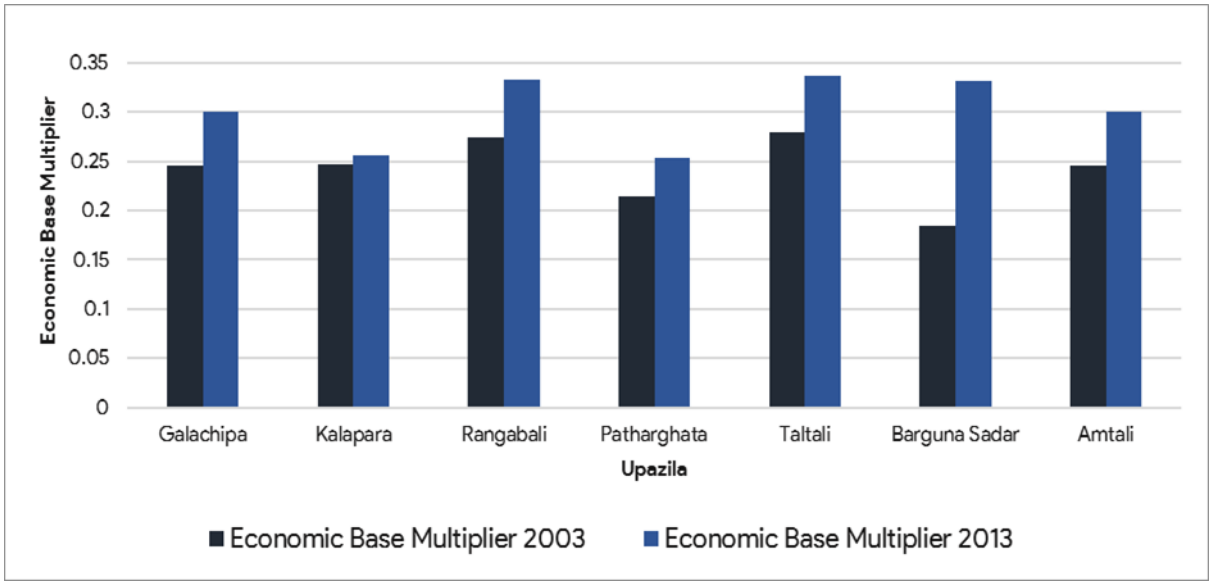


Figure 5-2: Economic Base Multiplier of the Upazilas in 2003 and 2013

5.2 Shift-Share Analysis

The growth of a region can be attributed to a national trend or unique regional factors. Industry combination of the nation or the region itself may play a role behind the regional growth also. Shift-Share analysis helps answer these questions by splitting the employment growth in between the three shift-share components namely: National Share, Proportionality Shift, and Differential Shift.

5.2.1 National Share (NS)

The share of local job growth that can be attributed to the growth of the national economy. Specifically, if the nation as a whole is experiencing employment growth, one would expect total national growth to exert a positive growth influence on the local area.

5.2.2 Industrial Mix (IM)/Proportionality Shift (PS)

The industrial mix or proportionality shift component reflects differences in industry "mix" between the local and national levels. The mix-factor examines how national growth or decline of a particular industry translates into local growth or decline of that industry.

5.2.3 Regional Shift (RS)/Differential Shift (DS)

This share of local job growth describes the extent to which factors unique to the local area have caused growth or decline in regional employment of an industrial group. Even during periods of general prosperity, some regions and some industries grow faster than others do. This is usually attributed to some local comparative advantage such as natural resources, linked industries, or favorable local labor situations. The formula for calculating various components of shift-share analysis are given below.

$$National\ Share, NS = \sum_{i=1}^{n} E_{ir}^{t-1}\left[\frac{E_{nation}^{t}}{E_{nation}^{t-1}} - 1\right]$$

$$Propostionality\ Shift, PS = \sum_{i=1}^{n} E_{ir}^{t-1}\left[\frac{E_{ination}^{t}}{E_{ination}^{t-1}} - \frac{E_{nation}^{t}}{E_{nation}^{t-1}}\right]$$

$$Differential\ Shift, DS = \sum_{i-1}^{n} E_{i}^{t-1}\left[\frac{E_{ir}^{t}}{E_{ir}^{t-1}} - \frac{E_{ination}^{t}}{E_{ination}^{t-1}}\right]$$

Total Regional Growth, G = NS + PS + DS
Total Net Shift Component, (PS+DS) = G – NS
Where, E_{ir} = total employment in industry i in region r
E_{nation}^{t} = total national employment at the terminal period
t= Terminal and t-1 = Base/Initial period; i = industry subscript

5.2.4 Analysis and Findings

The three components of Industrial Structure analysis or Shift-Share analysis is given below for the seven upazilas in **Table 5-7**.

The industrial structure analysis provides an insight of the growth of the upazilas. It is seen that the growth of Galachipa upazila is depressed with respect to its National Share (if it had grown at national rate) as the aggregate Growth of Employment (Gj) [11258] is lower than National Share (NS) [16215] (**Table 5-7**). Growth of Galachipa upazila is dominated by the Wholesale and Retail Trade sector followed by Community, Social and Personal Services sector. Lowest growth is in the Public Administration and Defense sector followed by Real Estate and renting sector and Electricity, Gas and Water Supply sector being only three sectors with negative growth.

Net Shift Component of Galachipa upazila is negative indicating the region is depressed due to some national or local factor (**Table 5-7**). But the growth occurs due to sectors like Community, Social and Personal Services, Transportation, Storage and Communication, Hotel and Restaurant. Net shift was found positive for five sectors.

Table 5-7: Industrial Structure Analysis

Upazila	Growth (G_j)	National Share (NS)	Industrial Mix (IM)	Regional Shift (RM)	Net Shift Component
Galachipa	11258	16215	-2772	-2187	-4959
Rangabali	3634	6000	-1116	-1249	-2366
Kalapara	4971	13355	-2919	-5581	-8501
Patharghata	5117	8129	-1073	-1939	-3012
Barguna Sadar	5101	16528	-2510	-8917	-11427
Taltali	3476	3527	-565	514	-51
Amtali	9090	6129	-976	3937	2961

When the Net Shift Component is divided into Industrial Mix and Regional Shift component it is found that both of them were negative (**ANNEXURE-I: Table-7**). This indicates that the industry mix of the region and local factors are not favorable for nationally fast-growing industry such as Wholesale and Retail Trade. Any growth of this sector in this region is due to national contribution. Transportation, Storage and Communication sector is favored by the industry mix of the region and Hotel and Restaurant sector is favored by local factors. Emphasis should be given in all other sectors as most of them were negative for both Industrial Mix and Regional Shift Component.

Growth is found to be lower than national rate in Rangabali upazila (**Table 5-7**). Wholesale and Retail Trade sector has grown most between 2003 and 2013. However, this sector has a negative value for both the Industrial Mix [-946] and Regional Shift [-1299] component indicating this growth has resulted from national contribution (Annexure Table 8). Transportation, Storage and Communication sector has the most industrial mix advantage and Hotel and Restaurant sector have the local advantage (**ANNEXURE-I: Table-8**).

Kalapara upazila was also found to be lagging behind national growth (**Table 5-7**). Manufacturing sector grew the most in this upazila (**ANNEXURE-I: Table-9**). Wholesale and Retail Trade sector shows a negative growth whereas the National Share component is positive indicating that local factors and industry mix have deterred the development in this sector (**ANNEXURE-I: Table-9**). This is confirmed by the negative value for Industrial Mix [-1906] and Regional Shift [-6231] component resulting in a negative net shift component. Transportation, Storage and Communication sector is positive of Industrial Mix and Bank, Insurance and Financial Activities sector for Regional Shift. Manufacturing industry holds some industry and regional factors contributing to the overall growth.

Patharghata upazila lags behind the national growth rate as the Growth is lower than National Share (**Table 5-7**). Wholesale and Retail Trade was supposed to grow to 3463 whereas it grew to 942 (**ANNEXURE-I: Table-10**). This is a result of unfavorable industry mix and regional disadvantage. Manufacturing sector shows quite a lot of potential as it grew more than national growth. This sector has both industry and local advantage resulting in a positive Net Shift Component. Transportation, Storage and Communication sector also has an advantage from industry mix. Hotel and Restaurant sector benefitted from local advantage.

Regional Growth of Barguna Sadar is very low [5101] from the National Average [16528] (**Table 5-7**). Wholesale and Retail Trade sector was supposed to grow and contribute to regional growth. However, the opposite is seen in industrial structure analysis. Net Shift Component is also negative indicating the disadvantageous position of the upazila from a national or local point of view. Closer look the at the sectoral values for Industrial Mix and Regional Shift Component reveals that both of them are negative for a nationally fast-growing industry like Wholesale and Retail Trade sector. As a result, the region is depressed in this sector as well as the growth is slowed down.

The regional growth [3476] of Taltali upazila is closer to what would have been if it had grown at the national average growth rate [3527] (**Table 5-7**). Wholesale and Retail Trade sector contributed most in this growth. This sector had a regional or local advantage [157] rather than industrial advantage [-440] (**ANNEXURE-I: Table-12**). This is also apparent from the Industry Mix and Regional Shift total values as they are negative and positive respectively. Community, Social and Personal Services sector is the beneficial sector from the industry mix.

Only Amtali upazila has grown in terms of employment compared to the national average rate (**Table 5-7**). Wholesale and Retail Trade sector has contributed most to this growth as well as Community, Social and Personal Services sector, Education sector, Manufacturing sector, and Hotel and Restaurant sector. All of these sectors have either a local advantage or the benefit of regional factors. The Net Shift Component is positive for this region indicating that this upazila has a large potential for nationally fast-growing sectors to be implemented and expand here.

5.3.5 General Findings

Figure 5-3 depicts the upazilas as Fast-Growing or Slow-Growing region based on the Total Growth of Employment (G_j) in each region with respect to their National Share (NS). It is done by comparing the G_j of each region with their NS; if it is higher than NS then the region is considered Fast-Growing otherwise Slow-Growing. It is found that only Amtali upazila can be considered Fast-Growing in terms of regional growth. This means that the overall growth rate of employment at the region was higher than the overall growth rate of employment at the nation. Other upazilas are lagging behind the national growth.

Figure 5-4 delineates the upazilas in Fast-Growing or Slow-Growing region based on their Industry Mix (IM). If the value of IM is positive then the region is considered Fast-Growing, otherwise Slow-Growing region. And all the upazilas are found to be Slow-Growing region in terms of IM. This means that the Upazilas do not have significant employment in those sectors which are fast-growing (sectoral growth rate is higher than national average growth rate) at the national level.

Figure 5-5 is prepared on the basis of Regional Shift (RS) component and divides the upazilas into Fast-Growing or Slow-Growing region based on local advantages. Taltali and Amtali upazila are fast-growing in terms of regional/local advantages. This means that the growth rates of employment in a number of sectors in these Upazilas are higher than the growth rates in these sectors at the national level. These sectors with positive net shifts are shown in **Table 5-8** below.

5.3.6 Policy Implications

Table 5-8 shows the distribution of Upazilas by positive and negative net shifts by sectors. Here net shift is the difference between actual growth of employment in the region and the national share which represents the regional employment growth if regional employment grew at the same rate as the overall (all sectors combined) growth rate of employment in the nation. The Net Shift is positive if the actual growth rate of regional employment is higher than overall national employment growth rate and negative if the actual regional growth rate of employment is lower than overall national employment growth rate. In the PKCP area Patharghata and Amtali have 7 sectors with positive Net Shift, Barguna and Taltali have 5 sectors with positive Net Shift, Galachipa and Rangabali have 4 sectors with positive net shifts and Kalapara has 3 sectors with positive Net Shift (**Annexure-I, Tables 7 to 13**). Thus, while making sectoral investments, priority should be given to those sectors in each Upazila which have positive Net Shift.

Table 5-8: Upazilas with Positive and Negative Net Shifts by Sectors

	Galachipa	Rangabali	Kalapara	Patharghata	Barguna Sadar	Taltali	Amtali
Mining and Quarrying	-	-	-	-	-	-	-
Manufacturing	-	-	+	+	-	-	+
Electricity, Gas and Water Supply	-	-	-	+	+	-	-
Construction	-	-	-	-	+	-	-
Wholesale and Retail Trade	-	-	-	-	-	-	-
Hotel and Restaurant	+	+	-	+	+	+	+
Transportation, Storage, Communication	+	+	+	+	+	+	+
Bank, Insurance and Financial Activities	-	+	+	+	+	+	+
Real Estate and renting	-	-	-	-	-	-	-
Public Administration and Defense	-	-	-	-	-	-	+
Education	-	-	-	-	-	-	+
Health and Social Work	+	-	-	+	-	+	
Community, Social and Personal services	+	+	-	+	-	+	+

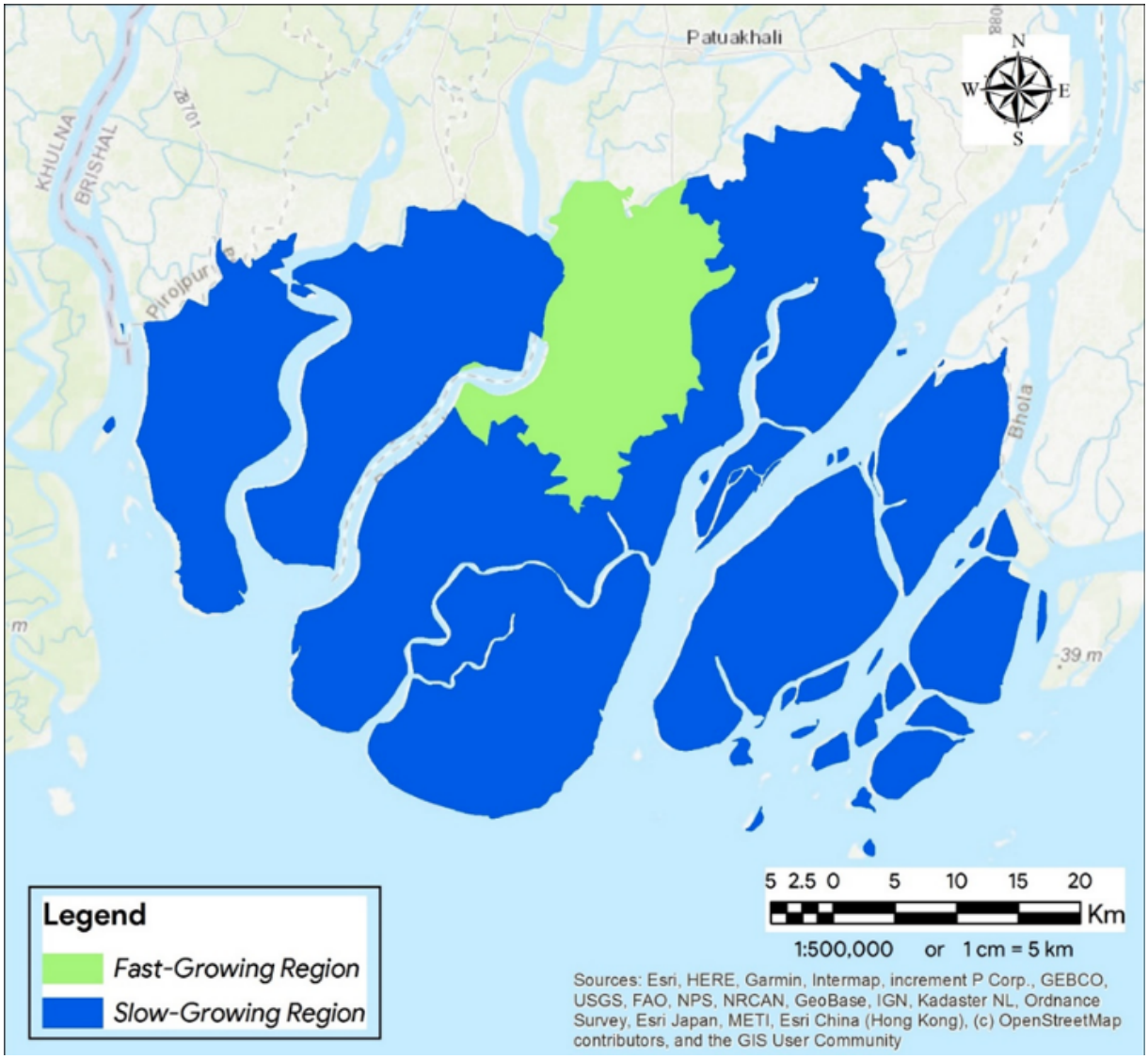


Figure 5-3: Delineation of Fast Growing and Slow Growing Regions Based on Net Regional Growth

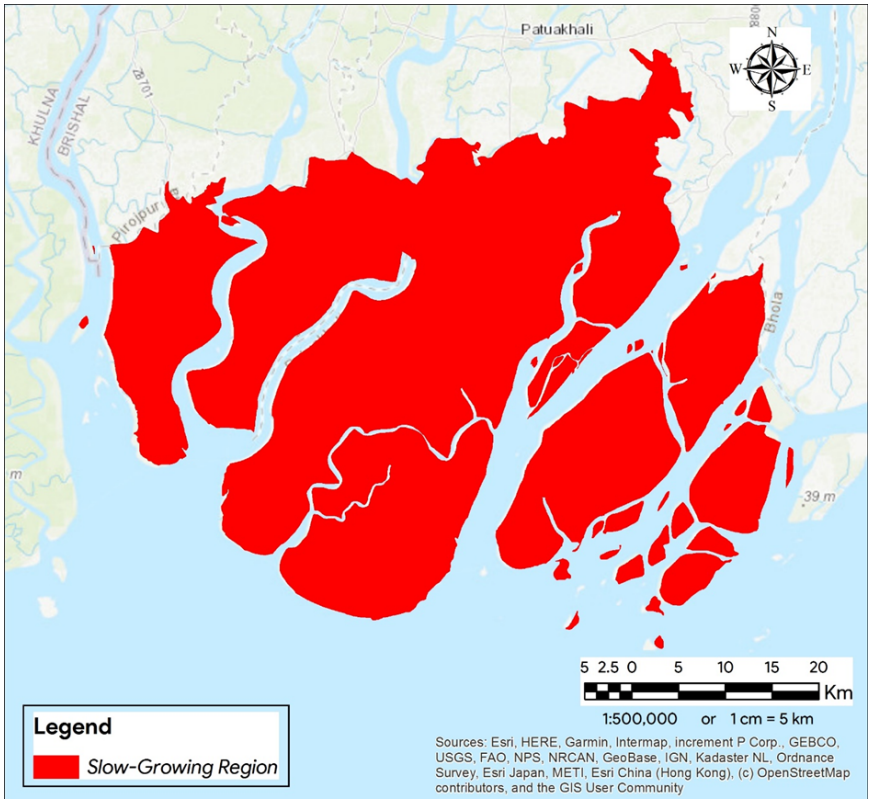


Figure 5-4: Delineation of Fast Growing and Slow Growing Regions on the Basis of Industry Mix Component (Sectors with High Growth Rate at National Level)

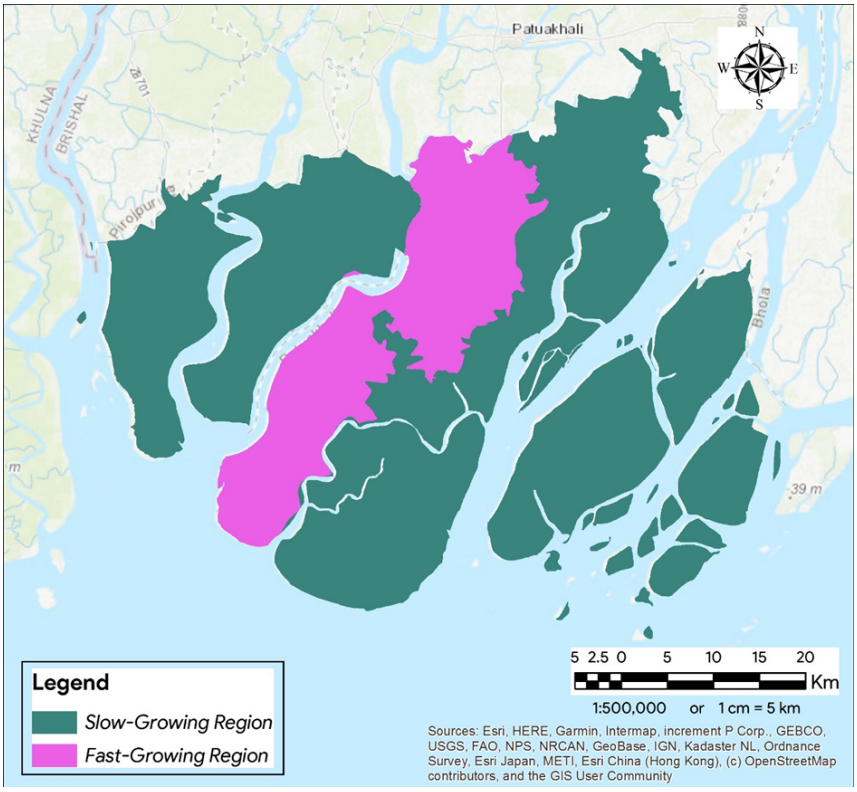


Figure 5-5: Delineation of Fast Growing and Slow Growing Regions on the Basis of Regional Shift Component (Sectors with High Growth Rates at Regional Level)

6. ASSESSMENT OF SOCIO-ECONOMIC FACILITIES IN THE AREA: NEED AND GAP ANALYSIS

6.1 Introduction

There is increasing awareness that planning need to be responsive to the emerging problems of society at various spatial levels. One major problem of the area under study is the disparity among the Upazilas in terms of service facilities. Therefore, planning service facilities requires critical examination of existing facilities and their distribution.

The social services/facilities for the study has been selected mainly considering their importance and data availability. The facilities have been broadly categorized into four groups:

1. Educational facilities: Primary schools, high schools, and madrashas
2. Commercial facilities: Growth centres and rural markets
3. Health facilities: Upazila health complexes/hospitals, family welfare centres and community clinics
4. Disaster management facility: Cyclone shelters

In this study the need for a facility has been determined on the basis of population threshold for that facility. Population threshold is the minimum number of population or user or customer required to support a given facility. For example, if the threshold population for any service facility i.e. school is 1500, it means that any Mauza with a population of 1500 must contain a school.

In this study, population threshold for facilities have been calculated using Reed-Muench method which had been further developed by Hagget and Gunawardena (**ANNEXURE-II**). For calculating the threshold population for any service facility, existing number of that service facility per administrative units (i.e., Mauza or Union of the study area) need to be identified. Threshold population usually varies according to hierarchy of services. Thus, it can be said that threshold population for a college is expected to be higher from the threshold population of a school. Therefore, if we use Mauza population for calculating threshold population of a school, we may use Union population for calculating threshold population of a college.

6.2 Need and Gap Analysis

The need for social facilities and the gap between required and existing facilities have been determined in several phases as follows:

- The number of existing facilities in each upazila has been identified.
- Population of each upazila has been projected for the year 2021, 2031, and 2041.
- Threshold population for each facility has been estimated on the basis of Reed-Muench method as discussed in **ANNEXURE-II**.
- Requirement of a facility for an upazila has been determined by dividing the projected population of that upazila by the threshold population of that facility.
- The gap is the difference between the required number of a facility and its existing number.

6.2.1 Existing Facilities

The distribution of existing socio-economic facilities by upazilas is presented in **Table 6-1** while the **Table 6-2** presents the distribution of facilities per 10,000 people which gives a relative picture of the upazilas in terms of availability of facilities. For example, in Patharghata Upazila, there is only 0.67 or less than one high School per 10,000 people while in Galachipa Upazila, there are 2.24 High Schools per 10,000 people. This means that in Galachipa Upazila availability of High Schools is about 3.34 times (2.24/0.67) better than the availability of High Schools in Patharghata Upazila.

Galachipa performs best while Patharghata performs worst in terms of educational facilities if high school is considered. In case of primary school Patharghata performs better than other upazilas while Rangabali's performance is the worst in this case. Availability of madrasa is the highest in Amtali but the lowest in Kalapara.

A comparative analysis of health facilities indicates that Amtali has better facilities in all categories of health facilities such as health complex/hospital, family welfare centres and community clinics compared to other upazilas. Rangabali suffers most in terms of availability of health facilities although the condition in other upazilas is not at all satisfactory.

Significant variations are observed when availability of commercial facilities such as growth centres and rural markets are considered. Patharghata has highest number of growth centres per thousand population while Amtali has the highest number of rural markets per thousand population. Rangabali and Barguna Sadar lag behind other upazilas in terms of availability of growth centres and rural markets respectively.

Cyclone Shelters are widely available in different upazilas. However, highest number of cyclone Shelters per unit of population is found in Taltali while lowest number is found in Amtali.

6.2.2 Requirements of Social Facilities in Future

Requirements of socio-economic facilities have been determined on the basis of threshold population for each facility as discussed above. Threshold population of each facility in the study area as calculated on the basis of Reed-Muench method is shown below:

Facility	Threshold Population
Primary school	450
Madrasa	8315
High school	7217
College	31783
Upazila health complex/ hospital	208403
Family welfare centre	22001
Community clinic	24975
Growth centre	38202
Rural market	2850
Cyclone shelter	2569

For calculating threshold population Mouza, Union and Upazila level population data are required. That is why population data of 2011 population Census have been used for this purpose.

Table 6-3 presents the projected requirements of socio-economic facilities in different upazilas in 2021 while **Table 6-4** and **Table 6-5** show the projected requirements of facilities in different upazilas in 2031 and 2041, respectively. **Table 6-6** indicates that if facilities are provided on the basis of threshold population then there would be very little disparity among the upazilas in terms of availability of facilities under study.

Table 6-1: Distribution of Existing Facilities by Upazilas

Facility	Total Number of Existing Facilities									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Galachipa	58	265	24	0	15	22	8	43	39	10
Kalapara	46	219	22	2	14	24	10	34	35	6
Rangabali	16	78	13	0	3	2	1	21	17	0
Patharghata	11	196	22	2	8	20	10	39	49	5
Taltali	11	94	15	0	5	10	5	11	33	2
Barguna Sadar	34	239	30	2	8	27	5	31	47	6
Amtali	28	186	34	4	19	24	3	47	22	6

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 6-2: Existing Facilities per 10,000 People in Different Upazilas

Facility	Number of Existing Facilities per 10,000 People									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Galachipa	2.24	10.25	0.92	0.00	0.58	0.85	0.31	1.66	1.51	0.39
Kalapara	1.93	9.20	0.92	0.08	0.58	1.01	0.42	1.43	1.47	0.25
Rangabali	1.55	7.57	1.26	0.00	0.29	0.19	0.10	2.04	1.65	0.00
Patharghata	0.67	11.95	1.34	0.12	0.49	1.22	0.61	2.38	2.99	0.31
Taltali	1.25	10.68	1.70	0.00	0.56	1.13	0.56	1.25	3.75	0.23
Barguna Sadar	1.30	9.14	1.14	0.08	0.30	1.03	0.19	1.18	1.80	0.23
Amtali	1.53	10.17	1.86	0.21	1.04	1.31	0.16	2.57	1.20	0.33

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 6-3: Projected Requirement of Facilities by Upazilas in 2021

Facility	Total Number of Facilities Required by 2021									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Galachipa	40	644	35	1	13	12	8	102	113	9
Kalapara	37	600	33	1	12	11	7	95	105	9
Rangabali	15	247	13	1	5	4	3	39	43	4
Patharghata	26	416	23	1	9	8	5	66	73	6
Taltali	14	224	12	0	5	4	3	35	39	3
Barguna Sadar	39	632	34	1	13	11	7	100	111	9
Amtali	29	469	25	1	10	8	6	74	82	7

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 6-4: Projected Requirement of Facilities by Upazilas in 2031

Facility	Total Number of Facilities Required by 2031									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Galachipa	44	707	38	2	14	13	8	112	124	10
Kalapara	42	674	36	1	14	12	8	106	118	10
Rangabali	17	271	15	1	6	5	3	43	47	4
Patharghata	28	455	25	1	9	8	5	72	80	6
Taltali	15	245	13	1	5	4	3	39	43	3
Barguna Sadar	43	682	37	1	14	12	8	108	120	10
Amtali	32	514	28	1	11	9	6	81	90	7

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 6-5: Projected Requirement of Facilities by Upazilas in 2041

Facility	Total Number of Facilities Required by 2041									
	HS[1]	PS[2]	MDSA[3]	UHC/H[4]	FWC[5]	CC[6]	GC[7]	RM[8]	CS[9]	COL[10]
Galachipa	48	769	42	2	16	14	9	122	135	11
Kalapara	47	747	40	2	15	13	9	118	131	11
Rangabali	18	294	16	1	6	5	3	46	51	4
Patharghata	31	493	27	1	10	9	6	78	86	7
Taltali	17	266	14	1	5	5	3	42	47	4
Barguna Sadar	46	733	40	2	15	13	9	116	128	10
Amtali	35	559	30	1	11	10	7	88	98	8

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

Table 6-6: Facilities per 10,000 People if Required Facilities are Provided

Facility	Number of Facilities per 10,000 People in 2041 if Required Facilities are Provided									
	HS[1]	**PS[2]**	**MDSA[3]**	**UHC/H[4]**	**FWC[5]**	**CC[6]**	**GC[7]**	**RM[8]**	**CS[9]**	**COL[10]**
Galachipa	1.39	22.20	1.21	0.06	0.46	0.40	0.26	3.52	1.39	0.35
Kalapara	1.40	22.22	1.19	0.06	0.45	0.39	0.27	3.51	1.40	0.38
Rangabali	1.36	22.23	1.21	0.08	0.45	0.38	0.23	3.48	1.36	0.39
Patharghata	1.40	22.19	1.22	0.05	0.45	0.41	0.27	3.51	1.40	0.37
Taltali	1.42	22.20	1.17	0.08	0.42	0.42	0.25	3.51	1.42	0.34
Barguna Sadar	1.39	22.21	1.21	0.06	0.45	0.39	0.27	3.52	1.39	0.34
Amtali	1.39	22.23	1.19	0.04	0.44	0.40	0.28	3.50	1.39	0.38

1=High School 2= Primary School 3=Madrasa 4=Upazila Health Complex/Hospital 5=Family Welfare Centre 6=Community Clinic 7= Growth Centre 8=Rural Market 9= Cyclone Shelter 10=College

7. LAND USE SUITABILITY ANALYSIS FOR URBAN AND INFRASTRUCTURE DEVELOPMENT OF THE PLANNING AREA

7.1 Suitability Analysis

The suitability analysis for urban growth is considered one of the most important and effective techniques for identifying the best urban growth locations. This technique employs different types of criteria and weights. Land suitability evaluation involves the selection of suitable locations of development via mapping of the suitability index of a specific area. GIS techniques have become a significant tool for controlling and monitoring changes in urban development and their impact on ecosystems. Land suitability analysis based on GIS environments is a process that aims to identify the best locations of development while considering environmental sustainability.

Since site selection and suitability process are related to geospatial issues, geographical information system (GIS) allows using data related parameters for suitability modeling. One of the advantages of using GIS in site suitability analysis is the capability of GIS in development of alternative scenarios for urban development. Suitability analysis in a GIS context is a geographic or GIS-based process used to determine the appropriateness of a given area for a particular use. The basic premise of GIS suitability analysis is that each aspect of the landscape has intrinsic characteristics that are to some degree either suitable or unsuitable for the activities being planned. Suitability is determined through systematic, multi-factor analysis of the different aspects of the problem (Murphy, 2005).

A GIS suitability model typically answers the question, ‘where is the best location? Land suitability analysis is used for site selection, impact studies and land use planning (Edward et. al. 2010).

7.2 Methodology

In the present study, several suitability analyses have been done considering different impacts and every suitability analysis has been sub categorized into logical sub parameters observing its extent. The major suitability analyses are outlined below:

- Agricultural suitability
- Hydro-geological suitability
- Flood depth mapping
- Urban land use suitability

For the determination of suitability analysis, preference is given to physical parameters. The physical factors that positively influenced urban promotional area are given preferences in this analysis. In this part of the research, the previous studies are used to identify the significant factors that influence the determination of appropriate suitability analysis. Additionally, the influencing sub factors are determined based on statements gained from local experts working in related Government authorities. The sub-factors derived from each Suitability Analysis have been identified in **Figure 7-1**.

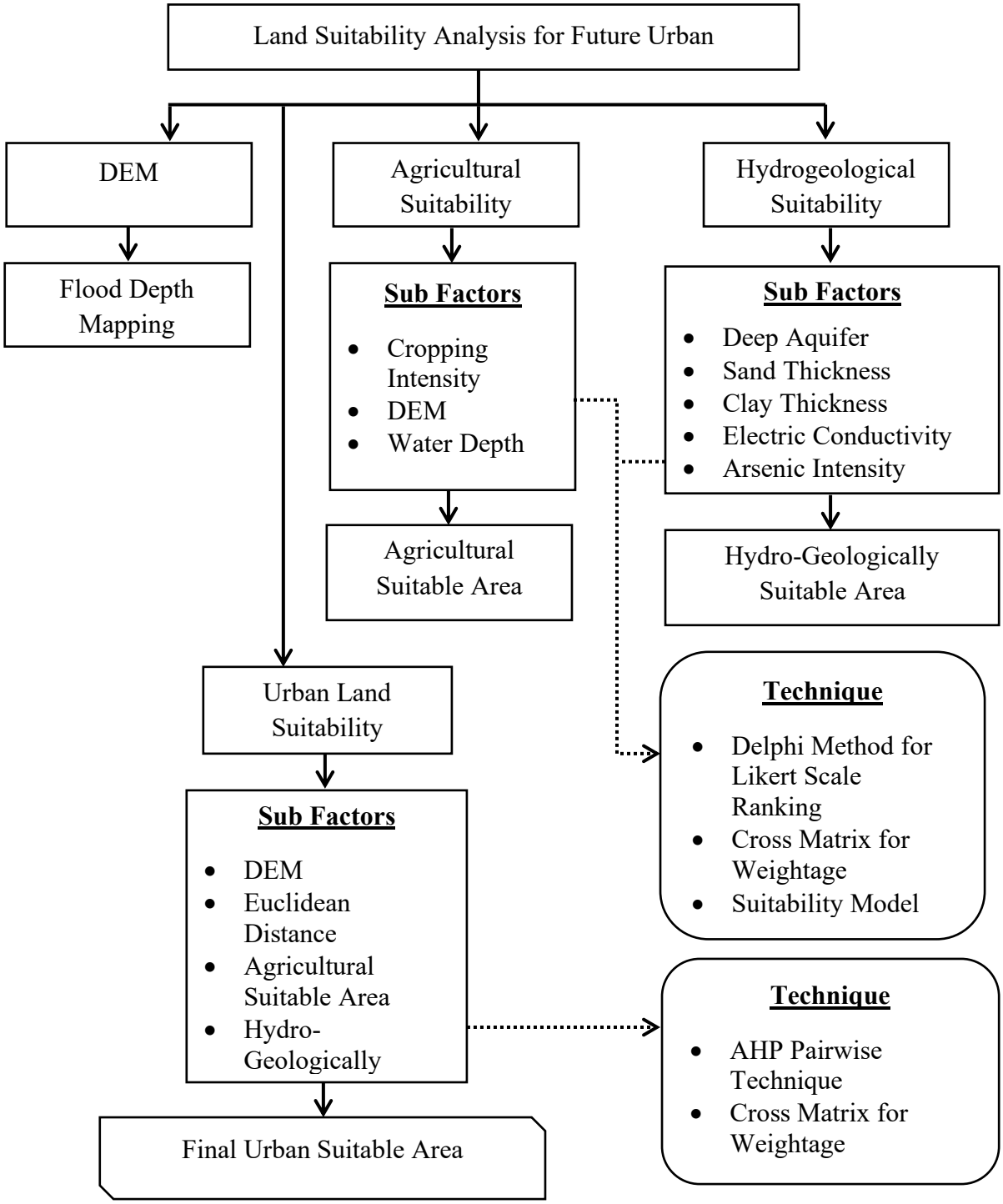


Figure 7-1: Flow Chart of Suitability Analysis Methodology

7.2.1 Agricultural Suitability

A proper evaluation of suitability analysis characterizes the importance of agricultural land. An assessment of potential factors affecting agricultural land is considered here for agricultural suitability analysis which will deter the future urban land for planning and development. Cropping Intensity, DEM and Water Depth are considered for agricultural suitability analysis.

7.2.2 Hydro-Geological Suitability

Water is an inevitable element for any development works. Without prior determining of its sources, it can accrue a great loss for a project. As Bangladesh is very risk prone country for safe drinking water, shallow aquifers here are mostly contaminated by various poisonous elements like Arsenic, Iron, Chloride, Magnesium, Sulfates etc. Moreover, recharging of deep groundwater is rarely quantified. For determining Hydrological Suitability five factors have been considered which are respectively Arsenic, Electric Conductivity, Deep Aquifer, Clay Thickness and Sand Thickness.

7.2.3 Flood Depth Mapping

Hydrology analysis is important to extract the information about where water comes from and where it is going across on any cell of a raster data. Defined by topographic divides, a watershed is an area that drains surface water to a common outlet. A watershed is a hydrologic unit that is often used for the management and planning of natural resources. Flood Depth Raster has been created after reclassifying the DEM according to Flood Depth categories (**Table 7-1**).

Table 7-1: Flood Depth Categories

Land Type	Flood Depth
F0	Less than 0.3 m
F1	0.3m to 0.6 m
F2	0.6m to 1.8 m
F3	1.8m to 3.6m
F4	Greater than 3.6m

7.3 Urban Land Use Suitability Analysis

Urban Suitability analysis has been done after taking into consideration of all Suitability analysis mentioned earlier. The aim of this suitability is to find the best suitable area and gain an overall idea of land for urban land use planning. Factors and criteria are defined based on literature review, experts' opinions, local contexts and availability of data. Based on above-mentioned suitability analyses several maps have been prepared which show the following:

Delineation of Areas by Agricultural Suitability (**Figure 7-2**)
Delineation of Areas by Hydro-Geological Suitability (**Figure 7-3**)
Delineation of Areas by Flood Depth (**Figure 7-4**)
Delineation of Areas by Foundation Depth (**Figure 7-5**)
Delineation of Areas by Soil Characteristics (**Figure 7-6**)
Delineation of Areas by Building Height Suitability (**Figure 7-7**)
Delineation of Areas by Liquefaction Hazard (**Figure 7-8**)
Delineation of Areas by Urban Land Use/Infrastructure Suitability (**Figure 7-9**)

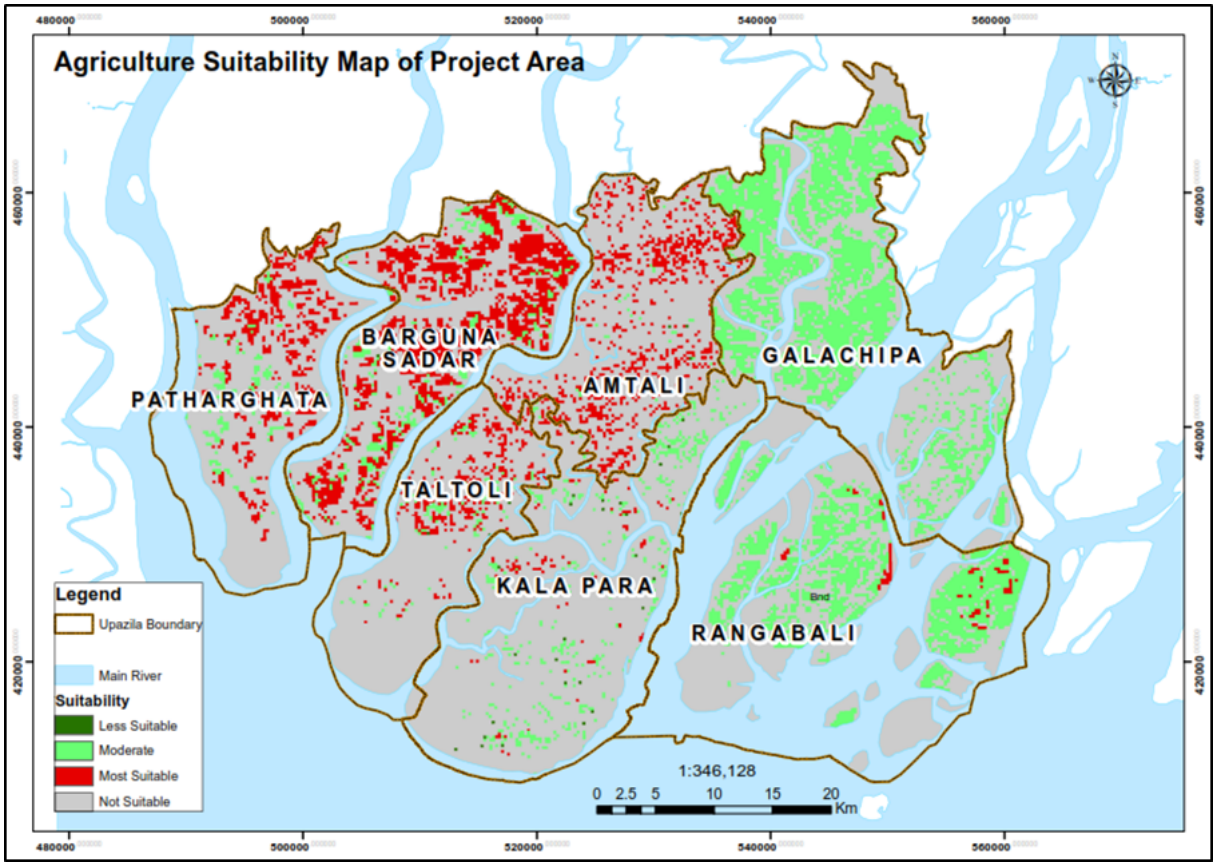


Figure 7-2: Agricultural Suitability of Planning Area

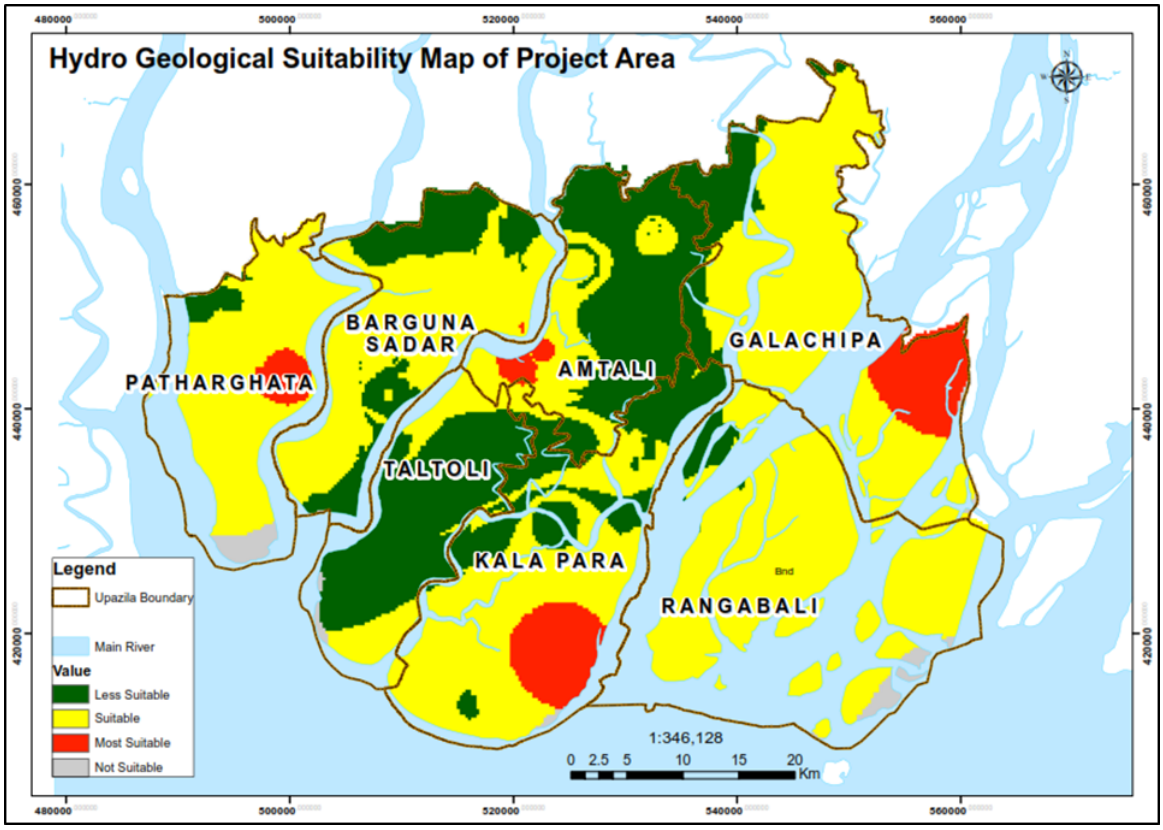


Figure 7-3: Hydro-Geological Suitability of Planning Area

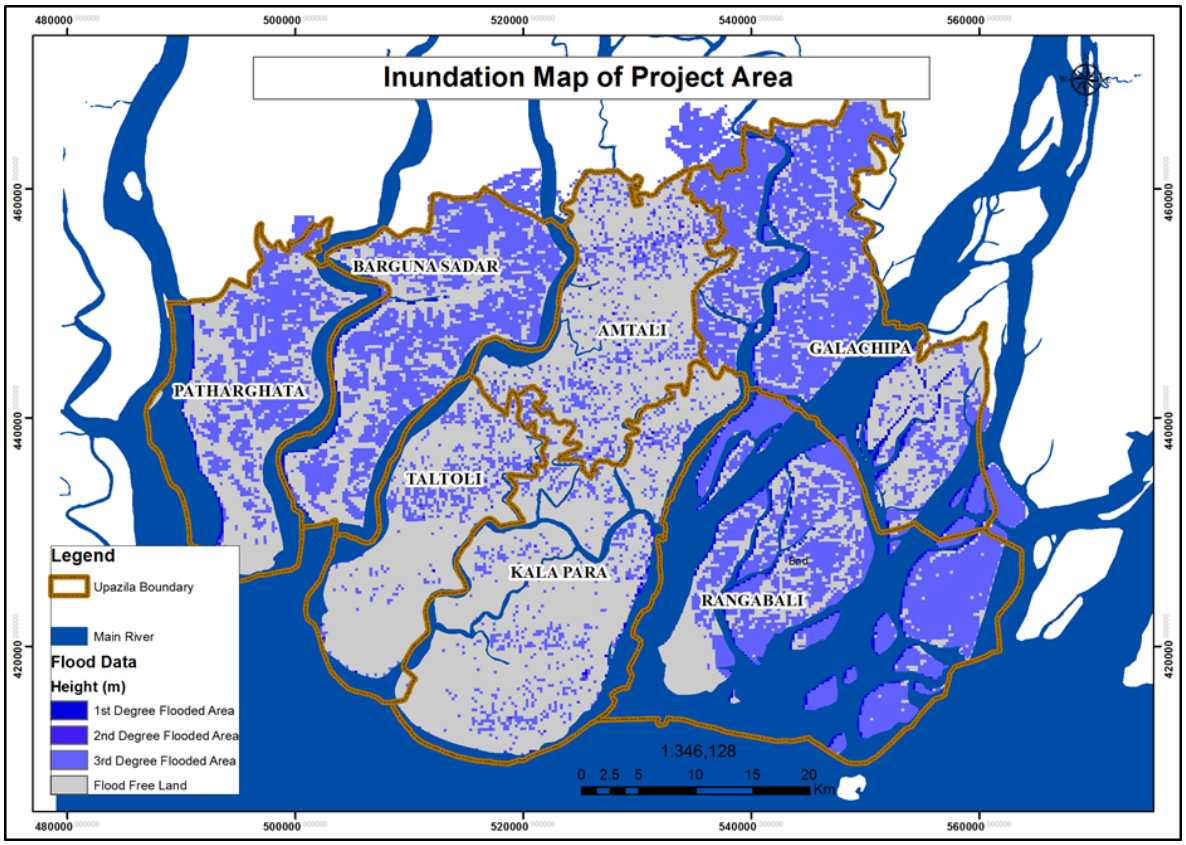


Figure 7-4: Delineation of Areas by Flood Depth

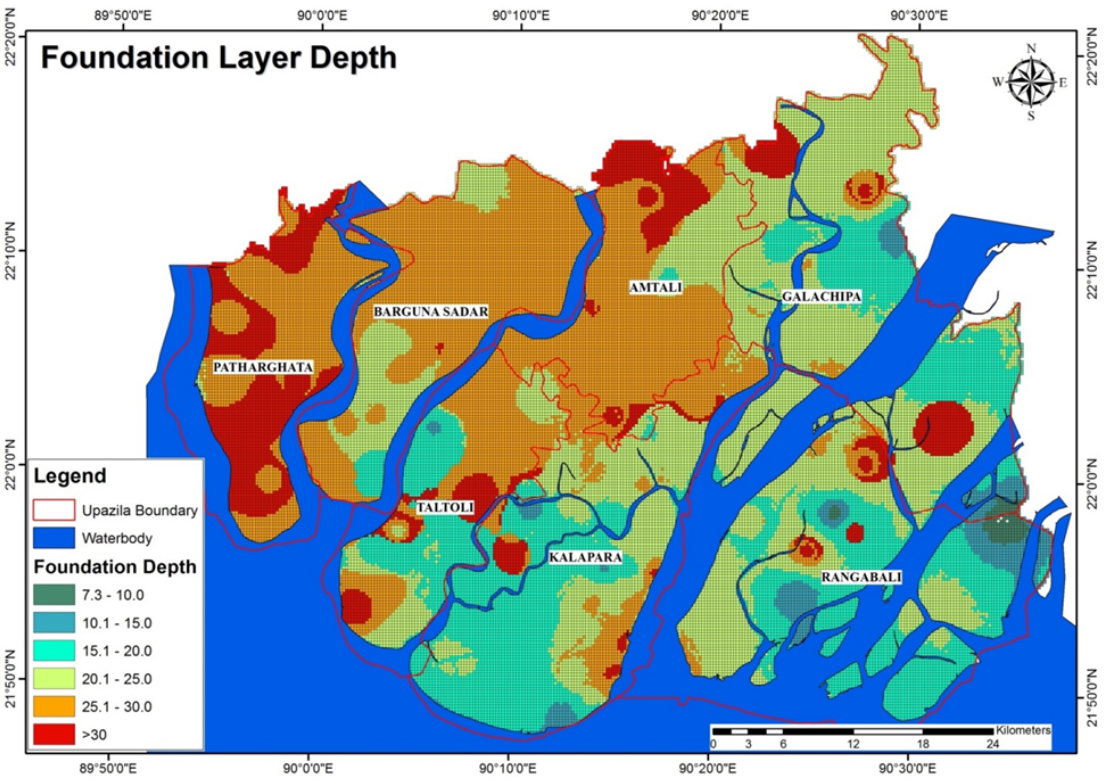


Figure 7-5: Delineation of Areas by Foundation Depth

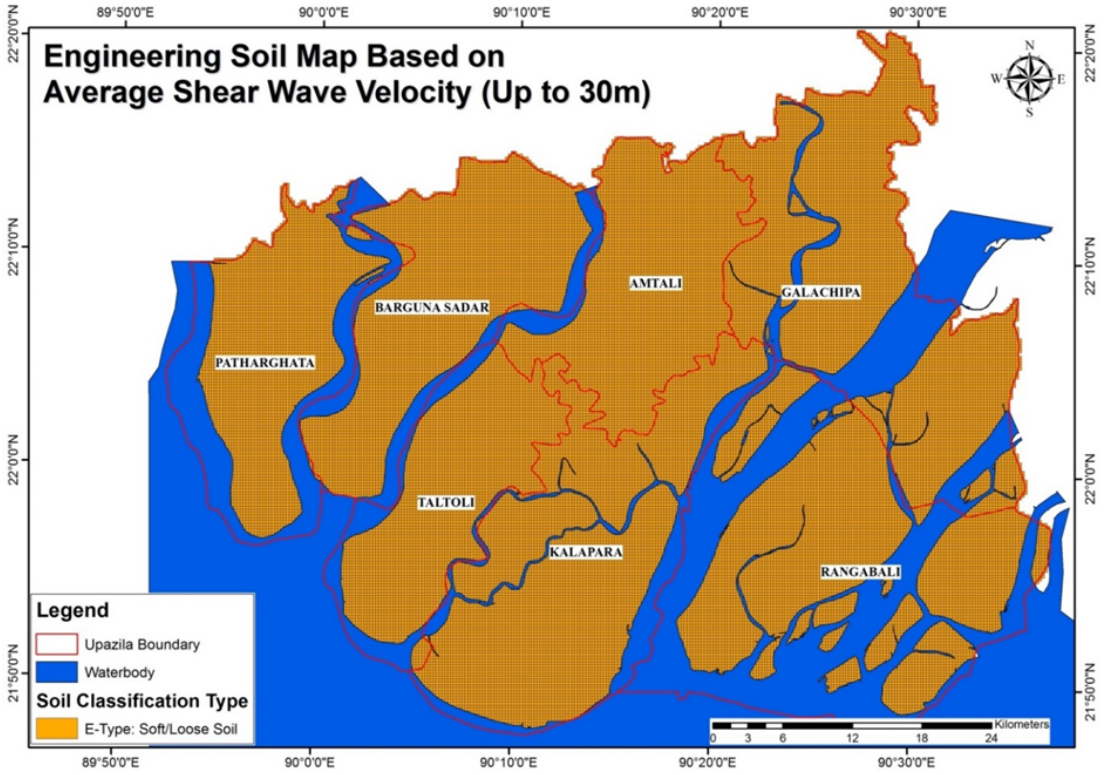


Figure 7-6: Delineation of Areas by Soil Characteristics

(Soil classification map of the Planning Area according to NEHRP (National Earthquake Hazard Reduction Program, USA) provisions based on the average shear wave velocity distribution down to 30 m)

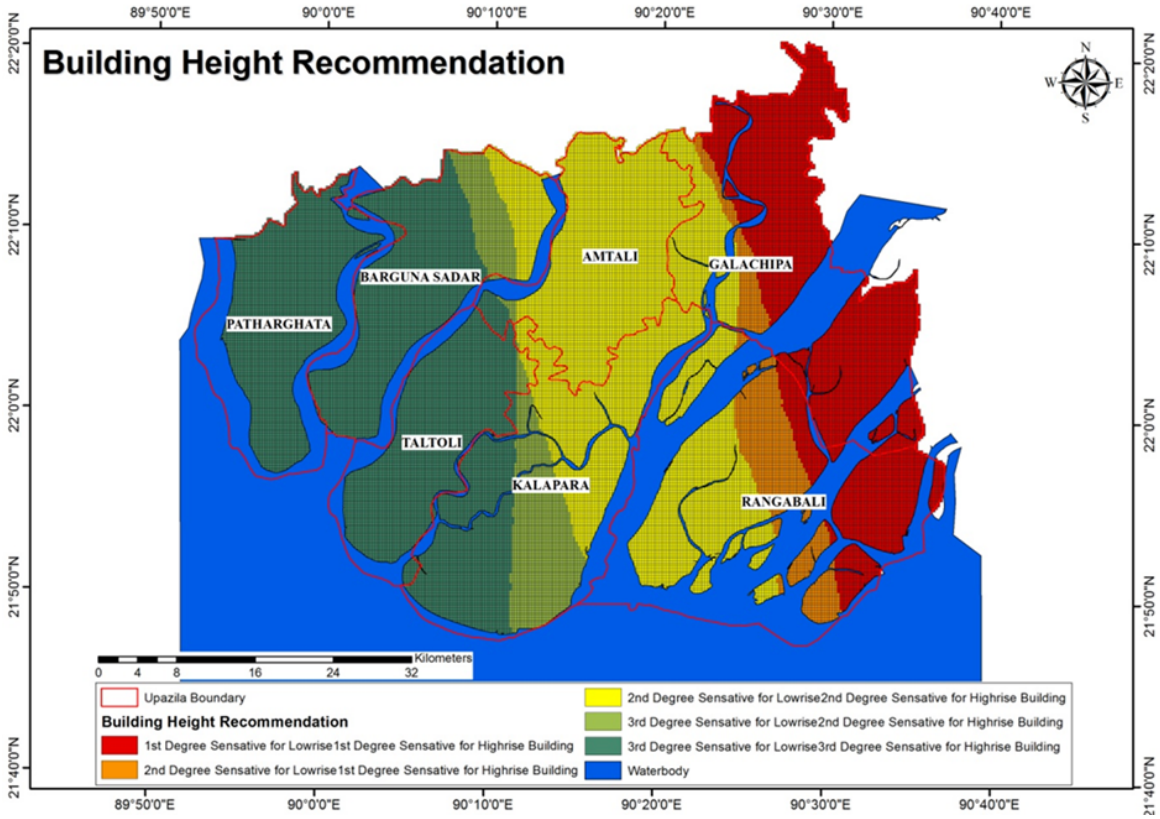


Figure 7-7: Delineation of Areas by Building Height

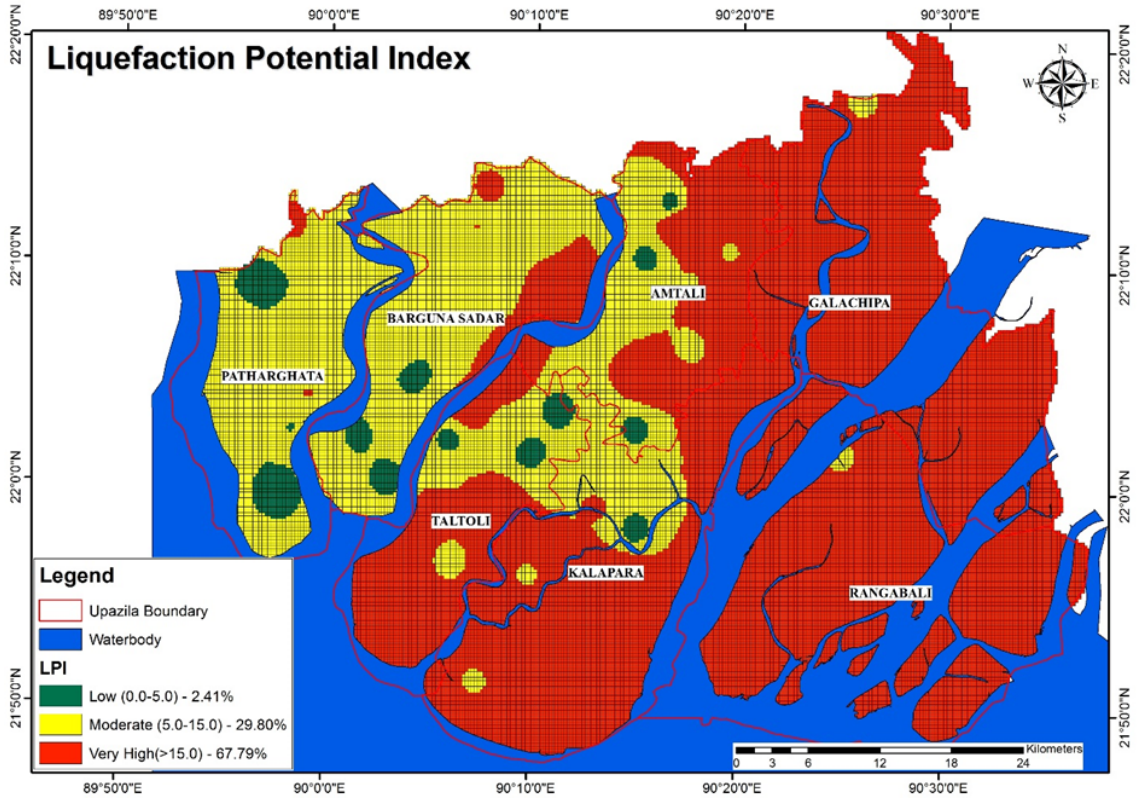


Figure 7-8: Delineation of Areas by Liquefaction Hazard

A composite land use/infrastructure suitability map has been prepared based on various types of suitability analysis. **Figure 7-9** shows that areas delineated by Sage green color areas of Patharghata, Barguna Sadar, Taltoli and Kalapara upazila are relatively good within this study area in terms of suitability and is suitable for light infrastructure with a foundation depth around 12 to 20m. Large and tall infrastructure requires pile foundation placed on Soil layer no 4 or 6 (**Table 7-2**). Those areas can be used for Commercial, Residential and Industrial Zone. Soil profile of Layer 4 and 6 in the project area is presented in **Table 7-3**.

Yellow color area of Patharghata, Barguna Sadar, Amtoli, Taltoli and Kalapara upazila is moderately suitable in comparison to other areas within the study area and for light infrastructure requires on-site subsoil investigation and proper foundation design. Deep pile foundation is required for large infrastructure. Such areas can be used as Industrial zone, Residential area, Commercial area, Agricultural Zone, Park and Recreation site.

Orange and Red color area of Galachipa, Rangabali, Barguna Sadar, Amtoli, Taltoli and Kalapara upazila is poorly and Very poorly suitable in comparison to other areas within the study area for infrastructure development. Detailed subsoil investigation and proper foundation design is required for all types of infrastructure, due to low suitability with hazard potential. Agricultural zone, rural settlement, Park and Recreation site are suggested for such sites.

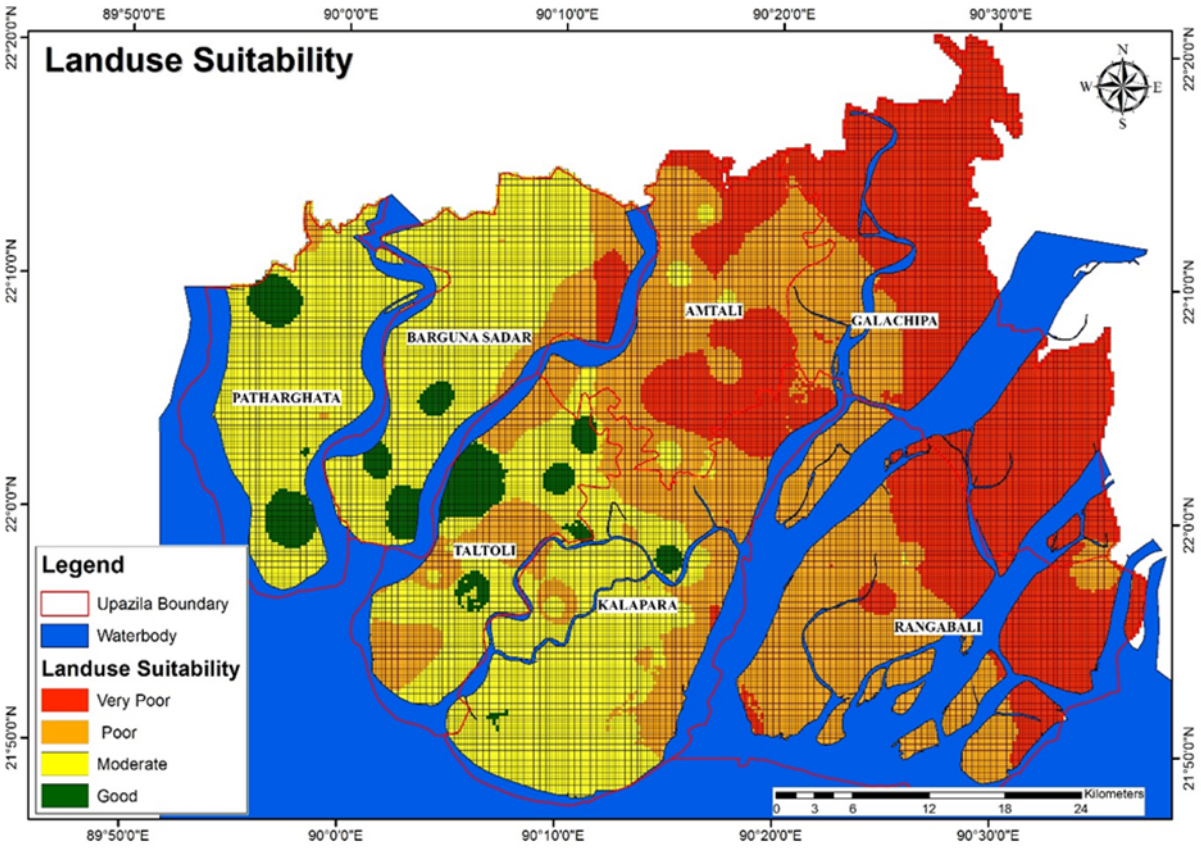


Figure 7-9: Delineation of Areas by Urban Land Use/ Infrastructure Suitability

Table 7-2: Land Use Classification for Infrastructure Development

SL	Infrastructure Suitability	Infrastructure foundation suitability	Suggested land use suitability
1	Good	Low-rise building/light infrastructure is suitable with a foundation depth of around 12 - 20m. Large and tall infrastructure requires pile foundation placed on layer no 4 or 6.	Commercial area, Residential area, Industrial zone
2	Moderate	Low-rise building/light infrastructure requires on-site subsoil investigation and proper foundation design. Deep pile foundation is needed for large infrastructure.	Industrial zone, Residential area, Commercial area, Agricultural zone, Park and recreation
3	Poor	Detail subsoil investigation and proper foundation design is required for all types of infrastructure, due to low suitability with hazard potential.	Agricultural zone, Wetland, Rural settlement, Park and recreation
4	Very Poor	Detail subsoil investigation for deep pile foundation is essential, due to very low soil resistance and high hazard potential. Shallow foundation is not preferred.	Agricultural zone, Wetland, Rural settlement, Park and recreation

Land use suitability classification has been prepared to reduce the damage of property and life due to seismic hazard by implementing above suggestion.

Table 7-3: Soil Profile of Layer 4 and 6 in Project Area

Row Labels	Min of SPT	Max of SPT	Average of SPT	Min_ Thickness	Max_ Thickness	Average_ Thickness	Min Depth	Maximum Depth
Layer-4	6	57	22	1.5	15	4	8	28
Layer-6	10	118	42	1.5	8.5	3	21.5	28

7.4 Conclusion

Seismically, Bangladesh is divided into three zones i.e. highly risk zone (zone 1), moderate risk zone (zone 2) and less risk zone (zone 3). Payra-Kuakata project area is situated in zone 3. Besides these, this area is located near Arakan Megathrust. So, Payra-Kuakata project area is less vulnerable compared to other zones in Bangladesh for earthquake. However, the project area is relatively liquefaction hazard prone. Liquefaction hazard map is showing approximately 67.79% areas are at very high risk, 29.80% have moderate risk and 2.41 % areas are at low and very low risk respectively. Overall, the area lies in very high to moderate liquefaction hazard prone area. Most of the area lies within very highly liquefaction hazard prone area (about 67.79%). The remaining project area is mostly in moderate liquefaction hazard prone zone (about 29.80%). According to Infrastructure suitability map, most of the area is moderately suitable (approx. 33.31%) to poorly suitable (approx. 35.35%) for infrastructure development, mainly in the western part, central part and southern part of the study area as well as north part of the Amtali upazila. Approximately 3.57% (good) area represents very suitable for infrastructure development in the study area. And very poorly (approx. 27.77% of the total area) suitable area for the infrastructure development are along with eastern part as well as north-eastern part of the study area.

8. TOURISM DEVELOPMENT POTENTIAL IN THE REGION

8.1 Introduction

Bangladesh is a country with high potentiality to be a prime tourist destination in the world because of its attractive natural beauty and rich cultural heritage. In the last decade, tourism in Bangladesh has increased in terms of revenue generation and tourist arrivals. According to Parjatan Corporation statistics, only 1,000 tourists visited Bangladesh in 1991, which increased to 156,000 in 1995, 162,000 in 2005 and 163,000 in 2008. According to the World Travel and Tourism Council, Bangladesh had 463,000 international tourist arrivals in 2015. This is expected to grow to 652,000 in 2025, and the flow of expenditure is predicted to amount to BDT 18.4 bn, an increase of 5.7 percent per annum. Travel and tourism is expected to rise by 7.8 percent per annum over the next ten years with a figure of BDT 132.1 bn predicted for 2025. Tourism in Bangladesh generated 1,281,500 jobs in 2012 or 1.8 percent of the country's total employment.

Bangladesh is yet to realize its potential, despite the presence of abundant tourism attractions for all types of tourists (Tourism policy, 2010). Poor performance of the sector can be attributed to inadequate infrastructure and lack of needed facilities for tourists including hotels and restaurants with proper services (water supply, electricity, sanitation etc.), health facilities, telecommunication facilities, transportation services, provision for safety and security of tourists etc.

The Government of Bangladesh has now given special emphasis on maximizing the potential of tourism in Bangladesh and allure a wider segment of national and international tourist community through creation of tourism friendly environment in Bangladesh. In line with National Tourism Policy 2010, Bangladesh Parjatan Corporation has taken up programs for identification of new tourist spots, and renovation and modernization of the existing tourist infrastructures and construction of new ones in order to make tourism as one of the major foreign currency-earning sector of the country.

8.2 Tourist Locations in Payra-Kuakata Region

Payra-Kuakata region offers ample opportunities for creating facilities for tourists. The region is home to unique flora and fauna and possesses many panoramic beauties. Forests, beaches, lakes and rivers make the region ideal place for ecotourism development. A Brief Description of potential tourism sites in the Payra-Kuakata Project Area is present in the following.

Sonakata Ecopark

The Sonakata ecopark located in the forest of Fatra of the newly founded Taltoli Upazilla of Barguna District has recently been bustling with crowds, both from inside and outside of the district. The 19-acre ecotourism center is shrouded with exquisite flora and fauna, with numerous canals spread throughout the ecopark like spider-webs (**Figure 8-1**). The greeneries of both sides of the canals quickly captivate the visiting outdoorsmen. The tourists can also quench the thirst for more by visiting the sea beach located at south-west side of the ecopark. The ecopark is located about 40 kilometers from Amtali. The newly built roads without any

need for ferries enables the tourists easily visit the park. Many tourists are visiting the park from Kuakata by launch, trawlers etc. The park gets crowded during the winter. Many visitors come to the park from various regions of the country for camping, picnic and other outdoors activity.

Figure 8-1: Sonakata Ecopark

Rakhaine Village

13 Rakhaine Villages are located throughout the Kabirajpara, Agathakurpara, Tatipara, Monukhapara, Momeshepara, Tongpara, Laupara, Chhatonpara, Talukdarpara, Boro Ankupara, Chhoto Ankupara and Sawdagorpara of Taltoli Upazilla. A total of One Thousand and Five Hundered Fifty-Eight rakhaines are living in these villages. The Rakhaines are indigenous people of Taltoli Upazilla with origins rooted back in Myanmar. About Seventeen thousand Rakhaines are spread throughout Barguna, Patuakhali, Coxs' Bazar, Chattogram, Rangamati, Bandarban and Khagrachari. Their village is seen illuminated at night, with them wide awake looming clothes. Many tourists visit these villages to experience the indigenous lifestyle and acquire the knowledge about the Rakhaines. A sacred and historic Rakhaine temple is situated here aside from the village. Tourist spots like Ashar Char, Sonar Char are located near these Rakhaine villages.

Shuvo Shondha Beach

The Shuvo Shondha Beach is located in Nalbunia in Nishanbaria Union of Taltoli Upazila (**Figure 8-2**). The main three river: Payra, Bishkhali and Bawleshwer of Barguna district has been all connected near the beach. The shoreline covers Four kilometer area and the sea beach itself is about 15 kilometers away from Taltoli Upazilla Sadar adjacent to the south western side Sonakata Ecopark. In the past due to its distance from Jila Sadar the sea beach was somewhat deserted and devoid from any form of tourism except from local people and fishermen who came here for livelihood purposes. Thanks to social media, the sea beach has attracted the attention of many tourist and nature enthusiasts.

Figure 8-2: Shuvo Shondha Beach

Misripara Buddhist Temple

A near thousand people come to visit the Buddhist Temple in Misripara of Kalapara Upazilla. The temple is about 8 kilometers from Kuakata has attracted the attention of many tourists throughout the nation. According to the temple authority, besides the local visitors many tourists of foreign nationality also come to see the temple. The 32 feet tall statue of the Buddha is considered one of the largest Buddha statues of Asia (**Figure 8-3**). The temple covers 2 acres of area. According to the local people the temple was damaged during the Sidr and Aila tropical storm. Thanks to the donation of German government the temple has been able resurface as a whole new religious site in 2014. Many shops have been built surrounding the temple and the transportation facilities have also been improved.

Figure 8-3: Misripara Buddhist Temple

Kuakata Sea Beach

Kuakata is one of the main sea beach situated at the southernmost area of Bangladesh. The sea beach is known as the "Sagar Kannya" (Sea Maiden). This is the only sea beach in Bangladesh where both sunset and sunrise can be seen (**Figure 8-4**).

Figure 8-4: Kuakata Sea Beach

Several tourist spots are also located nearest Kuakata Sea Beach. Other places of interest near the sea beach include:

***Fatra Forest*:** A mangrove forest reserve at the western part of Kuakata sea beach which has been considered as the "second sundarban" (**Figure 8-5**). Keye, Gauya, Goran, Golpata etc type of mangrove trees are seen there. There are also many birds and animals like monkeys pigs etc. Visitors can go there by trawler Fare is Tk. 1000-Tk. 3000 and required travel time is 30 min – 1.30 hr. Fatrar Char is also a part of sundarban forest.

Figure 8-5: Fatra Forest

***Well of Kuakata*:** An ancient well is built near the Rakhaine village of Keranipara (**Figure 8-6**). Legend has it the name Kuakata has been derived from the Well as the local people calls it The "Kua" (well) of Kuakata.

Figure 8-6: Well of Kuakata

Sheema Buddhist Temple: The temple is standing right in front of the the Well of Kuakata. A buddhastatue weighing 37 mon made of osta metal is situated here. **Figure 8-7** shows the image of the temple.

Figure 8-7: Sheema Buddhist Temple

***Coconut Foliage of the Sea Coast*:** The sea beach has numerous coconut foliages which enhanced the beauty of the beach to a much greater extent (**Figure 8-8**).

Figure 8-8: Coconut Foliage of the Sea Coast

Alipur Port: The Alipur Port which has been considered one the largest of busiest fisheries port is about 4 kilometers away from the kuakata sea beach. **Figure 8-9** shows an image of the port.

Figure 8-9: Alipur Port

***Gangamati Forest*:** Gangamati forest (or Gajmati Forest according to some local people) is situated at the east side of the sea beach. **Figure 8-10** shows an image of the forest.

Figure 8-10: Gangamati Forest

Shutki Palli

A numerous fishermen family lives in Ashar Char and a large shutki (dried fish) industry has been established here. During the drying season many fishermen come to these chars like a nomad. The processing of dried fish takes most of the 7/8 months of a year. Many men and women are engaged in processing dried fish in Kalapara Upazilla of Patuakhali. The fishermen families have been flocking here to earn livelihood. The number of fisherman huts is increasing as a result of the profitable business. Several trawlers can be seen in the sea engaged in harvesting. The traders buy fishes like poa, sonapata, modhufaissha, rupchanda, potka, shaplapata, chapila, faissha, loitta, chingri, chhuri, Hangor, bhol, med and other fishes of various species from the fishermen. Some people are seen busy clean and processing the harvested fishes. **Figure 8-11** shows an image of Shutki Palli.

Figure 8-11: Shutki Palli

Gurinda One Gambuz Mosque

Gurinda One Gambuz Mosque can be considered one of the most ancient artifacts of the Islamic architecture of Bangladesh (**Figure 8-12**). It is located in Ratnadi of Galachipa upazilla at the east side of Ulania Street. Due to the lack of much needed reparation and maintenance the mosque is almost turning to a ruin. It is believed that mosque has been built around the time of the rise of Muslim Empire in Chardadip Bakla. According to the legend, the mosque has been built before the catastrophic hurricane and cyclone of 1584. Moreover, according to some people, the mosque was built before the conquest of Chandradip in 1465 by Sultan Mobarak Shah. The main complex of the mosque is about 360 square feet of area and the height is about

16 feet. The mosque has only one floot and one Gambuz (Dome) thus gaining the name One Gambuz Mosque. The mosque has been built from 4 feet from the ground. It has one meeting house.

Figure 8-12: Gurinda One Gambuz Mosque

Sonar Char Reserve

The reserve is located around 50 kilometer south-east and 40 kilometers from the Kuakata tourist zone at the estuary of Buragauranga river. The area of Sonar Char is about 10 square kilometers. The char was devastated in the 70's catastrophic cyclone. The trees were uprooted making sonar char a barren land. The Patuakhali Forest Department took the responsibility of reforesting the char in 1975. The department planted kewra, sundari, khulsi, koroi plants covering up to 5.5 acre of land. Besides, many plants were grown on its own through the natural courses. These plants turned Sonar Char into an amazing forest land. Besides the flora, Sonar char has ample amounts of faunas as well as foxes, bulls, boars, monkeys etc. In 1995 a total of nine deer were released in sonar char in two bouts. There are no confirmed statistics about the total number of deer in the char at present day however many of them can be seen grazing throughout the forest. In the beach an abundant number of red crab can be sighted. Myriads of species of birds can also be observed especially in winter when migrant birds arrive here. Realizing the tourism potentiality of Sonar Char, Bangladesh Parjatan Corporation (BPC) proposed a tourist complex at Sonar Char that includes a youth inn, a restaurant, picnic sheds, outdoor party area and eco-cottaqes. The project, however, would not be feasible right now because of lack of communication network, inadequate accommodation facility and very poor utility services (electricity, water supply, gas). According to the results of the cost-benefit analysis of the project prepared by the consultant, it is also seen that the project is neither economically nor financially viable. **Figure 8-13** shows an image of Sonar Char Reserve.

Figure 8-13: Sonar Char Reserve

Laldia Forest

The Laldia reserve and Haringhata tourism spot is situated 6 kilometers away from the Patharghata upazila town of Barguna in Sadar union of Haringhata Bishkhali River. Across the Bishkhali River in the Bay of Bengal lies the Laldia sea beach. The tourism spot covers as much as area from Bishkhali river bank to the coast of Bay of Bengal. It's located at the south side of Patharghata upazila. The forest can be found strolling through about two hours of distance in the Haringhata forest. Bishkhali river is at the east side of the and at west side is the Baleshwer river. The beach is clinging to the Laldia forest. Though the forest is quite small it has no lacking for entrancing the attention of nature loving visitors. The forest is teeming with wildlife and a tourist can become enthralled by the sound of sea water rushing on the coast. A flock of seagull and thousands of red crabs can be seen at the forest side beach. Four watchtowers, a total of ten benches and brick road has been built for the tourists. A fresh water pond has also been dug. Many mangrove plants like kewra and sundari has been planted as well as rain trees. Many species of wild animals can also be seen in the forest. **Figure 8-14** shows an image of the forest.

Figure 8-14: Laldia Forest

Haringhata Forest and Tourist Spot

Endless sea at the one side and natural forestry on other and in between stands the Haringhata Forest to fascinate the nature loving tourists. The forest is at the southern side of Patharghata upazilla. One can experience the sunset and sunrise as well as find many wildlife and myriads

of plant species (**Figure 8-15**). The Haringhata name came from the fact that the forest use to be grazing ground for the spotted deer which can also be found at the sundarban. The beauty of the forest has been enhanced by the three adjacent beaches – laldia, padma and lathimara. It can be said that this spot is one of the best for observing both sunset and sunrise. The naturally made forest is teeming with thousands of species of plants and trees. The mail flora includes mangrove trees like kewra, goran, gewa, ora etc. Spotted Deers, Monkeys, Wild cats, Boars can be seen in the forest. Aside from these several species of birds and reptiles can also be seen here. One of the most attractive aspects of the forest is its serpent like myriads of canals. During the high tide river cruising through the forest can be mesmerizing.

Figure 8-15: Haringhata Forest and Tourist Spot

Bihongo Island

Bihongo Island is can be found at the estuary of the river Baleshwer of the Bay of Bengal. The island was named "Bihongo" recently. It is known as Dhansir Char to the local people. The island is much closer to the world heritage site Sundarbans. Patharghata and sundarban is at the east side of the island. According to the elders of Ruhita village the island surfaced around 20 to 25 years ago. The naturally decorated island is filled with wildlife and trees (**Figure 8-16**). The island looks like an emerald hill from afar, the red crabs on the white sand looks like red carpet, the grey seagulls far away. The afternoon looks great at this place especially when the sun sets the sky ablaze golden with sunlight. The fishermen flock around the sea during the fishing season. One can easily buy fishes from there at a really low price.

Figure 8-16: Bihongo Island

8.3 Zoning of Tourist Locations Based on Attractive Factors

Figure 8-17 shows location of the tourist spots. **Figure 8-18** presents the composite tourist zoning map that identifies 13 zones which have important characteristics that may attract tourists both domestic and international. Three of these locations are attractive because of high quality beach, five have a combination of forest and char (small island) and another five have both beach and mangrove forest. These are as follows:

a. *Locations Based on High Quality Beach*
   - Shuvo Sandha Beach
   - Kuakata and Adjoining Areas (Lebur Char, Gangamati Char and Lal Kakrar Dip)
   - Kauar Char

b. *Locations Based on a Combination of Char and Mangrove Forest*
   - Char Tufania
   - Char Kashem
   - Char Hare
   - Andar Char
   - Sonar Char

c. *Locations Based on a Combination of Beach and Forest*
   - Haringhata Forest
   - Shopno Saikat
   - Sonakata Ecopark
   - Fatrar Char
   - Char Bagala

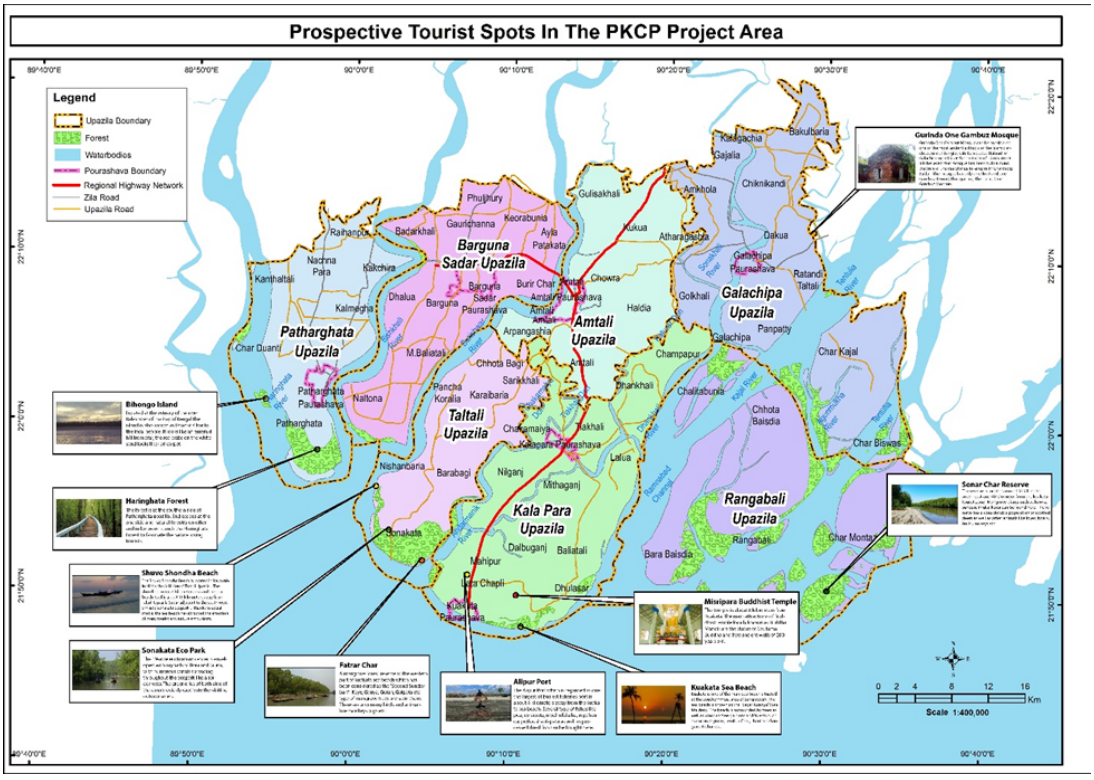


Figure 8-17: Location of the Tourist Spots

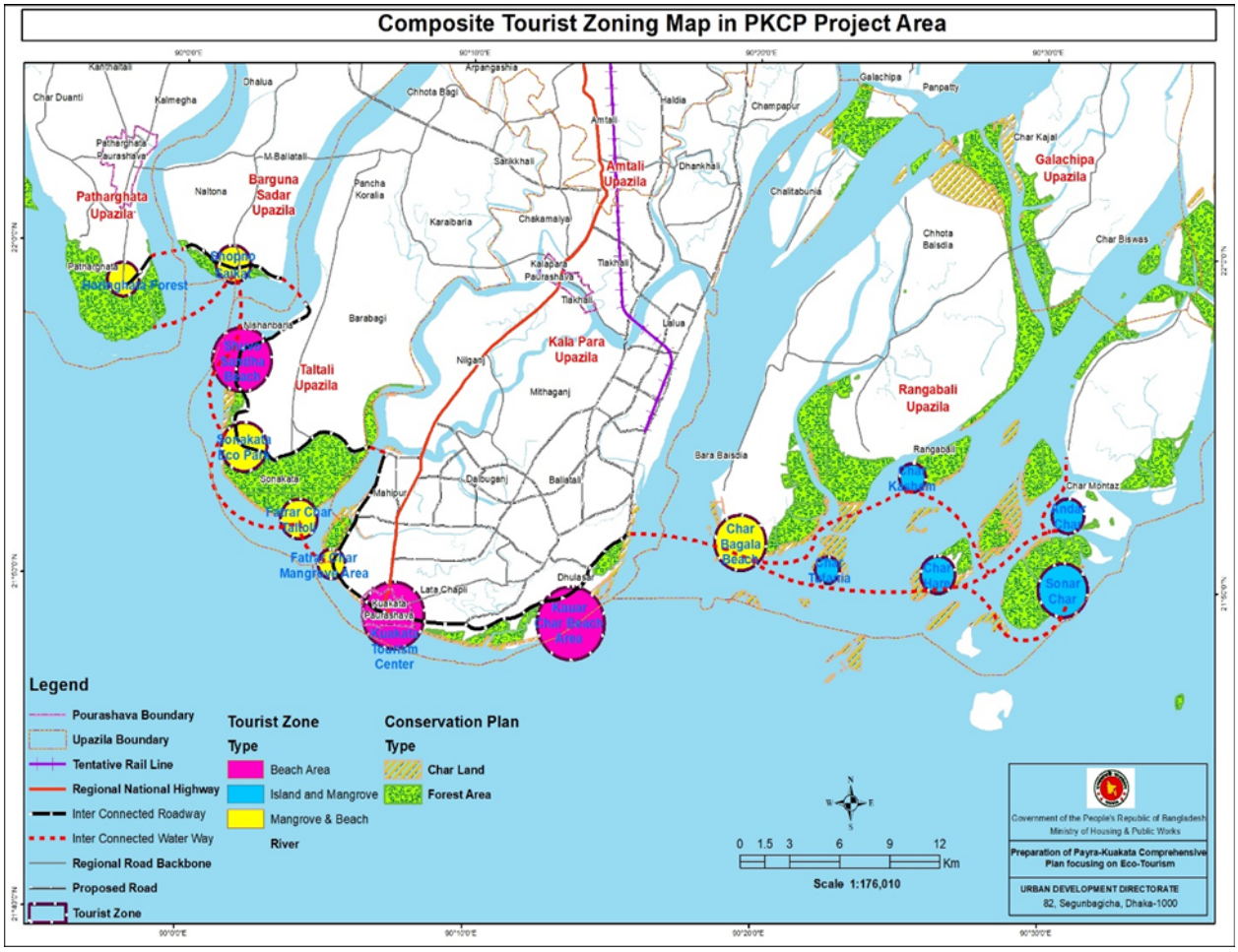


Figure 8-18: Composite Tourist Zoning Map

8.4 Recommendations for Improvement of Tourism in Payra-Kuakata Region

Tourism is a rising industry in Bangladesh which comprised of 4.4% of the total GDP in 2018. However, the dominant portion (97%) of earnings in tourism comes from domestic sources. This indicates that Bangladesh is not a popular destination among foreign tourists. Bangladesh lacks a tourist friendly environment. The most substantial disadvantage of Bangladesh lies in the Tourist Service Infrastructure where Bangladesh is ranked 133rd out of 140 countries and is in the worst position among Asian countries (Travel and Tourism Competitiveness Report 2019, World Economic Forum). Bangladesh, therefore, needs to make provision of adequate and proper Tourist Service Infrastructure for attracting tourists from abroad. This would also strengthen the domestic tourism sector and encourage more domestic tourists to visit the places of their interest. In order to develop the tourism sector in the Payra-Kuakata Region, a comprehensive master plan for tourism development in the region should be prepared with particular attention to the following aspects.

8.4.1 Infrastructure

Transportation

Transportation linkage to different tourism spots by road, rail, air and water is not efficient. A master plan of transportation network should be prepared and implemented so as to enhance the accessibility of tourists to existing tourism attractions of the region. As the region is crisscrossed by rivers, canals and creeks special attention should be given to water transportation facilities. Cruise vessels of high standard will be needed for attracting international tourists. Special attention should be given to establish connectivity of Rangabali Upazila with the mainland, especially with Galachipa and Kalapara Upazilas by providing ferry service. Action plan should be prepared for construction of roads in Rangabali and other Upazilas for implementation of the proposed transportation plan.

Utilities

Utility services are essential for developing the tourism services in any area. Usually electricity, water, drainage, waste management, health facilities, telecommunication etc. are considered under utility services. Constant supply of water and electricity is extremely important. Availability of telecommunication facility and broadband internet service are also very important without which a tourist location cannot be much attractive. Since the tourists have nothing to do after sunset such internet services would help to relieve boredom after sunset. Realizing the tourism potentiality of Sonar Char in Rangabali Upazila, Bangladesh Parjatan Corporation (BPC) proposed a tourist complex at Sonar Char. This is an excellent tourist location but cannot be attractive unless electricity supply is ensured. Feasibility of undertaking a project should be explored to supply electricity produced in non-grid Bhola Island to Rangabali by setting up a gridline from Bhola.

8.4.2 Accommodation

Creation of proper and affordable accommodation along with related facilities is very important. This may include the following:

- Accommodation: hotels, restaurants, homestays
- Catering and food services: restaurants, coffee/tea shops, fast food shops etc.
- Souvenir shops
- Recreation facilities
- Parking facilities

Short-term rental bungalows that are cheap and clean, but cozy in design are ideal for international tourists. Setting up tourist-friendly villages will entice backpackers and adventurers. The government has an opportunity through public/private partnerships to construct bungalows in these destinations. Homestays with double-room cabins made from wood and thatched roofs would be ideal. Open-air kitchens allow guests to cook communally and chat about their trip agenda. For facilitating communication with international tourists the government could take up programs to educate the owners with basic hospitality-level English, enough to set their guests up and to give them directions around the village to nearby hot spots.

8.4.3 Marketing and Management

The success of tourism sector mostly depends on marketing promotion tools like advertising, sales promotion and public relations. BPC as the National Tourism Organization (NTO) should be strengthened with adequate fund, skilled human resources and technical expertise to function the organization smoothly and formulate policy guidelines for promotion tools and overall marketing. Innovative ideas are necessary to highlight the tourist spots to people within and outside the country. Website of the Bangladesh Parjatan Corporation (BPC) should be well developed with adequate information such as photographs of renowned places, accommodation facilities, modes of transportation, distance from the capital city etc. The organization should coordinate activities of various organizations directly or indirectly involved in international tourists and local tourist intermediaries such as travel agencies, tour operators or tourism service providers.

8.4.4 Safety and Security of Tourists

Ensure safety and security for tourists, especially at the tourist spots is extremely important. If the tourists do not feel safe in the area they visit, the area would not be able to attract tourists even if other facilities are available. Already the government of 'Bangladesh has formulated "Tourist Police". But their capacity in terms of human resources and infrastructure need to be strengthened.

8.4.5 Environmental Safeguards

The government should create a tourism friendly environment in Bangladesh and market its tourism potential at home and abroad. Steps should also be taken to prevent unplanned infrastructural development and undertaking of unplanned activities in the defined restricted tourism areas and special tourism zones.

9. DEVELOPING THE TRANSPORTATION SYSTEM FOR INTEGRATED URBAN AND REGIONAL DEVELOPMENT

9.1 Introduction

The study area, located within ecological region with panoramic beauty, is in Barisal division. The entire study area is comprised with seven Upazilas of Barguna and Patuakhali Districts. Sundarbans is a unique location for tourism development. Also Sonar char of Rangabali upazila is a place of panoramic beauty. There is ample opportunity for tourism development in the study area. Moreover, Payra Bandar, the third sea port is going to be established at Ravnabad Channel in Kalapara Upazila, which would act as a catalyst for radical change in the overall urbanization in the area.

Better transportation accessibility to study area is extremely needed to improve its connectivity within the area and with the remaining parts of the country. Better accessibility within the tourist spots can enhance the tourism sector of the country which will have greater impact on tourism and economic sector in Bangladesh. In addition, improvement of walkability and other facilities like housing, tourist entertainment activities, restaurants etc. within the tourist spots is necessary to provide safety and comfort to the local and international tourists.

9.2 Existing Road Transportation Network and Related Problems

The success of developing the study area, especially Kuakata and other touristic places as tourist center, depends largely on the good transportation and communication facilities along with availability of modern amenities. Moreover, the proposed sea port at Kalapara would generate many port related new activities including huge traffic by air, rail, and road and water ways. The eco-tourism development and seaport establishment would create both positive and negative impacts on socio-economic condition and change the existing land use pattern of the region. For this, it is necessary to understand the present state of the transportation system based on which a sustainable transportation system can be built for the future. Therefore, a thorough traffic study on the existing road network is imperative. This will shed light on the recent state of transportation as well as provide information about its pros and cons and possibilities for future development.

The present transport network is shown in the figures below. **Figure 9-1** and **Figure 9-2** present the road map of Payra-Kuakata Comprehensive Plan Area. **Figure 9-3** shows the routes used by heavy vehicles while **Figure 9-4** shows the routes used mainly by light vehicles. It is important to note that light vehicles are also found in the routes used by heavy vehicles like trucks and buses. Roads are of average standard. Most of the road conditions are so bad that it becomes risky for the motorized vehicles to move on the roads. There are cracks on the pavement at many points with a lot of holes. Most of the roads are Katcha and Brick pavement roads which are not in good condition. During flood road goes under water and becomes muddy, hence local people are fully dependent on waterways for movement. Moreover, roads are also narrow and condition of culvert is miserable. Condition of launch ghat is also not good. Moreover, it is observed that the chaotic and provisional stand for local buses, electric auto rickshaws and motorbikes create traffic congestion around the Kalapara bazar, Khepupara

Bridge and its access road. **Figure 9-3** shows the river routes and river/ferry ghats of the study area.

Figure 9-1: Road Map of Payra-Kuakata Comprehensive Plan Area

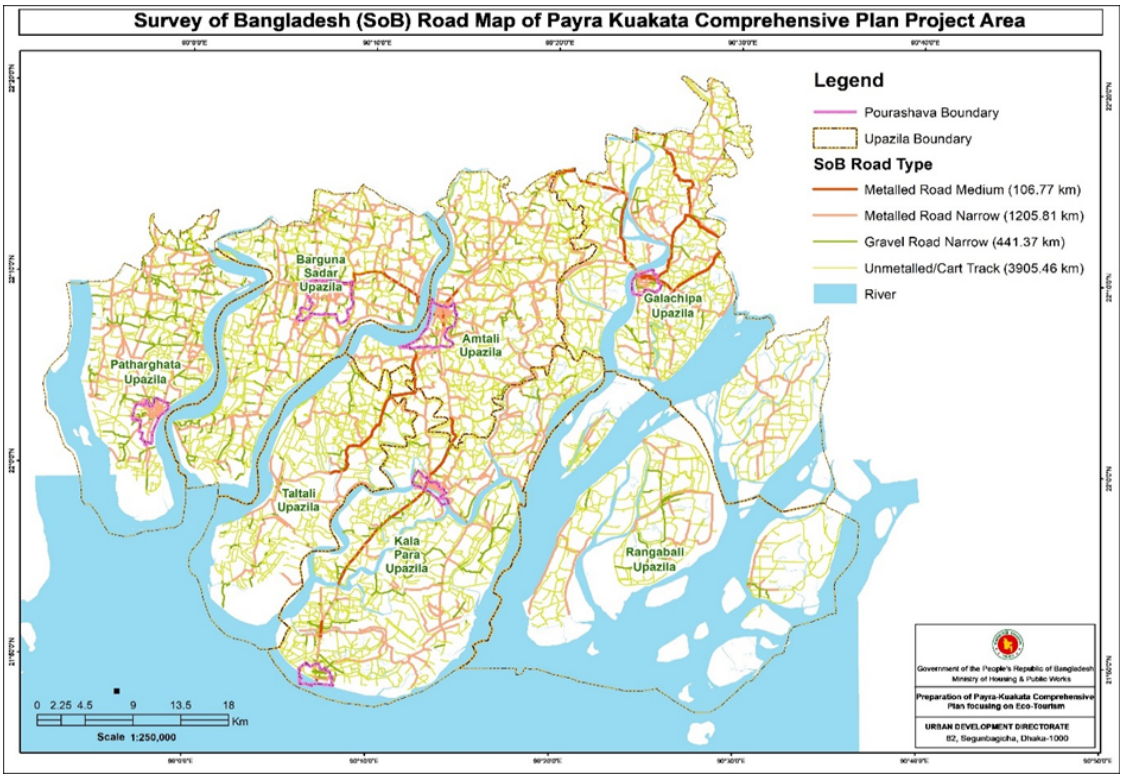


Figure 9-2: Type of Road in Payra-Kuakata Comprehensive Plan Area

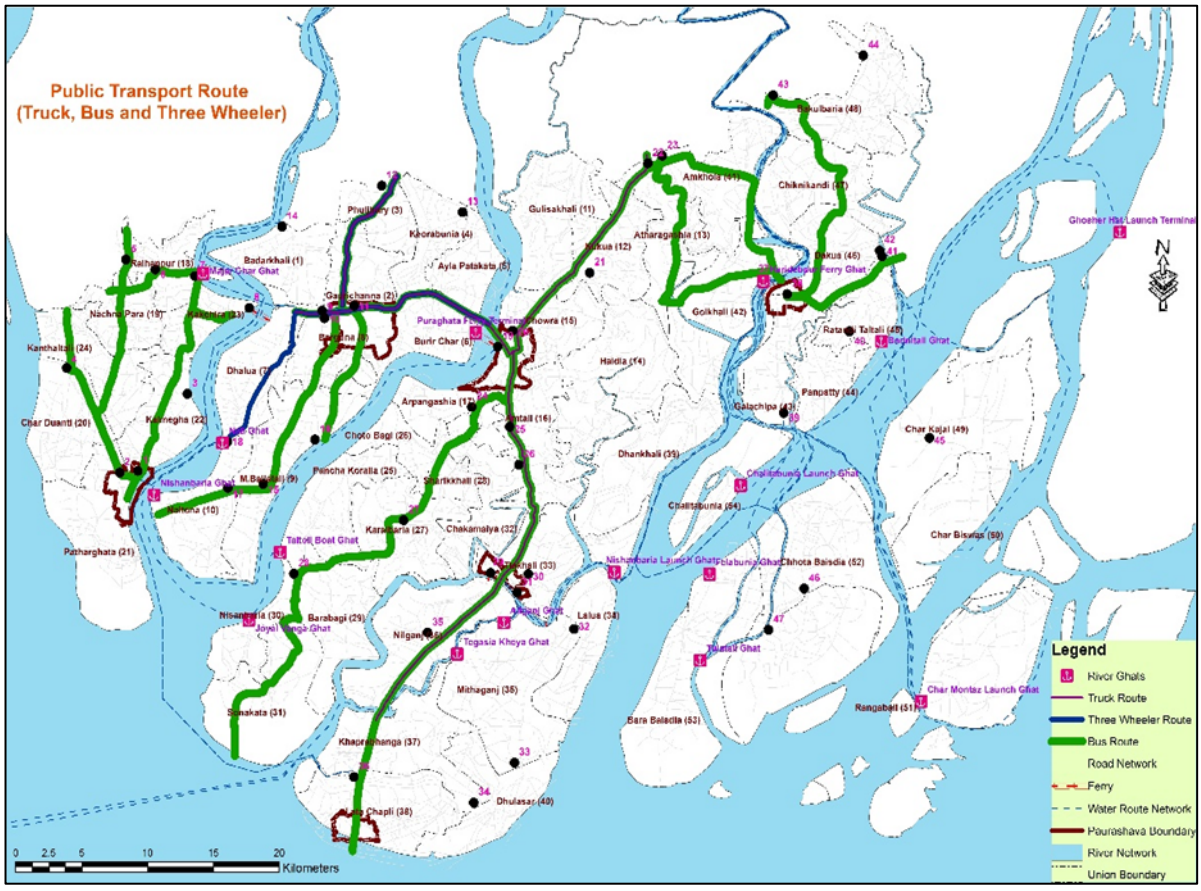


Figure 9-3: Public Transport Routes (Heavy Vehicles)

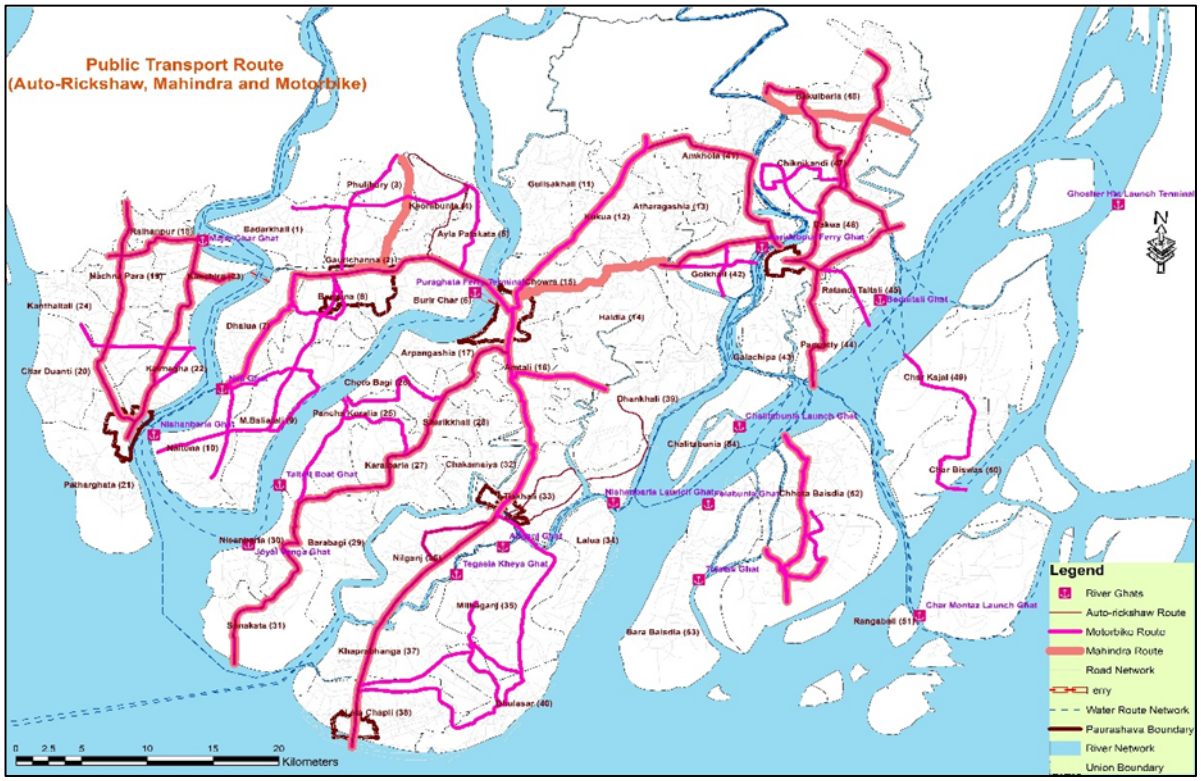


Figure 9-4: Public Transport Routes (Light Vehicles)

9.2.1 Trip Purpose

For the ease of analysis all trip purposes have been grouped five categories: Educational, Shopping (trips to bazar are also included), Work, Recreational and others (personal, treatment etc.). Other than these categories there is another category called Home Based Trip which includes all trips that destined to a household. Combining the results for each zone, the share of trips by different purposes as obtained from the household survey, can be represented by the following pie chart (**Figure 9-5**). It is seen that 18% of the trips are made for educational purpose, 22% trips are made for work purposes and shopping trips account for about 6% of trips.

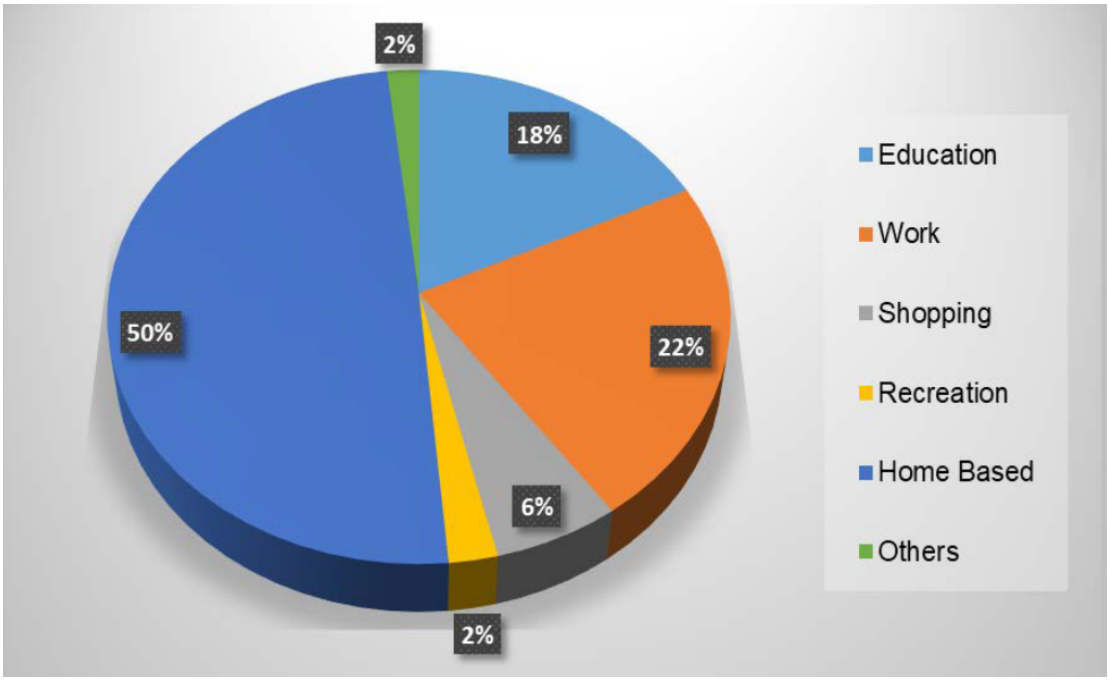


Figure 9-5: Trip Purpose

9.2.2 Mode Choice

In the overall scenario for whole Study area (**Figure 9-6**), people make most of the trips by walking which is 65.7% of total trips. These trips are mainly short distance trips. Again, 12.9% are made by Auto-Rickshaw, 7.7% by Motorbike and 5.8% Rickshaw-Cycle. Among the other modes except walking water modes account for a total of 2.4% (where big launch 0.1%, boat 1.5%, ferry 0.1%, small launch 0.3% and trawler 0.5%). People do not use water transport in case of medium or short distance because of more time consumption. In short and medium distance trips, road-based mode is more suitable. People use more boat service mainly for crossing river or canal from one side to another. In case of long-distance travel people use big and small launches because of comfort compared to bus service. Each upazila is locally well connected by road network.

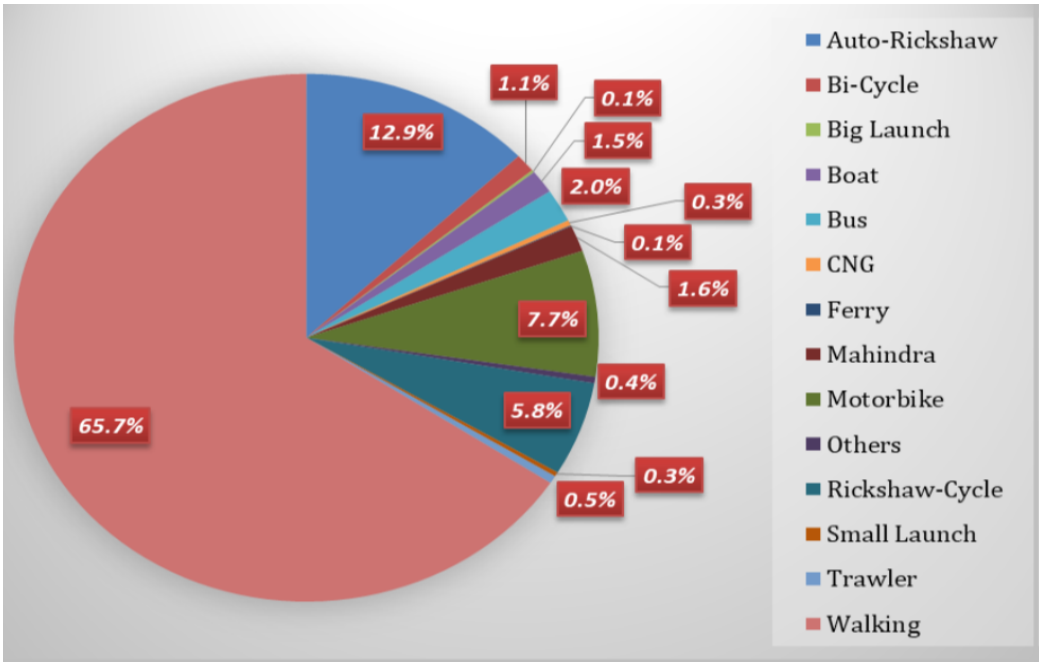


Figure 9-6: Mode of Travel

9.2.3 Transport Study of Growth Centers

Growth Centers (GC) are those areas where maximum economic growth in a certain region is expected. For study area, it is assumed that most economic activities in present scenario take place in the major growth centers. In addition, it can be considered that the other markets will also develop to be of the same attributes as those of the existing GCs with overall development of the study area. So some issues are needed to find out like *existing road network, road condition, traffic congestion, mode of travel, parking facility and catchment area* of the growth centers. For this study, Twenty-nine (29) growth centers were studied out of which 23 were Hats/Bazars and six (6) were Pouarashavas as shown below.

Patharghata Upazila • Lamua Hat • Kakchira Hat • Charduani Hat • Kalmegha Hat • Patharghata Paurashava	Barguna Sadar Upazila • Phuljhuri Hat • Ayla Hat • Chalitatali Bazar • Nali Hat • Baliatali • Babuganj Bazar • Barguna Paurashava	Amtali Upazila • Gazipur Hat • Amtali Paurashava	Kalapara Upazila • Nomor Hat • Kalapara Paurashava • Lalua Hat • Chapali Hat • Mohipur Hat • Kuakata Paurashava	Galachipa Upazila • Patabunia Hat • Kalagachia Hat • Badura Hat • Ulania Hat • Galachipa Hat • Char Biswas Hat	Taltali Upazila • Taltali Hat • Bogir Hat • Kochupatra Hat

Figure 9-7 presents the Growth Centers and their catchment areas while **Table 9-1** shows the current and projected population of Growth Centers and their catchment areas.

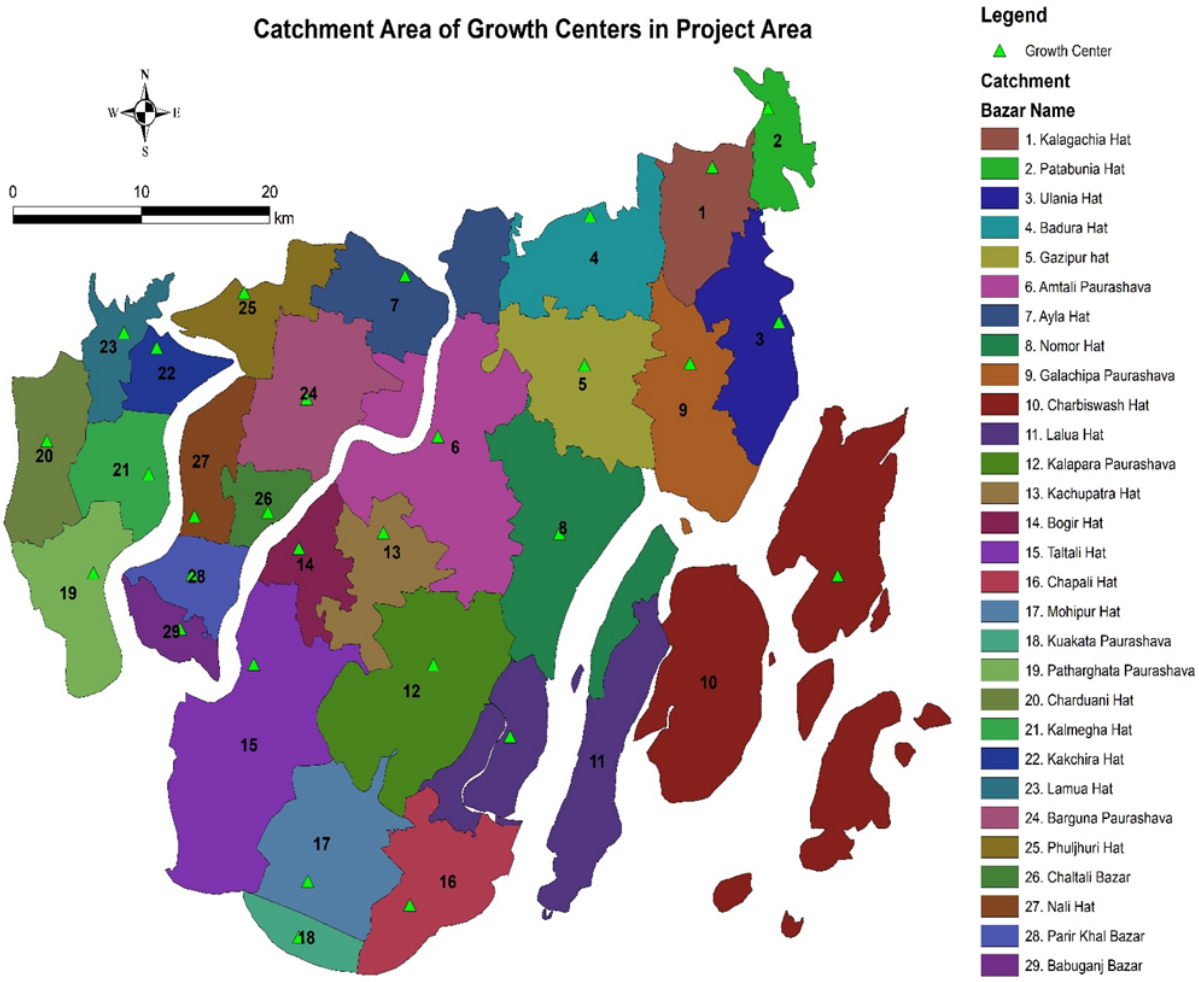


Figure 9-7: Growth Centers and their Catchment Areas

Table 9-1: Growth Centers and Catchment Area Population (2011 – 2041)

FID	Growth Center/Bazar Name	Catchment Population 2011	Projected Catchment population 2021	Projected catchment population 2031	Projected catchment population 2041
1	Kalagachia Hat	22867	25643	28139	30636
2	Patabunia Hat	21745	24384	26758	29133
3	Ulania Hat	49890	55946	61392	66839
4	Badura Hat	50863	57889	63462	69036
5	Gazipur hat	56366	64390	70572	76754
6	Amtali Paurashava	100288	114949	125657	136364
7	Ayla Hat	52739	58733	63781	68829
8	Nomor Hat	52325	59332	65901	72471
9	Galachipa Paurashava	68851	77208	84725	92242
10	Charbiswash Hat	114556	125788	137761	149734

FID	Growth Center/Bazar Name	Catchment Population 2011	Projected Catchment population 2021	Projected catchment population 2031	Projected catchment population 2041
11	Lalua Hat	51898	57532	63731	69931
12	Kalapara Paurashava	76447	86884	97467	108049
13	Kachupatra Hat	22850	26109	28800	31490
14	Bogir Hat	16989	19462	21296	23130
15	Taltali Hat	55497	63574	69565	75557
16	Chapali Hat	30074	34180	38343	42506
17	Mohipur Hat	49398	56142	62980	69819
18	Kuakata Paurashava	18250	20742	23268	25794
19	Patharghata Paurashava	58393	66748	72940	79132
20	Charduani Hat	36917	42199	46114	50029
21	Kalmegha Hat	26271	30030	32816	35602
22	Kakchira Hat	21371	24429	26695	28961
23	Lamua Hat	20975	23976	26200	28425
24	Barguna Paurashava	101603	110589	119444	128299
25	Phuljhuri Hat	39080	42537	45942	49348
26	Chaltali Bazar	12924	14067	15193	16320
27	Nali Hat	29815	32452	35050	37649
28	Parir Khal Bazar	16180	17611	19021	20431
29	Babuganj Bazar	14602	15894	17166	18439

- *Road Network:* Every growth center is connected with mainly upazila or union roads (**Figure 9-8**). Some GCs are accessible via waterway. Some other village roads are connected with the prominent access road. These connected roads ease the accessibility towards other areas.
- *Road Condition:* Most of the road conditions are so bad that it becomes risky for the motorized vehicles to move on the roads. Pavement depleted at many points with a lot of holes and shattered. Most of the roads are Katcha and Brick soling roads which are not in good condition. During flood road goes under and becomes muddy. Roads are also so narrow. Condition of culvert is also miserable. Condition of launch ghat is not also good.
- *Traffic Congestion:* Traffic congestion is noticeable mainly in typical hat days. Most business activities are done in hat day/ days. Goods loading and unloading occur in that day; many people come for different purposes in the hat day so growth center becomes crowded in that day. The volume of vehicle also becomes high. So traffic congestion occurs in typical hat days rather than other days of the week. On street parking encroaches the road which leads to the traffic jam.
- *Parking Facility:* There is no parking facility in the growth centers. Vehicles are parked on the street. There are some bus depots where people can access the growth center by bus. There are also some ghats for goods loading and unloading especially fish products.

- *Mode of Travel:* The major modes of travel are motorbike, tomtom, easybike, auto rickshaw, three wheeler, mahindra, cycle rickshaw, bicycle, borak, passenger pickup, tempo, bus etc. In the waterway trawler, boat and launch area available to travel.

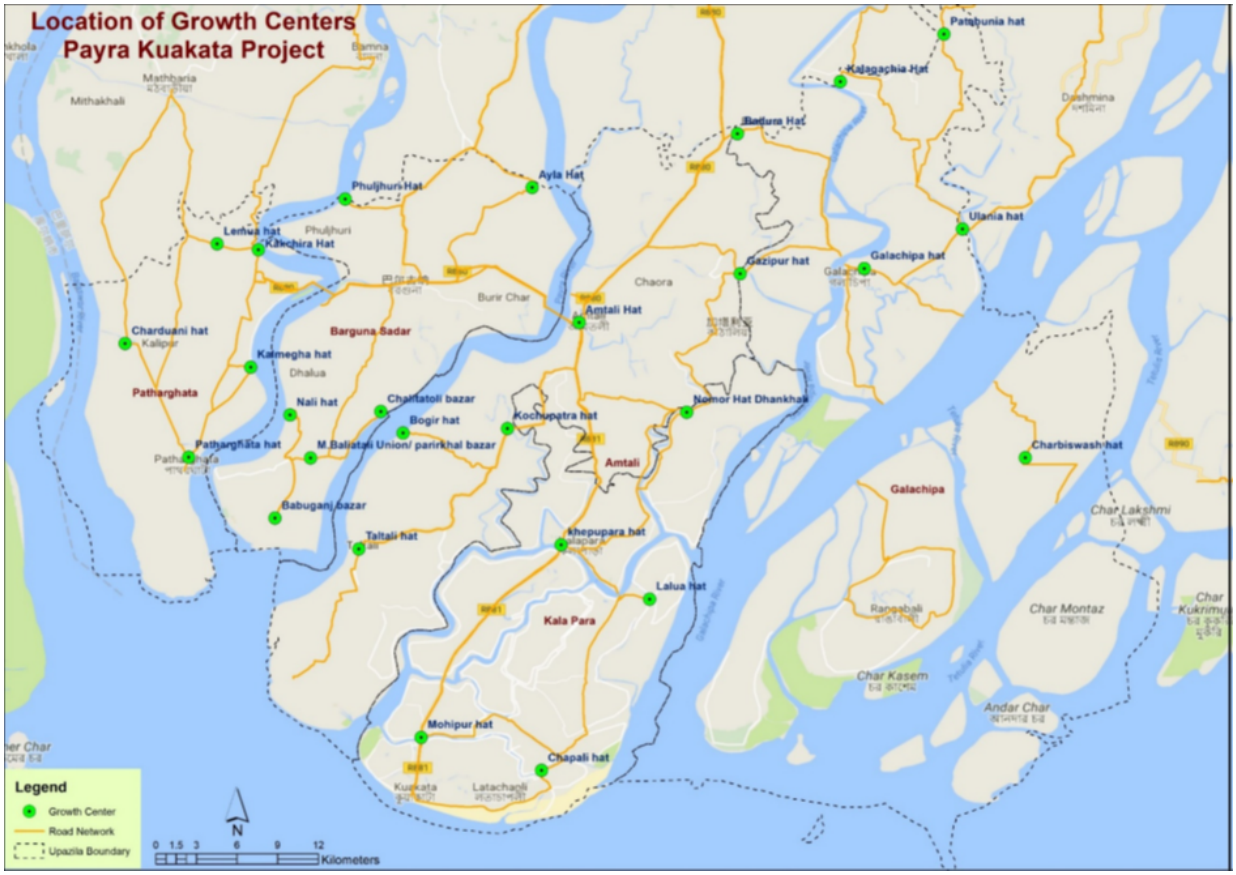


Figure 9-8: Location and Accessibility of the Growth Centers

9.3 Proposed Road Network and Its Validation by Transport Demand Modeling

The main purpose of this project is to develop a comprehensive plan to promote tourism as well as enhance socio-economic and infrastructural development of the seven upazilas of the Barguna and Patuakhali Districts. The transportation model developed under this project will optimize the overall transportation system and business activities associated with the major transportation hubs like Payra Port and Kuakata Sea Beach as well as other small to medium growth centres in the project area. The proposed transportation network is shown in **Figure 9-9** while **Figure 9-10** shows the prospective future urban centers along the proposed transportation network. **Figure 9-11** shows the phasing of development of the prospective urban centers as shown in **Figure 9-10**.

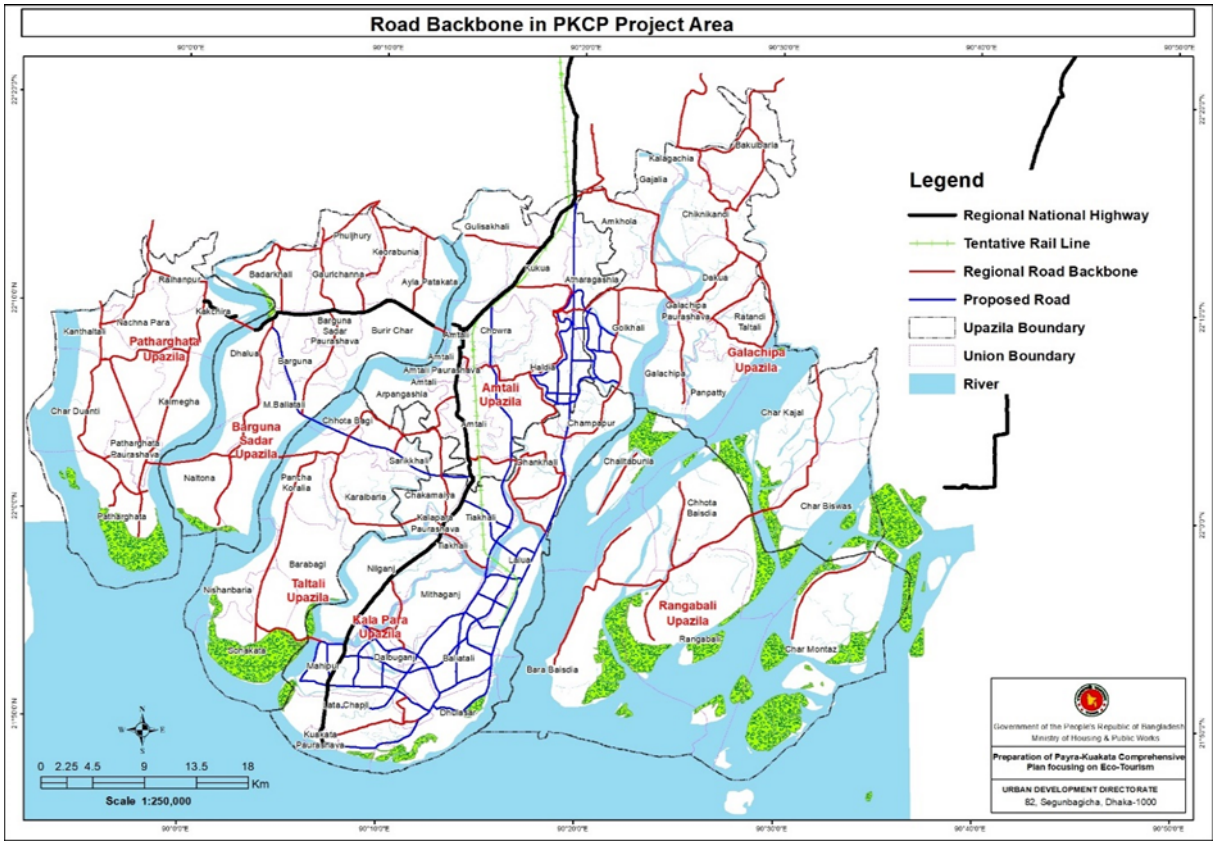


Figure 9-9: Proposed Transportation Network

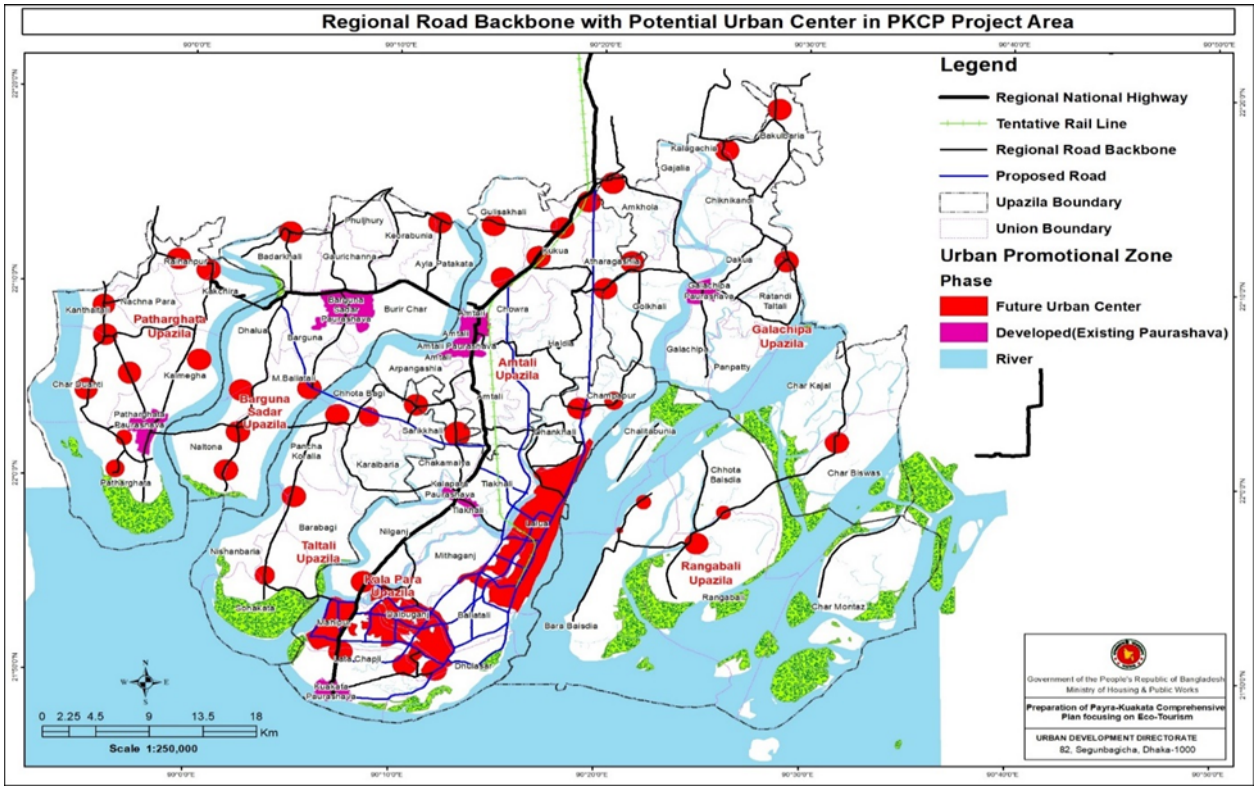


Figure 9-10: Proposed Transportation Network and Future Urban Centers

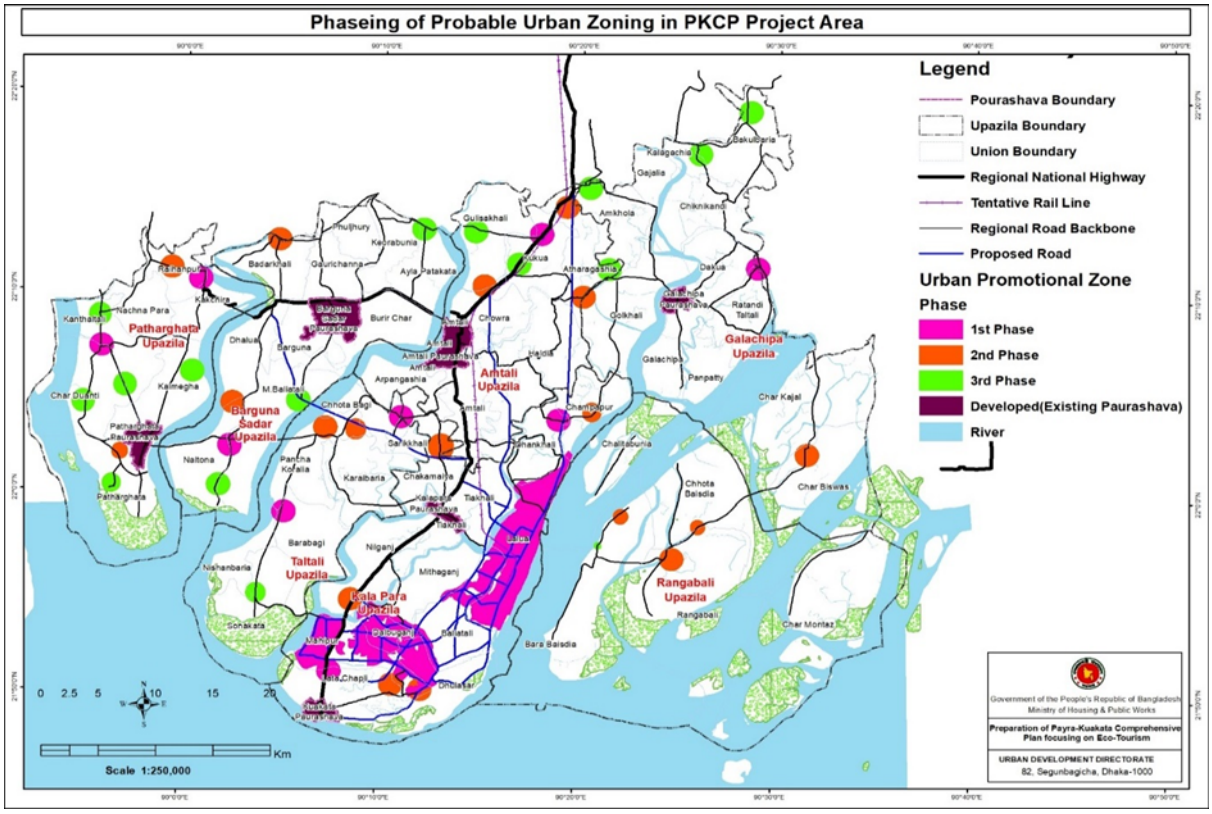


Figure 9-11: Phasing of Development of Future Urban Centers

In order to construct a 20-year prediction model for transportation of the project area and to estimate the future traffic demand on the future road network of Payra-Kuakata the following surveys have been conducted: 1) Reconnaissance Survey, 2) Household Interview Survey, 3) Passenger Interview Survey, 4) Survey on Growth Centre, 5) Traffic Count Survey including Motorized Vessel Count, 6) Pedestrian and Vehicle Count at Kuakata Sea Beach, 7) Survey at Fishing Boat Terminal, 8) Origin-Destination Survey of both motorized vehicle and vessel, 9) Public Transport Interview Survey, 10) Stakeholder Interview Survey and 11) Travel Time Survey. In addition, population and employment patterns of Growth Centers (Hats/Bazars and Paurashavas) and their catchment areas have been projected up to 2041 for use in future transport demand forecasting.

Using all the collected survey data and the projected population and employment patterns a four-step travel demand forecasting model has been developed for Payra-Kuakata region incorporating the dynamics of a cluster of prospective cities or townships in riverine region having huge economic and tourism opportunities. In this model, two different major scenarios have been considered (including the base scenario). Under these major scenarios, several child scenarios can be considered, e.g., different alignments, approach roads, railroads, etc. The major scenarios are as follows:

Scenario 1 (Base Scenario – 2019): This scenario represents the existing transportation condition in the seven selected upazilas in Payra-Kuakata and the regional roads within the vicinity. The model is constructed with the existing road and public transportation network, traffic count data and socioeconomic data.

Scenario 2 (Future Scenario – 2040): This scenario projects the traffic demand and calculates corresponding traffic loading on the network for the year 2040 considering projected population and employment, calculated based on the newly proposed land use plan for Payra-Kuakata keeping ecotourism in focus.

The outcome from the model suggests that the travel within the study area in the base year is limited within specific OD zones. The road network comprising of road category of zila road and regional roads exhibit high operating speed and the local road networks are operating at lower speed. Also, bottle necks in the study area can only be seen at points where there is a ferry, i.e., construction of bridges will alleviate that congestion. All these issues have been successfully addressed in the future scenario with proposed road network. The scenarios also yield the total network cost during the peak hours as well as the off-peak hours as follows:

Base Year (in time unit, hr):

- Total AM Network Costs: 10,628,972
- Total OP Network Costs: 17,138,541
- Total PM Network Costs: 9,695,002

Future Scenario (in time unit, hr):

- Total AM Network Costs: 28,017,165
- Total OP Network Costs: 57,241,740
- Total PM Network Costs: 27,557,087

The results suggest that as both the future road network is larger and the traffic volume on the network is higher, the total network cost during the peak hours as well as the off-peak hour, represented in terms of time unit, i.e., amount of time vehicles ply on the roads, are substantially higher in the future scenario. It suggests the proposed land use change in the study area will significantly increase vehicular movement in the network for the future scenario, i.e., an indication that the proposed expansion of road network can be justified to handle the future traffic demand. At the same time, the network is not going to remain overly congested, i.e., decent amount of operating speed can be achieved. This further justifies that the proposed road network is sufficient.

9.4 Water Transport: Problems and Issues

PKCPA is a riverine region having a navigable network (river and canal combined) varying from 2432 km round the year to 2676 km during the monsoon. Its inland water transport (IWT) continues to be an important mode of transport for the movement of freight and passengers. Water transport is such a mode of transport that has been characterized as the least-cost, environment friendly, less prone to accident and low maintenance cost. Moreover, the development of waterways does not even require any cultivable land. Rather, it is very much helpful for development of other sectors of economy including maintaining ecological balance.

Table 9-2 presents the lengths (Kms.) of waterways while **Figure 9-12** shows the river routes and ghats in different Upazilas of the region.

Table 9-2: Waterways in the Region (km)

Upazila	Waterway during monsoon (River+Canal)	Waterway round the year (River+Canal)
Amtali and Taltali	120	140
Barguna Sadar	112	88
Patharghata	130	82
Galachipa and Rangabali	2083	1900
Kalapara	231	222
	2676	2432

Source: BBS (2013): District Statistics 2011 (Barguna and Patuakhali)

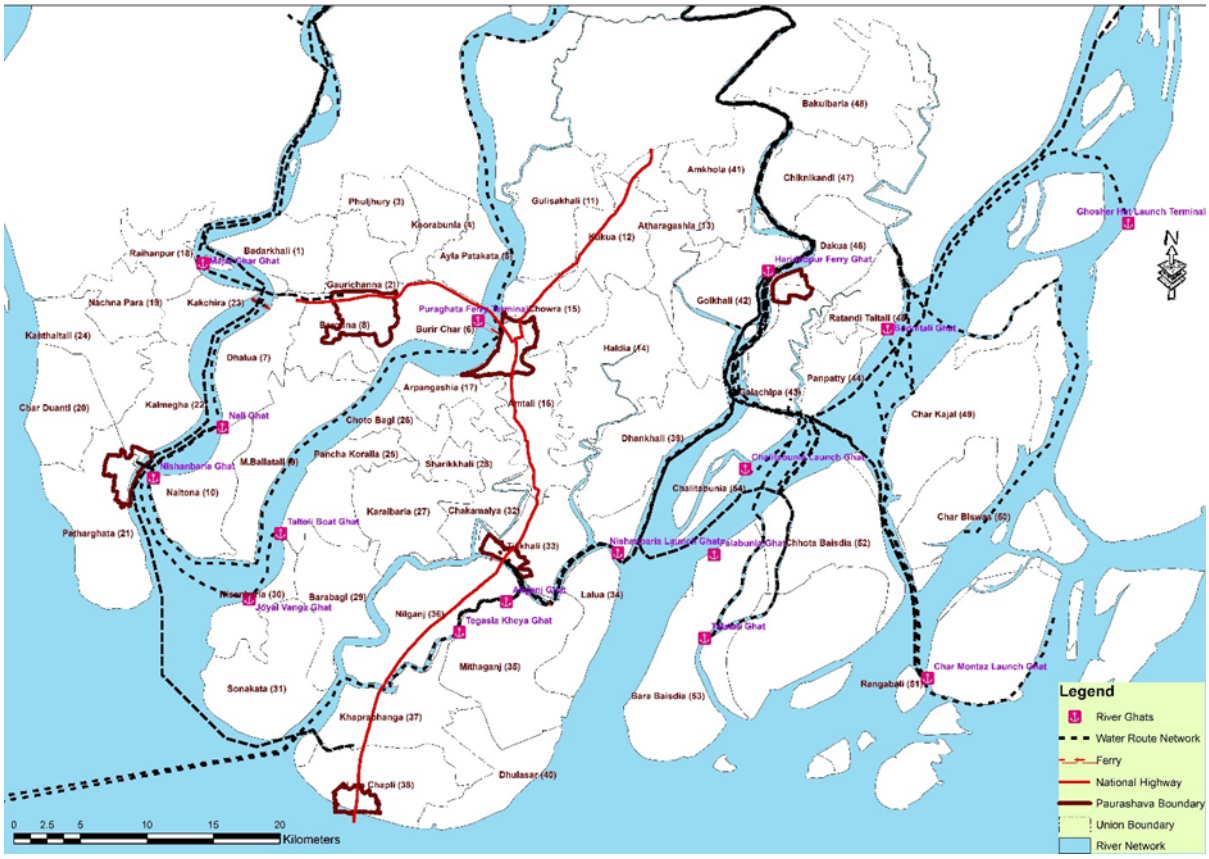


Figure 9-12: River Routes and River/Ferry Ghats

Ferries link sections of roads separated by large channels in the absence of bridges. Functionally these are an entirely separate category since they are part of the road transport system rather than the IWT system. However, operationally it is sensible to integrate aspects of the ferry services (such as vessel maintenance and repair and river dredging) with those of IWT. Overall ferry service in Patuakhali and Barguna is in awful condition over the years. 10 ferries are already shutdown a long time ago. Most of the ferries are now at risky situation due

to cracks that let water get inside and it often requires removal of the water with pumping machines.

Three of the ferries are active now: (i) Lebukhali point on Paira River along with Patuakhali-Barisal road, (ii) Amtali on the Paira River along Patuakhali-Barguna road and (iii) at Bainchutki along Barguna-Kakchira road in Barguna district. The ferries at Lebukhali, Kalapara, Hazipur, Mohipur and Amtali run round the clock while the rest run only during the day only. Vehicles cross the gangway at Mohipur on Patuakhali-Kuakata road amid risk as steel-made plates at the north side cracked. Workers have to regularly pump out water from the ferry there. The pontoon at Galachipa ferry terminal partly sinks during the high tide as cracks developed at its bottom.

Rangabali Upazila is an isolated island and does not have any ferry service. All five unions Rangabali, Char Montaj, Borobaishdia, Chotobaishdia and Chalitabunia under Rangabali upazila are separated from the main land and about 80,000 people of these unions have to use small trawlers to communicate with Patuakhali district headquarters and other Upazilas. Steps should be taken to start a ferry service immediately between Rangabali and Galachipa. Eventually steps should be taken to develop ferry operations on secondary routes

Since the PKCP area is crisscrossed by rivers and canals, it is important to improve water transport in the area both from infrastructure and technological points of view. Bangladesh Inland Water Transport Authority (BIWTA) and corporation (BIWTC) give pilotage facilities to water vessels, regulate the movement of passenger launches and maintains inland ports including ghats and terminals. **Figure 9-13** shows the river port locations in the region. BIWTA classifies navigable rivers in Bangladesh into 4 categories as shown in **Table 9-3**. The navigable rivers and canals in the PKCP region should be classified and special attention should be given to the problems suffered by the waterways of the region from (i) siltation, (ii) day & night navigational problems, (iii) shortage of passenger & cargo handling facilities including transit shed at river ports, (iv) Presence of manual loading/unloading of cargo at river ports, (v) underdeveloped rural launch landing stations, inadequate number of water crafts etc.

Table 9-3: Categories of Navigable River Networks in Bangladesh

Class	Minimum Draft	Minimum Vertical Clearance	Minimum Horizontal Clearance	
Class- I	3.66 m	18.30 m	76.22 m	Least Available Draft (LAD) of 3.6 m required to be maintained round the year.
Class- II	2.13 m	12.20 m	76.22 m	Links major inland ports or place of economic importance to class I routes
Class–III	1.52 m	7.62 m	30.48 m	Being seasonal in nature, it is not feasible to maintain higher LAD throughout the year
Class–IV	Less than 1.52 m	5.00 m	20.00 m	These are seasonal routes where maintenance of LAD of 1.5m or more in dry season not feasible

(Source: IWT Master Plan Study 2009)

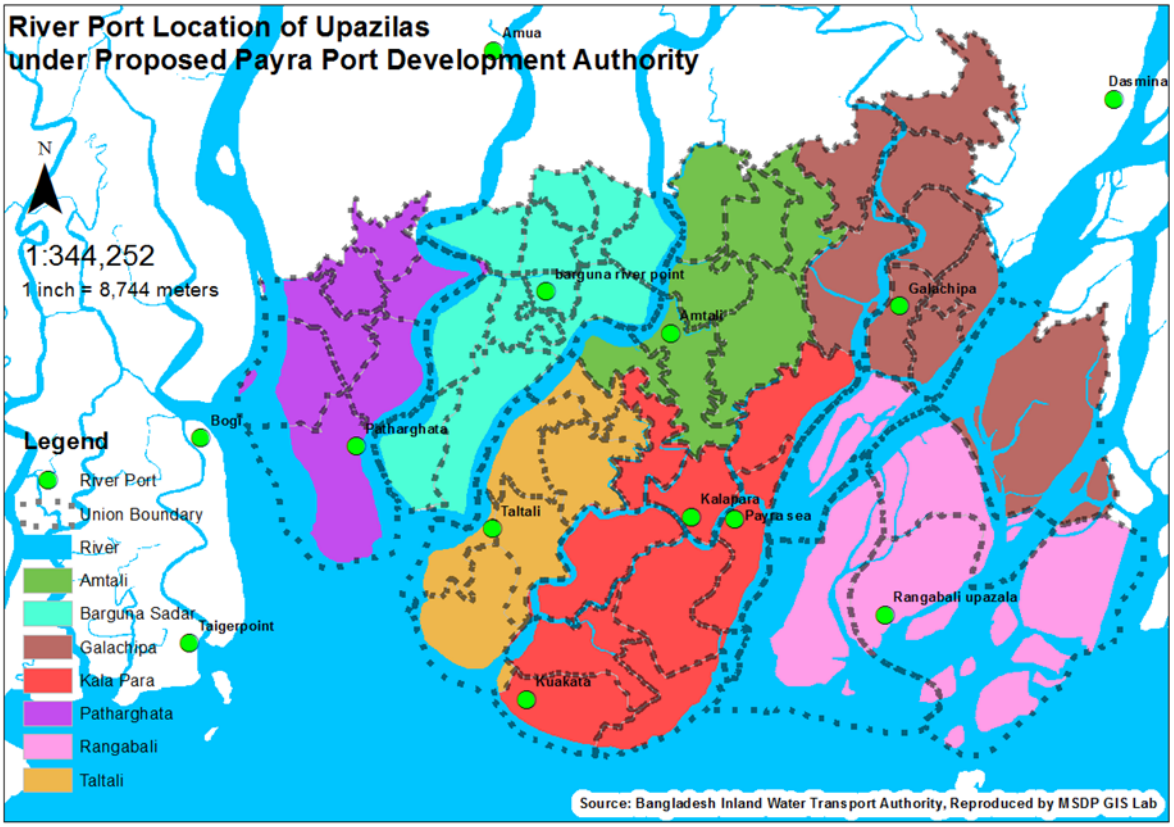


Figure 9-13: River Port Locations in Different Upazilas of the Region

PKCP Area is one of the poorest and least developed areas of Bangladesh. It is also prone to cyclones and storm surges. Major roads in the area are in poor condition, and sometimes impassable in the wet season. Certain parts of the network are closed to vehicle traffic due to inadequate structure of ferry connections. Cargo and passengers transport heavily rely on IWT. A substantial portion of the rural population here has no access to road transport and is directly affected by availability of IWT services. While the rural road network has considerably developed during the past ten years, many rural areas in the region remain isolated, especially during the high water season where road density is lower than in the rest of the country.

The water transport system, however, cannot be used to its full potential unless it has connectivity with road transportation systems. Water transport, therefore, should be a part of multimodal network comprising water bodies (rivers and canals) and roadways, including culverts, bridges etc., to be developed. This involves investment in a large number of activities to be carried out for infrastructure development including construction of roads and bridges, Channeling of the existing waterways through massive dredging and procurement of dredgers, improvement of day and night navigation for water crafts by providing navigational aids, construction of inland river ports etc. Some of the ports/terminals should be planned as multimodal hubs which will connect rail, road and waterways. Thus, integrated development of the rail, road and waterways will contribute towards sustainable development of the region.

10. PAYRA PORT AND ITS IMPACT IN THE REGION

10.1 Introduction

The Payra Port Authority and the port were established on 19 November 2013 through the Payra Sea Port Act 2013. The port started commercial operations from August 2016 under the port authority. Payra deep sea port is still under construction that is planned to be completed in three phases and the first phase is completed already in 2016 which was started in 2013. It is situated in the Southern part of Bangladesh, in Patuakhali District's Kalapara Upazilla. The port was planned to be upgraded to a deep sea port with the assistance of China. According to a techno-feasibility study prepared by British firm HR Wallingford & Consortium, Payra Port will require around 7,000 acres of land. Of the land, 6,000 acres will be used for port development, 500 acres for coal terminal and the rest for resettlement of the people affected by the construction of the port. Payra Port Authority (PPA) has already completed the construction of:

- A warehouse that has the capacity to hold 100,000 tons of goods.
- A six-storey administrative building is mostly done. It has already been opened for official activity as a site office for the port.
- Construction of a water purification plant to provide the port and adjacent area with safe drinking water is also complete.
- An 80 meter long and 21meter wide temporary jetty for service yard has also been set up and construction is going on in full swing.
- Housing for the officials and staff of PPA on 32 acres of land is mostly complete
- Construction of a four-lane port connecting concrete roads with the national highway is currently in progress.
- Rehabilitation of the homeless people due to land acquisition for port construction is also underway. According to PPA, there are six rehabilitation clusters ongoing on 484.11 acres of acquired land, and it will accommodate at least 3,500 affected families. The authorities are expecting the rehabilitation will be complete next year.

Works that remain to be completed are the following:

- Airport
- Rail Link to Dhaka
- Exclusive Economic Zone
- 200MW Power Plant
- Two container Terminals
- Multipurpose Terminals
- LNG Terminal
- Internal Ferry Terminals
- Ship-yard and Ship Repair Facilities

Figure 10-1 presents the site plan of the Payra Port and shows the locations of various Port facilities while **Figure 10-2** presents the draft zoning of the port area, adjacent township,

airport and surrounding areas prepared by the Urban Development Directorate (UDD). **ANNEXURE-III** shows alternative locations of Airport proposed by UDD.

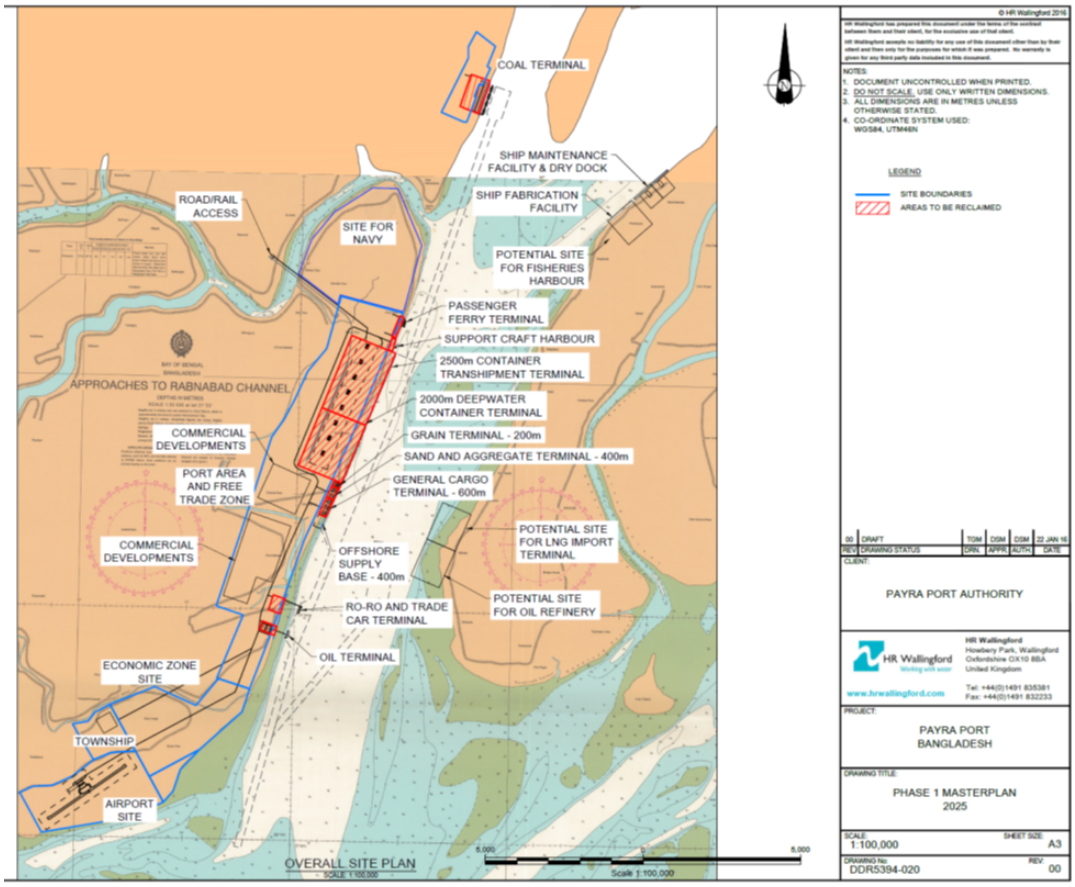


Figure 10-1: Payra Port Site Plan
(Source: Detailed Techno-Economic Feasibility Study and Conceptual Port Master Planning - Payra Port Final Report – January 2016)

10.2 Social, Economic and Environmental Impacts of the Port

10.2.1 Demographic Profile

The Payra Port is located on the bank of Rabnabad channel in Kalapara Upazila of Patuakhali district. The Rabnabad channel is situated in Meghna Estuary at Tentulia River in the Patuakhali district. It is about 270 km far from the Chittagong Port and 90 km away from Mongla Port. The port area and the rehabilitation area will be limited in Lalua, Baliatali and Dhulashwar unions of the Kalapara upazila. Demographic profile of the port area is presented in **Table 10-1**, **Figure 10-3**, and **Figure 10-4.**

Table 10-1: Demographic Profile of the Port Area

District	Upazila	Union	Total Population	Total Households
Patuakhali	Kalapara	Lalua	21562	5313
		Baliatali	16292	4050
		Dhulasar	18243	3974

(Source: BBS-Population and Housing Census-2011)

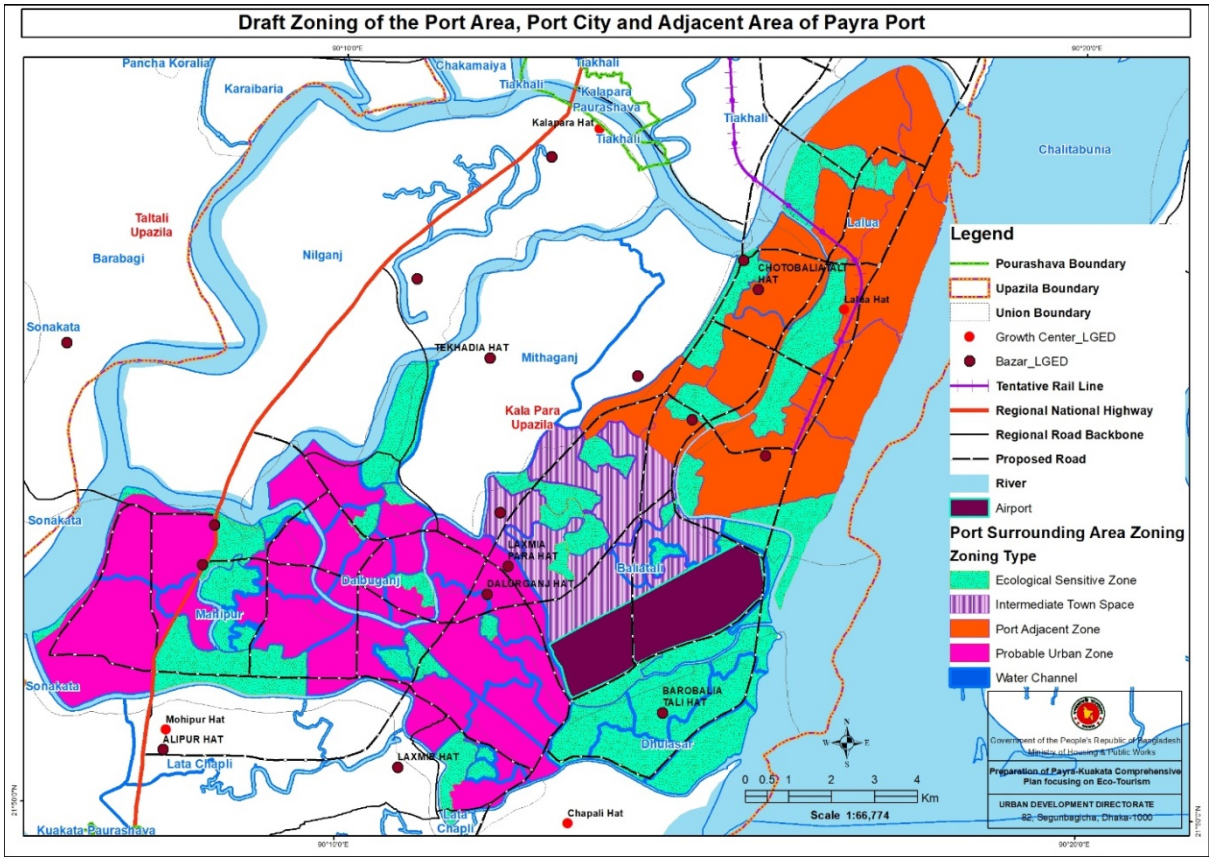
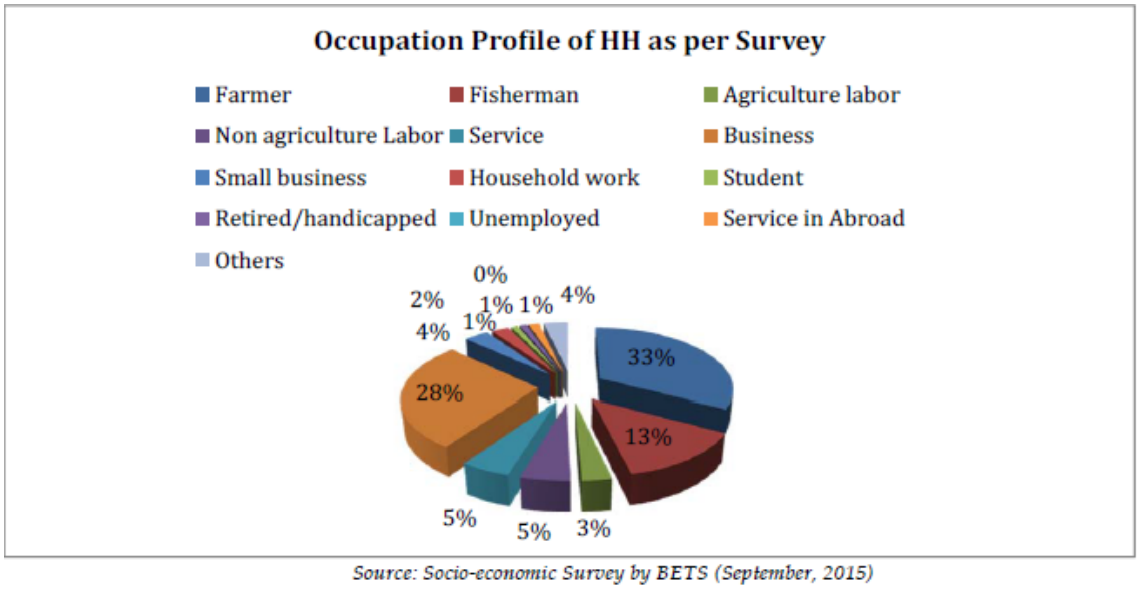


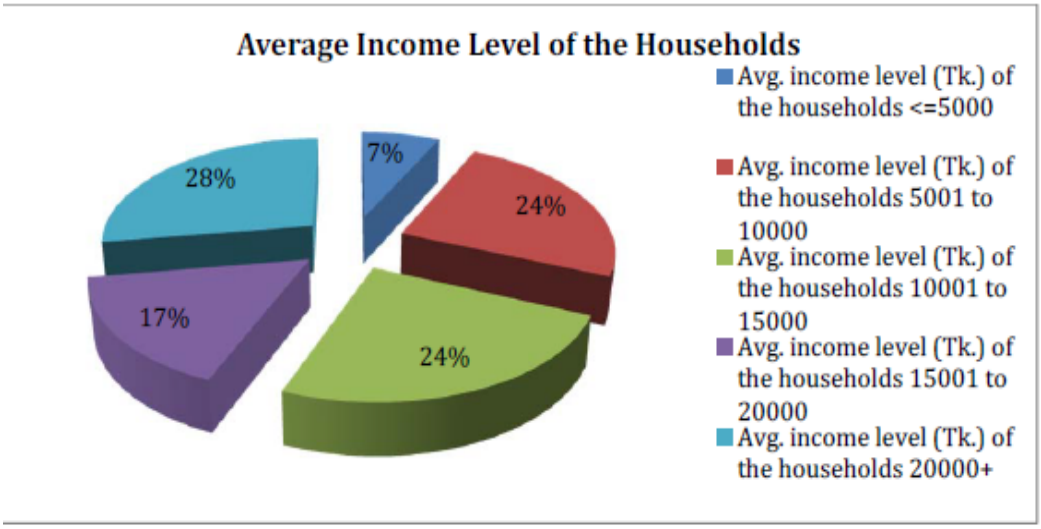
Figure 10-2: Draft Zoning of the Port Area, Adjacent Township, Airport and Surrounding Areas

(Source: UDD)



Source: Socio-economic Survey by BETS (September, 2015)

Figure 10-3: Occupational Profile of Households in Port and Adjacent Areas



Source: Socio-economic Survey by BETS (October, 2015)

Figure 10-4: Average Income Levels of Households in Port and Adjacent Areas

10.2.2 Socio-Economic and Environmental Impacts

Potential socio-economic and environmental impacts due to the port are presented in **Table 10-2**. The sources of such impacts may be development activity, Built environment (man-made structures, facilities etc.), biophysical changes and land acquisition.

10.2.3 Impact of the Port on Population and Employment

The Payra Port Master Plan prepared in January, 2016 estimated that by 2025 when the port becomes fully operational it would handle nearly 2 million containers, 2.5 million tons of general cargo and nearly 43 million tons of other materials (oil products, grain, sand and aggregate, coal etc. The port and related facilities (airport, free trade zone etc.) would employ about 13000 people including laborers. Since the Master Plan is being implemented at a slow pace, it is highly unlikely that the port would be fully operational in 2025. It is, however, expected that the port would become fully operational by 2030.

Based on the number of employments generated directly by the Payra port it is possible to predict the size of total employment (direct and indirect) and population in the Payra Township using the economic base multiplier as estimated in the economic base analysis and population-employment ratio estimated from 2011 census data on urban areas. Employments generated directly by the Port Authority can be considered as basic employment since the employed people would receive their income from the Port Authority. Total employment can then be estimated in the following way:

$$\text{Total Employment (TE)} = \text{Basic Employment} * \text{Economic Base Multiplier}$$

$$TE = 13000*3.35$$

$$TE = 43{,}550$$

Total population can now be estimated using estimated total employment in the following formula:

$$\text{Total Population (TP)} = \text{Total Employment} * \text{Population/Employment Ratio}$$

$$(TP) = 43{,}550 * 2.90$$

$$(TP) = 126{,}295$$

In the above formulas Economic Base Multiplier (EBM) represents the Average EBM of the Payra-Kuakata region, that is, average of the multipliers of the seven upazilas while Population/Employment Ratio has been estimated on the basis of the population and employment data of urban areas according to Urban Area Report of 2011 census. It is important to keep in mind that the projected total employment and population is based on the level of port employment. If the level of port employment varies then the projected total employment and total population would also vary.

Table 10-2: Expected Socio-Economic and Environmental Impacts

Source of Impact	Potential Impact
Development Activity	• Primary Employment • Spin off employment and Business opportunities • Property values and marketability • Increased demand for housing • Increased demand for services • Reduced community cohesion
Built Environment	• Reduced road safety • Reduced marine safety • Noise, dust and vibration • Reduced viability of commercial fishing • Loss of natural and recreational areas • Reduced access to culturally important areas and landscapes
Biophysical Changes	• Reduced viability of commercial fishing • Visual amenity/aesthetic quality • Loss of natural and recreational areas • Reduced access to culturally important areas and landscapes • Impacts on community values and aspirations • Formation of opinions and attitudes about the project
Land Acquisition	• Economic displacement of agricultural and fisheries livelihoods • Physical displacement of people and their settlements • Disruption and breakdown of existing social networks • Increased risk of social malaise and conflict etc.

Source: Socio-economic Survey by BETS (October, 2015)

10.2.4 Effect of Income Leakage

Leakage of income may also influence the projection of total employment and population. If a significant proportion of income received by the people employed by the Port Authority and related facilities is not spent locally, the value of EBM and Population/Employment Ratio could also be lower. According to the Port Master Plan 5% of the people employed would be management staff, 70% would be skilled workers (drivers, equipment operators, maintenance and engineering staff) and 25% would be semi-skilled labour ((security, clerks, labourers). The Social Impact Assessment Report submitted by BETS Consulting Services Ltd. in January 2016 indicated that the work force would be sourced locally, regionally and internationally. Only a small percentage of work force may come from the locality. In such a situation income leakage (income going outside the locality) may be as high as 50% and the value of EBM and population/employment ratio may as low as 2 or lower. In that case projected employment and population may be as below:

Total Employment (TE) = Basic Employment * Economic Base Multiplier

TE = 13000*2.00

TE = 26,000

Total Population (TP) = Total Employment*Population/Employment Ratio

(TP) = 26,000*2.00

(TP) = 52,000

Both the projections are, however, subject to the condition that the Port becomes fully operational.

10.3 Development of Competitive Ports and its Implication for Payra Port

Chittagong and Mongla are the only two sea borne trade ports in Bangladesh. Total tonnage of sea borne trade is presently over 45 million tons, growing over 10 percent per annum. Also the trend towards containerization persists and container traffic is growing over 12 percent per annum. Chittagong being the main gateway port of sea borne trade is handling over 95 percent of total tonnage. The Techno-Economic Feasibility Report of Payra Port indicates that due to capacity restrictions Chittagong and Mongla Ports would not be able to handle the growth of future container and cargo traffic and therefore more reliance will have to be put on Payra Port to handle the increased traffic. A comparative analysis is presented below to make this point clear.

10.3.1 Chittagong Port

The Chittagong Port (CP) installations are situated along the bank of the River Karnafuli 16 km from its outfall into the Bay of Bengal. The maximum permissible draft ranges from 8.50 to 9.20 m with length restriction of vessels being 188 m. As such vessels with more than 1,200 TEU cannot berth at Chittagong port, while the average capacity of the vessels calling at the South Asian ports is 3,500TEU. Chittagong has a theoretical capacity to handle about 1.7

million TEU, meaning that the port is currently operating at capacity. By bringing the New Mooring Terminal into operation this can be increased up to about 2.4 million TEUs and this can probably be achieved by 2021. Chittagong plans to bring the Bay Terminal into operation sometime around 2023, with six deep-sea berths plus 350 metres (4 berths) of river quayside for on-shipment to Dhaka. The Bay Terminal would have a capacity of up to 2 million TEU deep sea traffic on completion. Faster growth rate is projected for foreseeable future. Chittagong Port has not responded as yet to this demand effectively, resulting in congestions and delays at the port, as well as high costs to port users. Delays and uncertainties in port services seriously undermine economy's productivity and international trading links.

10.3.2 Mongla Port

The Mongla is located on the Pussur River about 130 km inland from the Bay and its permissible draft ranges from 7.00 to 8.50 m with length restriction of vessels being 225 m. This Port currently handles less than 5% of total container and cargo traffic in Bangladesh. It is assumed that Mongla Port will remain as a marginal container port, but with no major expansion of capacity. It has no real opportunity to increase the size of ship handled.

10.3.3 Implications for Payra Port

If Payra can meet the needs of its energy market i.e. servicing coal fired power stations with Kamsarmax vessels and also allowing an LNG FSRU to be operated in the port, then Payra can be developed as the deep-sea port for Bangladesh. It is, however, contingent upon developing a channel suitable to service a 14.5 meter draft vessel. **Table 10-3** below shows the forecast container traffic for Payra Port up to year 2033. The forecast assumes that the facility opens sometime in 2020 and by 2023 has seen throughput reach 1 million TEUs of deep-sea traffic. Thereafter the port grows rapidly, reaching 3.9 million TEUs by 2030. The forecast examines two scenarios, with either 20% or 50% of all traffic being moved inland from Payra by waterway.

10.4 Payra Energy Hub

Payra Energy Hub is located on the Rabnabad river bank in Dhankhali near Paira Bandar (**Figure 10-5**). Built on a 1,000-acre site, Payra energy hub will comprise two ultra-supercritical pulverised coal-fired single reheat boilers of 1,965t/h capacity, two single-axle eight-stage 660MW steam turbines, two water-hydrogen cooled generators, 32 forced draft cooling towers of 4,800m³/h capacity and a 275m-high flue stack to be shared with both the generating units. Other facilities of the plant include a 400kV switchyard, three coal storage yards, a fly ash storage area, and water treatment plants. Further, the plant is being equipped with electrostatic precipitators, flue gas desulfurization, and low NOx combustion technology for emissions control. Payra power plant uses water from the nearby Andhamanik River for cooling, coal handling, ash handling, and steam generation. The estimated cost is $2 billion.

The coal requirement for the plant is estimated to be 4.12 million tonnes per year (Mt/y). The Payra power plant site received the first coal shipment in September 2019. Electricity generated by the power plant is fed to the national grid via double-circuit 400kV transmission lines connected with the 400kV Patuakhali grid substation of Power Grid Company of

Bangladesh (PGCB). The plant is currently generating 1,000MW on an experimental basis, burning through some 13,000 tonnes of coal a day, generating 180 tonnes of fly and bottom ash as byproducts (The Daily Star, March 28, 2021; Dhaka Tribune, May 15, 2020; The Financial Express, April 04, 2019)

Table 10-3: Forecast Container Traffic for Payra Port up to Year 2033

Year	Mongla	Chittagong	Payra	Total	Payra	Chittagong	Mongla
	TEU	TEU	TEU	TEU	%	%	%
2008	27000	1,069,999				98%	2%
2009	28000	1,161,470				98%	2%
2010	29000	1,343,448				98%	2%
2011	29000	1,392,104				98%	2%
2012	30000	1,406,456				98%	2%
2013	31000	1,541,517				98%	2%
2014	32000	1,711,084				98%	2%
2015	33000	1,867,648				98%	2%
2016	34000	2,038,538				98%	2%
2017	35000	2,225,064				98%	2%
2018	36000	2,428,657				99%	1%
2019	37000	2,650,880				99%	1%
2020	38000	2,793,435	100,000		3%	95%	1%
2021	39000	2,874,186	250,000		8%	91%	1%
2022	40000	2,873,340	500,000		15%	84%	1%
2023	41000	2,642,364	1,000,000		27%	72%	1%
2024	42000	2,432,843	1,500,000		38%	61%	1%
2025	43000	2,246,487	2,000,000		47%	52%	1%
2026	44000	2,264,357	2,290,000		50%	49%	1%
2027	45000	2,262,498	2,622,050		53%	46%	1%
2028	46000	2,236,431	3,002,247		57%	42%	1%
2029	47000	2,180,909	3,437,573		61%	38%	1%
2030	48000	2,089,801	3,936,021		65%	34%	1%

10.5 Progress of Payra Port Development Activities

The progress of work towards full development of the port is quite slow. Since 2013, vehicles have been loading and unloading goods at the site. Currently only ship-to-ship loading and unloading is taking place. Between 2013 and 2018, around 27 vehicles arrived at the port with 5 to 13.50 meters draft (Dhaka Tribune, February 16, 2019). Goods were transported by lighterage. The most transported goods were stone chips, cement clinkers, dredging materials, and plant machinery. The Port cannot be fully functional unless it is turned into a deep sea port with 14.5 meter draft at Rabnabad Channel with airport, cargo, coal, LNG terminal, two long jetties etc.

To expedite the work consultancy agreement for the port master plan has been signed with Dutch company Royal Haskoning DHV and Bangladesh University of Engineering and Technology (BUET). Under the consultancy job, BUET will estimate the costs of all the 19 components of the project. Of the components, 13 will be implemented under foreign direct investment and the rest under the government-to-government deals with an estimated cost between $11 billion and $15 billion (The Daily Star, November 24, 2020)

The Payra port venture has drawn investment and development proposals from China, the UK, Belgium, the Netherlands, Denmark and India. If implemented as planned, Payra Port will become a major Port in the near future and become an effective partner of Chittagong and Mongla ports. Once turned into a deep seaport in future. it will gradually support transit trade handling as well as propel economic and social development of the country.

Figure 10-5: A View of the 1320MW Coal-Fired Power Plant in Dhankhali Area

11. PAYRA DEVELOPMENT AUTHORITY AND INTEGRATED DEVELOPMENT OF THE REGION

11.1 Payra Development Authority and Comprehensive Regional Plan

The need for an appropriate institutional arrangement for sustainable regional development can hardly be overemphasized. Realizing this need a decision was taken to establish a Development Authority for the seven upazilas (Amtali, Barguna Sadar, Galachipa, Kolapara, Pathorghata, Rangabali and Taltali) of the Payra-Kuakata Region in a meeting chaired by the Secretary of the Prime Minister's Secretariat on March 20, 2016. Seven Upazilas which are proposed to be under this Authority are shown in **Figure 11-1**. This Authority would propose planning policies and strategies and prepare integrated Master Plan for development of the region. This Authority is also expected to work as an agency for coordinating all development activities carried out by local governments and Central Government Agencies within the region. Current development activities of different organizations are shown in **ANNEXURE-IV**.

The Payra-Kuakata region includes environmentally sensitive areas which need protection from harmful human intervention. At the same time development activities also need to be promoted for poverty reduction and livelihood activities. Accomplishment of these objectives would require formulation and enforcement of land use regulations. **Figure 10-2** shows the comprehensive integrated regional development plan of the region and **Table 11-1** shows the distribution of areas by land use categories. The whole region has been divided into Conservation Areas, Development Areas, Tourist Zone and Agricultural Zone.

11.1.1 Conservation Areas

These include Char lands, Depression areas and forest area/green belt. Conservation zone set asides ecological sensitive spaces in order to ensure sustainable use of space. Unless prioritizing ecological conservation, urbanization can be disastrous for further development of built up area. Below are the categories on which conservation zone will be identified.

***Beach/Char area*:** Beach and char areas are important zone for conservation with potentiality for tourism and forest. A number of beaches located in the project area are attractive for their scenic beauty and therefore will be conserved as a place of passive recreation. A number of char areas has also emerged over decades and has potential for development as forests.

***Depression Area*:** Low lying land is higher in flood risk compare to high elevated land. This is the depression area which needs to be identified based on its level of inundation to reduce environmental risk and monetary loss of establishment as well as human livelihood.

***Forest/Mangrove Zone*:** Forest areas play critical role in planning the region for its ecological sensitivity and environmental benefit. Apart from mangrove zone, recently grown man made forest in char land has opened prospect for bio-diversity and ecosystem balancing for the region. A part of the 200 km buffer line of ECA of Sundarban forest has fallen within PKCP area (figure-10.2) which will be a zone of conservation as per project objective. The Sundarbans harbours 334 species of trees, shrubs, herbs and epiphytes and about 400 species of wild animals. Sundri (*Heritiera fomes*) is the most important floral species. The wetlands of

the Sundarbans consist of about 200 islands separated by about 400 interconnected tidal rivers, creeks and canals.

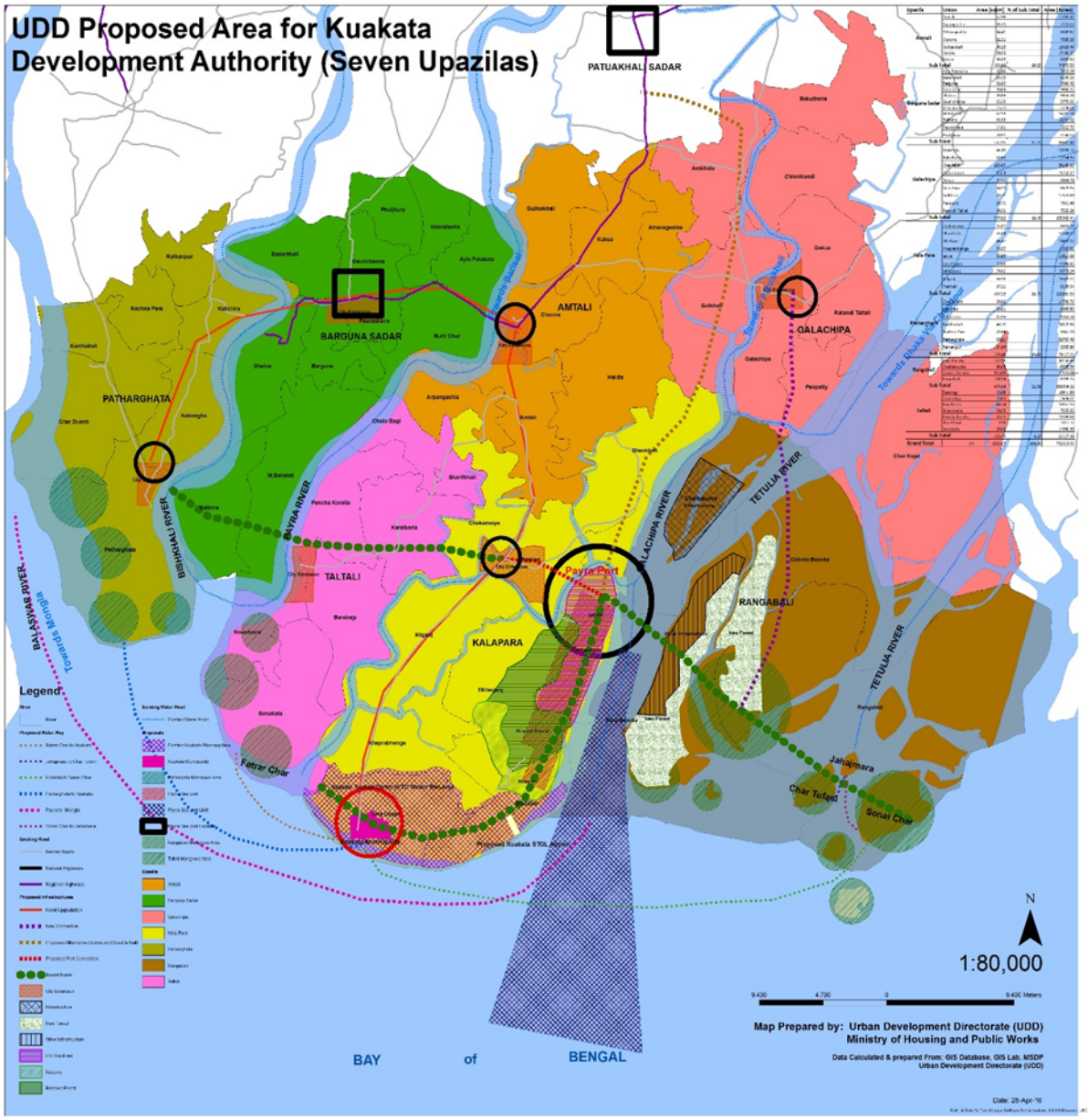


Figure 11-1: Proposed Area for Payra- Kuakata Development Authority
(Source: UDD)

The Sundarbans was recognised as a Natural World Heritage Site in 1997 by UNESCO and as a Ramsar Site of international importance in 1992 (**Figure 11-3**). Urbanization and industrialization will have a great impact over this mangrove forest lying at west side of the project area. That is why conservation of Sundarban mangrove forest area was given special consideration while preparing the plan for the region.

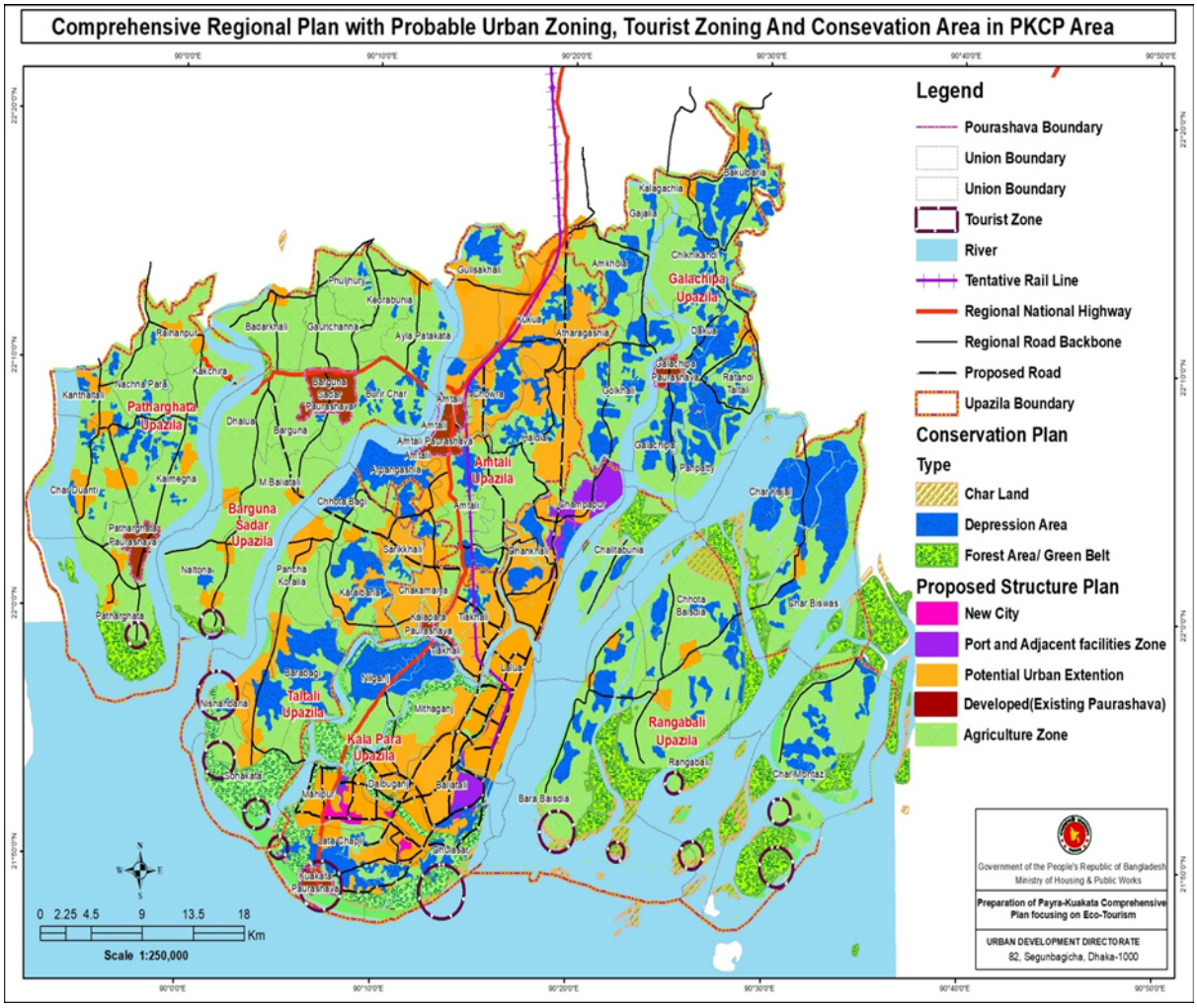


Figure 11-2: Comprehensive Regional Development Plan of Areas under Payra Development Authority

Table 11-1: Distribution of Plan Areas by Land Use Categories

Land Category	Area (Acre)	%
Agri Land	240225.64	29.26
Port and Adjacent Facility Area	28477.37	3.47
Potential Urban Area	18091.30	2.20
Existing Urban Area (Paurashava)	11347.69	1.38
Char Land	12205.44	1.49
Depression Area	107567.59	13.10
Green Belt	23470.05	2.86
Settlement with Homestead Forest	117584.14	14.32
Mangrove Forest	43262.08	5.27
Waterbody	182749.52	22.26
Bay of Bengal	32812.41	4.00
Sea Beach	3280.78	0.40
Total	**821074.00**	**100.00**

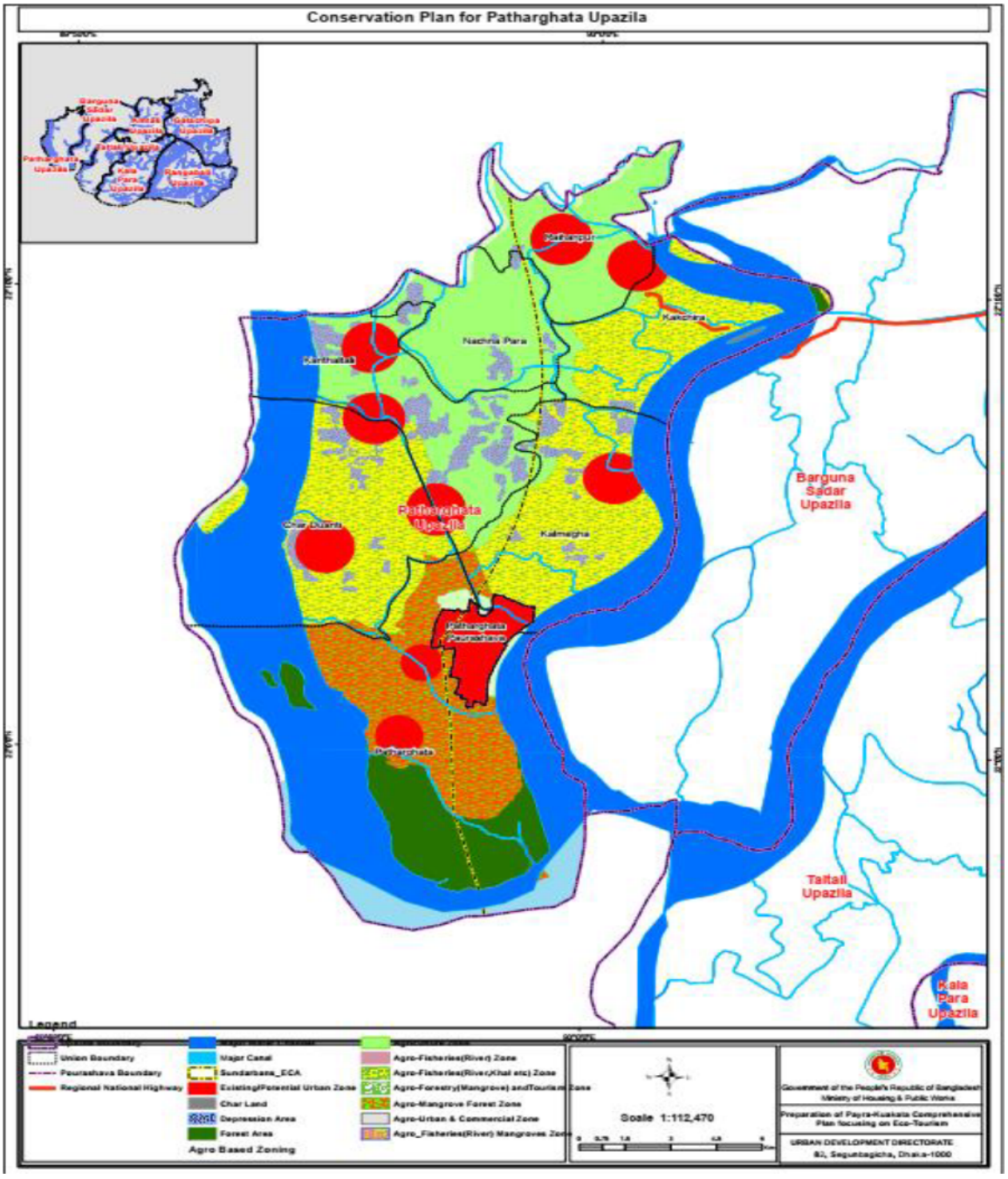


Figure 11-3: Part of Sundarban Ecological Critical Area in Patharghata Upazila (West side of dotted Line going through the middle of the Upazila)

11.1.2 Development Area

This area includes existing urban areas, new city, port and adjacent facilities zone, potential urban extension, and developed areas (existing Pourashavas).

***Existing Urban area*:** The urban areas already developed and currently playing as main places of urban activity will be identified to make maximum utilization of their spaces. Already developed urban zone need an extra care as it has tendency of haphazard growth.

***Urban promotional area*:** Considering development activities and increase of population, some places will be preserved to accommodate such increase in population and give them extended urban facilities to avert congestion and overload of the capacity of existing urban areas. These places are close to existing growth centers and transport facilities which will supplement the existing urban zone and subsequently promoted to larger urban area with time.

***Port-centric urban zone*:** The PKCP area is assumed to be developed as Payra Port will grow and enhance its port related activity. All the surrounding Upazilas will be connected to port and a new port-centric zone is necessary to be developed to ease business and commercial activity. Therefore, port-centric urban zone and a township need to be developed adjacent to the port area. This zone will facilitate the port activity with all other necessary urban amenities in order to accommodate different income groups who will be engaged in basic and non-basic activities.

***Eco-town*:** Based on certain parameter related to eco-town development criteria, a particular zone will be identified for eco-town development. The basis of such town development is to promote a model town which is climate resilient and less harmful for environment in terms of urban activity. The suitable location for this town area has been analyzed based on measuring proximity to water channels, forest and connectivity to urban areas and transport hub.

***Rural growth centers*:** Rural growth centers will be plotted in the plan to specify particular areas to perform rural hat- bazar activity. These centres will be well connected by major transport network and serve as rural urban linkage centers.

11.1.3 Tourist Zone

The project area has great potentiality for tourism due to its diversity of natural landscape. A rare combination of forest, sea, riverine scenic beauty is found in this project area. As the area is prospective for industrialization and port based economic development, a demand for local and national recreational activity will be generated and the tourist zone will cater to this demand.

***Tourism center*:** There are a number of beaches, historic visiting places and tribe community in the mainland of the project area which can be interesting sites for tourists for visiting. Considering national level future recreational demand, these sites need to be well connected to national and regional highways as well as nearby Upazilas.

***Island based tourism*:** The isolated char lands surrounded by river and Bay of Bengal distant from main land have good prospects for tourism development. These char lands need an eco-friendly development strategy so that physical structures do not interrupt natural environment. Water transport and safety are major concerns here for planning such tourism zone.

***Forest based tourism*:** Mangrove and other natural and man-made forest areas will be identified to develop forest-based tourism activity as part of comprehensive tourism development in this coastal region.

11.1.4 Agricultural Zone

Most of the lands in the PKCP area are under agricultural use and contribute to local economic development. The fertile land characteristics and availability of water channels have made this area prospective for agriculture, fishery, poultry and livestock rearing.

11.2 Strategies for Integrated Regional Development

Any development plan ultimately boils down to a set of programs across all aspects of development. Based on problems and potentials, strategies have been identified. These strategies are in line with the strategic objectives of the Coastal Development Strategy (CDS, 2006) and address the poverty reduction objectives as set forth in the 6th and 7th five year plans. The main areas of focus are as follows:

- Conservation and Management of the coastal environment
- Management of the water resources in the region
- Facilitating sustainable economic opportunities for coastal communities
- Developing productive economic activities
- Development infrastructure
- Development of social facilities including education, health, water and sanitation
- Mitigation of natural disasters

As the region faces natural disasters on a regular basis, strategies and policies for mitigation of natural disasters have been discussed in detail in the next chapter (**Chapter 12**).

11.2.1 Conservation and Management of the Coastal Environment management

A conservation plan can be a vision for the future ecological health of an area. It typically includes reference to a natural resources inventory, a description of important features and an action plan to protect these features over a long period of time. In the Comprehensive Regional Plan, Forest area, River, Canal and depression area will remain totally unchanged. Beside this, char land and beach area also demarcated in this map.

Contrary to some current impressions, conservation and economic development are not conflicting ideas. In fact, well-planned conservation-oriented development will add to the general economic and social prosperity of a coastal community, while bad development will sooner or later have a negative effect. With innovative management based upon sustainable use, communities may be able to achieve a desirable balance without serious sacrifice to either short-term development progress or longer-term conservation needs. Conservation and environmental management plan puts special emphasis on the following issues:

- Biodiversity conservation. The priority for biodiversity program should include conservation of Sunderban reserve forest and other forestry resources and wetland biodiversity management in the region.
- Forest resource management – conservation and afforestation.
- Pollution control – air quality control in the urban areas, industrial pollution control etc.

- Local Level Conservation Planning – Local governments, NGOs and Private Voluntary Organizations should determine conservation priorities and prepare conservation action plans
- Strengthening of the Department of Environment and Department of Forestry, participatory process in planning, advocacy and independent watch on development interventions which impact on environment.

Public sector program will primarily address interventions in the above areas. Partnership with NGOs, which have comparative advantage in implementing community level resource management and environmental issues, will play a strategic role in the implementation arrangement of these program interventions.

11.2.2 Water Resources Management

The Coastal Development Strategy (2006) provides an outline of priority areas in addressing present and future water resources management issues. These include safeguarding the availability of fresh water, water supply and sanitation program in the small towns (pourashavas), integrated and decentralized approach to regional water resources management. Additionally, the future program will require extension of ongoing programs in respect of rural water supply management, environmental sanitation, sewerage disposal schemes, and small-scale irrigation systems. Arsenic mitigation measures in the coastal areas will also require long-term capacity development and small investments at the community level. Investments in water resources management will be primarily funded from the government budget while donor support will also be critical. Partnership with NGOs will be critical. For mitigation of oil spillage in port and smaller jetties as well as control and prevention of industrial pollution resulting from industrial activities can be effectively addressed in cooperation and partnership with the private sector. Government support for policy and legal frameworks for containing industrial pollution can be effectively implemented through participation of private sector in addressing the pollution and environmental issues. Investment in capacity building measures will thus constitute an important strategy.

11.2.3 Sustainable Economic Opportunities for Coastal Communities

The fragile resource base upon which a majority of the coastal population depend for living is constantly under pressure of overexploitation and depletion. Thus, the strategy for enhancing livelihood opportunities for the poor in the coastal areas emphasizes the simultaneous attainment of the dual objective of improving income and employment (self and wage employment) and environment/natural resources management. Livelihood activities in the coastal zone can be clustered into two broad groups:

- Natural resource based activities, such as agriculture, salt processing, fishing, aquaculture, shrimp fry cultivation, dehydration of fish, extraction of forest resource, etc; and
- Human resource based activities, such as livestock raising, poultry keeping, small scale boat building, fishing net making, fish processing, trading and other small scale manufacturing and service activities.

In the past two decades NGOs in Bangladesh have built up an extensive network of support services for accessing the poor in improving their livelihood opportunities. As both funding agency and implementing partner of Government and multilateral and bilateral donors, a large number of NGOs currently have programs in the coastal zone in areas such as: community development to empower fisher folk communities, agriculture and small agro-based activities, micro and small enterprise development involving both women and men entrepreneurs and self-employed, wetland resource management and providing capacity development for income earning opportunities, alternative livelihoods for the local population living in tidal wetlands of southwest coastal region, and other income and employment generation activities.

Micro-credit programs and small enterprise development support are needed for employment generation and poverty reduction in the region. Micro-finance organizations have their presence in the area. Micro-credit program of Government's BRDB and small agricultural loans of the government's Krishi Bank (agricultural bank) also provide support for income and rural employment generation in the coastal zone. Micro-credit and small enterprise development at the household and community level would thus constitute a core strategy of the investment program aimed at poverty alleviation and natural resource management in the coastal zone. The program would harness the capacity of NGOs and micro-finance organizations for outreaching their program activities.

11.2.4 Developing Productive Economic Activities – Ecotourism

At the national level tourism and fisheries development have been identified as sub-sector that have the potential for generating employment and income as well as foreign exchange. The tourism sector has for many years been subject to public sector planning and management (BPC 2004). With the introduction of the Industrial Policy in mid-1980s private sector has been assigned to play an expanded role with additional incentives and regulatory support of the Government. Opportunities for private sector investment in tourism must be guided by carefully designed regulatory measures to ensure that the environmental and forestry conservation issues are simultaneously addressed. Investment opportunities in tourism development including hotels and resorts, tourism site development and other tourist attractions and amenities should be created in the region.

There is bright prospect for development of eco-tourism in the region. Foreign investment participation will augment the capacity of domestic investors in the tourism sector. International investors can bring in tested concepts for both large-scale tourism development as well as eco-tourism. Government has a major role in supporting private sector investment in tourism by providing a comprehensive sector strategy for tourism development in the coastal zone, parameters for eco-tourism, and sustainable development issues that need to be integrated with small and large-scale tourism projects.

11.2.5 Developing Productive Economic Activities – Fisheries

In the fisheries sector Bangladeshi entrepreneurs have a strong track record. Their contribution to business generated from the fisheries sub-sector make up a significant proportion of gross domestic product. The future output of capture fisheries is projected to decline. Both coastal

and inland fisheries may experience such decline in capture fisheries. The decline will have to be compensated by aquaculture output. There is potential for a managed development of fisheries in the coastal zone which presently has a major share in the national production. There is scope for increasing capture/output of some marine fisheries. There is also potential for further exploitation of inland fisheries and aquaculture (both freshwater species and shrimp culture). Investment in the fisheries sector will largely come from the private sector, while Government has a major development role in ensuring policies and regulatory measures to mitigate environmental problems associated with aquaculture and inland fisheries, overexploitation, and other negative externalities associated with capture and fish processing. Government needs to ensure protection to investors, enforce measures against illegal fishing in the deep sea and sea piracy with increased logistics for improved law and order. The development issues should be addressed comprehensively by way of a strategic development plan for the fishery sector and creating opportunities for increased private sector investment within the framework of sustainable development of fisheries.

11.2.6 Infrastructure Development

In the coastal zone, special provisions will have to be made to extend infrastructure projects to serve the remote islands and other coastal areas. These infrastructures will support industrial and social services projects in the coastal areas as well as establish strategic links with the national economy. Indeed, national economic development will require infrastructures that will link different areas with seaport and land port facilities in the coastal areas to serve the expansion of the country's exports.

Consistent with the national strategy for infrastructure development, infrastructure projects in the coastal zone must also support promotion and development of rural non-farm economic activities. Such projects for the coastal zone will include, among others, small scale wind energy and solar energy, rural roads network, physical structures for marketing support to facilitate market penetration of goods produced in the rural economy and the remotely placed coastal communities as well as the islands.

While a large part of the investment projects in the infrastructure sectors will be provided by the public sector, there will be scope for increased involvement and participation of the private sector in such infrastructure projects. This is consistent with Government policy and guidance for private sector participation is provided for in the Government issued gazette on Private Sector Infrastructure Guidelines".

11.2.7 Development of Social Facilities

Investment in social development should be consistent with the Government's poverty reduction strategy. Programs in health, population and nutrition support, education, and water and sanitation should be developed in the context of sector wide programs at the national level. Coastal dimension of the social sector program should be identified and derived from the national level program. Much of the investments in these programs will come from the public sector budget, although the private sector and NGOs are key partners of the government in the delivery and implementation of projects. Outside of the government budget NGOs have a

significant program budget for health and non- formal education. The private sector is also emerging as an important source of financing for hospitals and clinics as well as education.

12. CLIMATE CHANGE AND NATURAL DISASTERS: ADAPTATION AND MITIGATION STRATEGIES

12.1 Introduction

Coastal areas and the resident population are vulnerable to recurrent natural disasters – cyclones, drainage congestion and floods. Agriculture, irrigation systems and livelihood activities of the local population are threatened and often disrupted by erosion of embankments, polders, and other similar infrastructures. **Table 12-1** presents climate change impacts on key vulnerable sectors in Bangladesh. Recurrent floods caused extensive damage to primary and secondary roads, feeder roads, rural roads, small bridges and culverts, and inland waterways support systems including small jetties. A significant size of public sector budget is allocated to meet the replacement investment requirement to keep the physical infrastructures in operating condition to prevent further disruption to economic and livelihood activities of the local population.

Table 12-1: Climate Change Impacts on Key Vulnerable Sectors in Bangladesh

Sector	Likely impacts of climate change
Water	• Sea level rise • Increased flooded areas due to both sea and river flooding • Reduced water availability for purposes such as drinking water due to saline water intrusion • Increased water shortages, particularly in the northwest and southwest regions • Increased number of droughts, mostly in the western parts of the country • Displacement of coastline population
Agriculture	• Reduced main crop production by 13.9% in 2050, except for Boro rice production • Loss of productive agricultural land due to saline intrusion, coastal erosion, and inundation
Fisheries	• Reduced aquaculture production due to floods • Reduced habitat for freshwater fish due to saline water intrusion
Livestock	• Reduced milk production • Losses in suitable land for livestock • Increased cattle mortality due to extreme climate events
Human health	• Increased water- and air-borne diseases such as malaria, cholera, and diarrhoea • Changes in the spatial distribution of diseases and increased incidence zones for diseases such as malaria • Heightened risks to vulnerable groups such as women and children, due to saline water
Ecosystems and forests	• Endangerment of species in the Sundarbans mangrove and wetlands due to climate change–induced natural hazards • Loss of forest species and ecosystems in coastal areas due to sea level rise and inland due to greater moisture stress during dry periods
Infrastructure	• Damage to highways and railways due to flooding
Urban centres	• Increased urban floods and drainage congestion • Increased flash floods and landslides due to urban development (e.g., on hills)

	• Reduced water quality due to cyclones, storm surges, and floods causing saline intrusion

The Government has taken various steps to address the impact of climate change in the country. The Ministry of Environment, Forest and Climate Change (MoEFCC) has been designated as the 'focal ministry' for providing coordination and the technical lead on all climate change related matters. The Ministry led the drafting of Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008 and then in 2009 issued the revised version incorporating the views of the Cabinet Review Committee. It provided a ten-year programme to build the capacity and resilience of the country to meet the challenge of climate change. The programme is built on six pillars as shown below:

- Food security
- Social protection and health
- Comprehensive disaster management
- Infrastructure
- Research and knowledge management
- Mitigation and low carbon development
- Capacity building and institutional strengthening

12.2 Present Institutional Framework for Action on Climate Change

The MoEF is the focal ministry for all work on climate change in Bangladesh, including international negotiations. The Government of Bangladesh recognizes the need to strengthen their institutions to respond effectively to the enormous challenges of climate change. A National Steering Committee on Climate Change has been established to coordinate and facilitate national actions on climate change. A Climate Change Secretariat has been set up in the MoEFCC, to support the National Steering Committee on Climate Change. It is working with climate change cells in all ministries. The Climate Change Cell under the MoEF supports the mainstreaming of climate change into national development planning and has developed a network of 34 'focal points' in different government agencies, research and other organizations. **Figure 12-1** presents the Organizational Chart for Climate Change Action Plan.

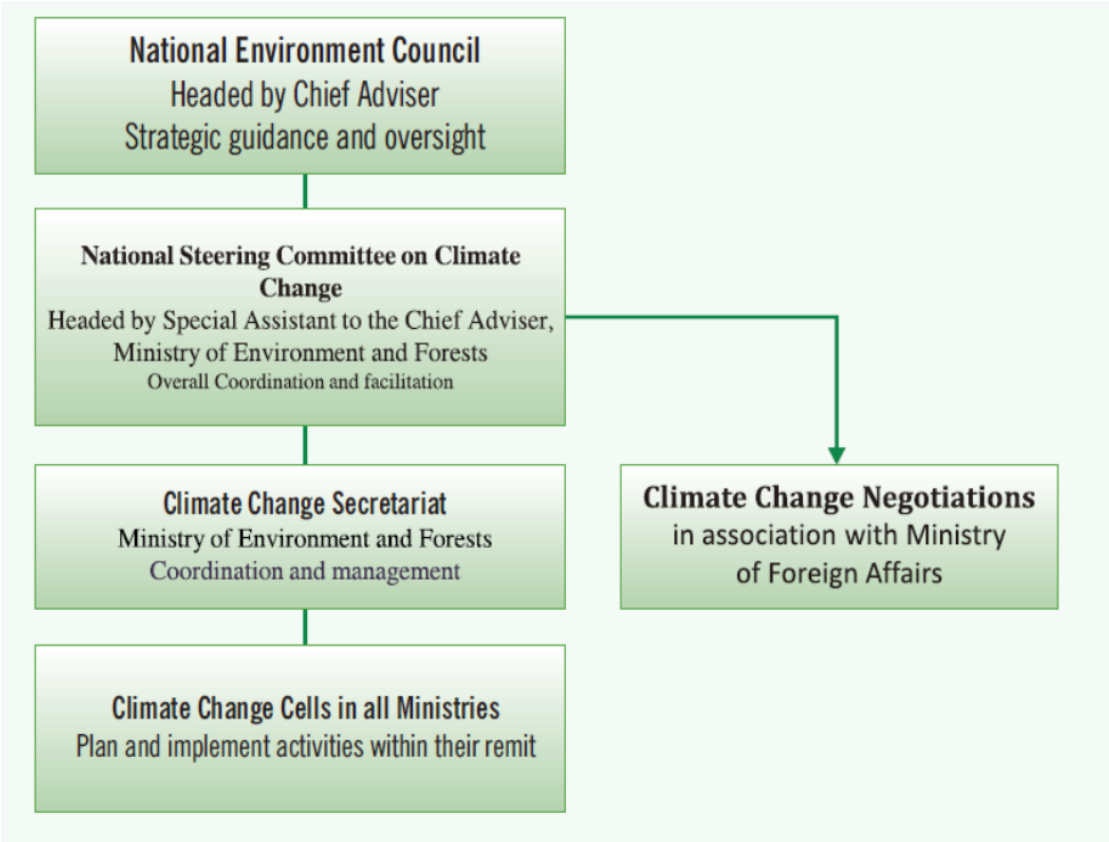


Figure 12-1: Climate Change Action Plan Organizational Chart

12.3 Adaptation to Climate Change

The BCCSAP, updated in 2009, sets out the adaptation needs of the country by priority areas, as summarized in **Table 12-2**.

Salinity is a major problem in the region which has been increasing over the years due to climate change. Salinity condition in the project area is presented in **Figure 12-2**. A community-led strategy is sometimes a better option because it is local village people who are often the real experts on climate change. Rather than implementing highly technical, expensive and outsider-led interventions that have not been tested in the field conditions, priority should be given to using and modifying traditional coping mechanisms developed in the communities in Bangladesh and around the world. In saline areas this may involve using ancient local technologies such as the huge locally fired clay pots that harvest and store rainwater from roofs, the selection of saline-tolerant rice varieties that have traditionally been cultivated by the sea, or belts of salt-tolerant trees such as mangroves planted along coastal areas to prevent saline intrusion.

Coastal vulnerability usually differs for different communities living in different parts of the coastal belt. Payra-Kuakata region is particularly vulnerable to cyclones associated with tidal surge mainly in pre-monsoon months of April-May and post-monsoon months of October-November. **Figure 12-3** and **Figure 12-4** show the cyclone affected zones in different Upazilas of the region.

Table 12-2: Priority Area for Adaptation

Area of Focus	Priority Actions
Food security, social protection and health	• Increase resilience of most vulnerable groups through community -level adaptation, diversification of livelihoods, improved access to services and social protection schemes (e.g. insurance); • Develop climate resilient cropping systems (including agricultural research), as well as fisheries and livestock systems to ensure local and national food security; • Implement surveillance systems for existing and new disease risks and to ensure health systems are poised to meet future demands; and • Implement drinking water and sanitation programs in areas at risk from climate change, including coastal zones and other flood and drought-prone areas
Comprehensive disaster management	• Improve the government's and civil society's ability to manage natural disasters and ensure that effective policies, laws, and regulations are in place; • Enhance community-based adaptation programs and ensure they are in place in disaster prone parts of the country; and • Enhance cyclone, storm surge, and flood early-warning systems
Infrastructure	• Repair existing infrastructure – including coastal embankments, river embankments, and drainage systems – to ensure effective operation and maintenance systems; • Plan, design and construct needed new infrastructure, including cyclone shelters, coastal and river embankments, water management systems, urban drainage systems, etc.; and • Undertake strategic planning of future infrastructure needs, and take into account (a) patterns of urbanization and socioeconomic development; and (b) the changing hydrology of the country.
Research and knowledge management	• Improve climate change modeling scenarios for Bangladesh by applying methodologies at the regional and national levels; • Model the likely hydrological impacts of climate change in the Ganges - Brahmaputra-Meghna system in order to assess future system discharges and river levels to feed into flood protection embankment measures; • Monitor and research the impacts of climate change on ecosystems and biodiversity; • Analyze the impacts of climate change on Bangladesh's macro-economy as well as key sectors. • Research the linkages between climate change, poverty, health, and vulnerability in order to ascertain how the resilience of the most vulnerable households may be improved; and • Create a Centre for Research and Knowledge Management on Climate Change to ensure that Bangladesh has access to the most current ideas and technologies available globally.
Capacity building and institutional strengthening	• Revise all government policies to ensure they consider climate change and its impacts; • Mainstream climate change considerations in national, sectoral, and spatial development planning; • Build the capacity of key government ministries and agencies to move forward on climate change adaptation; • Improve the capacity of the government to undertake international and regional negotiations on climate change; • Build the capacity of government, civil society, and the private sector on carbon financing; and • Build the capacity for education and training of environmental refugees to ease migration to other countries and integration into new societies

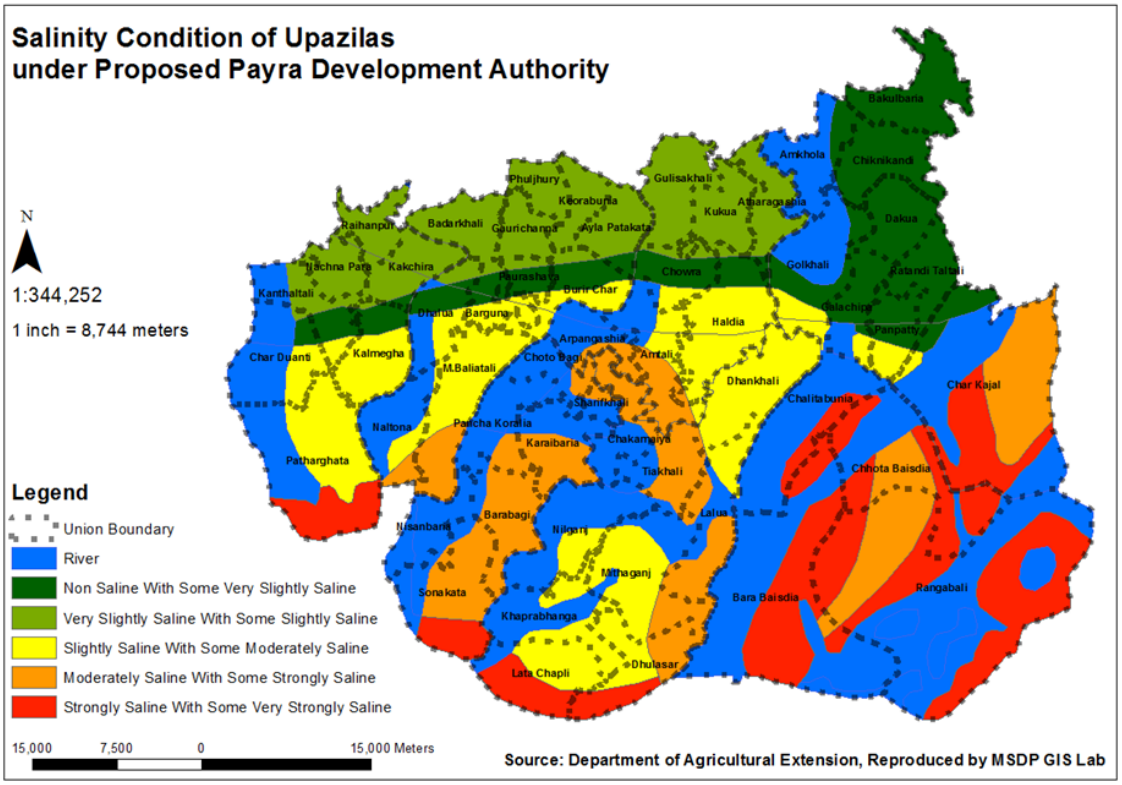


Figure 12-2: Salinity Condition of Upazilas under Proposed Payra Development Authority

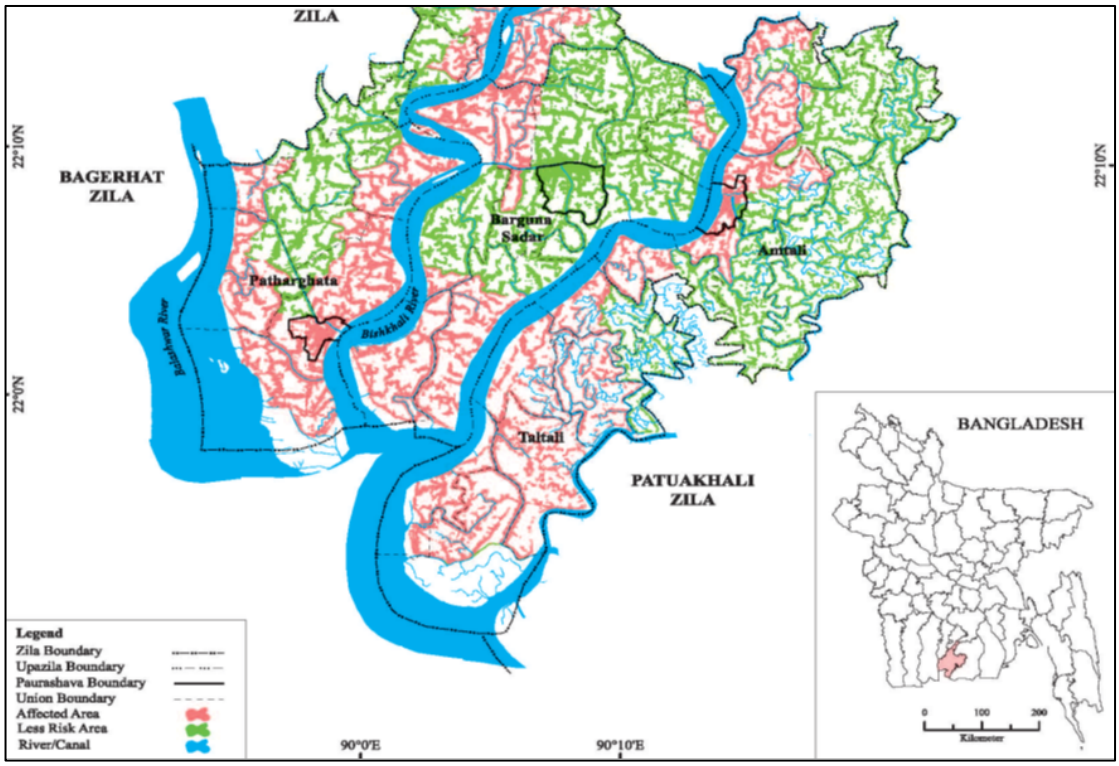


Figure 12-3: Cyclone Affected Zones (Risk Areas) in Patharghata, Barguna Sadar, Amtali and Taltali Upazilas

Source: BBS (2018): Disaster Prone Area Atlas of Bangladesh-Barguna Zila

Figure 12-4: Cyclone Affected Zones (Risk Areas) in Kalapara, Galachipa and Rangabali Upazilas

Source: BBS (2018): Disaster Prone Area Atlas of Bangladesh-Barguna Zila

Severe cyclones pose a threat to lives and (their) properties in the coastal region because of inundation due to storm surges. Records of storm surge height indicate that a range of 1.5 to 9.0 meters high storm surges may occur during severe cyclones. Adaptation requires some infrastructure development such as concrete cyclone shelters on stilts along the coast which have already saved thousands of lives – and are often used as schools and offices outside emergency periods.

The projected climate change and variability is likely to have a significant impact on the water supply and sanitation sector in the region. The water supply and sanitation systems, particularly in the coastal region of the country, are vulnerable to such factors as cyclonic and storm surges and flooding. To improve the situation, it is important to:

- Conserve water effectively
- Recycle and reuse water
- Raise tube wells on concrete platforms in order that a clean source of water is available above floodwaters.

Other measures that may significantly improve the adaptive capacity of the coastal communities may include the following:

- Development of coastal green belts as a measure against storm surge (**Figure 12-5**)
- Improvement of existing cyclone forecasting and warning system
- Analysis of meteorological data to improve prediction of changes in the pattern of cyclonic events
- Ensuring safety by introducing hazard-resistant housing (improved material, alternative design etc.)

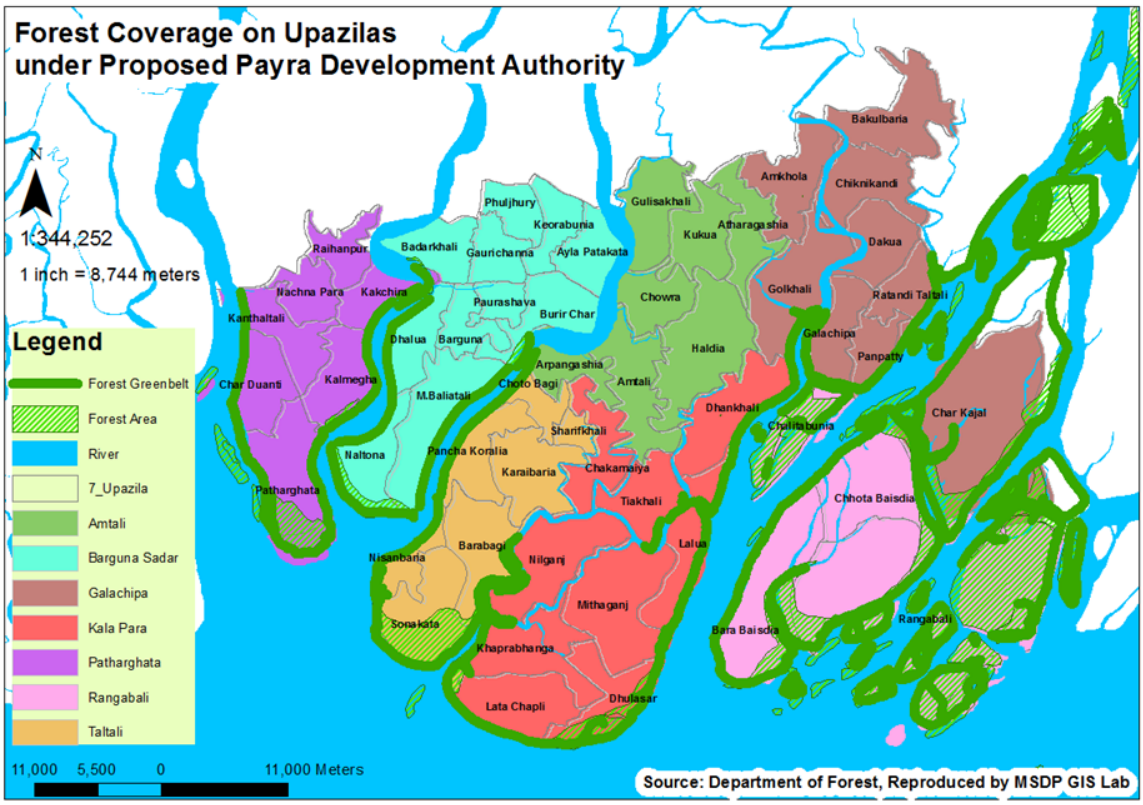


Figure 12-5: Forest Coverage and Proposed Green Belt in the Region

12.4 Mitigation Measures

In order to address the increasing risks due to extreme events like cyclone, storm surge, coastal flood, wind storm etc. due to climate change a substantial magnitude of public investment program is required to create resilient infrastructure, including drainage and flood control, water supply, sanitation, cyclone shelters, emergency access roads and bridges, slum improvements, bus terminals, boat landings, and markets. All the projects selected for such programme should be assessed for climate risk on the basis of agreed technical criteria and climate projections for 2040 in detailed designs. Institutional capacity to integrate climate and disaster risks into urban and regional planning and infrastructure management also need to be addressed. The priority investment program for mitigating natural disasters and ensuring safety and protection of the coastal population should focus on the following:

Coastal Embankment Construction and Rehabilitation, including:

- Protection from saline water
- River bank and khal protection schemes
- Rehabilitation and of polders, as well as extension of polders (**Figure 12-6**)
- Canal excavation
- Construction of new embankments
- Protection and extension of irrigation systems
- Excavation of river and branch channels
- Multipurpose cyclone shelter centers

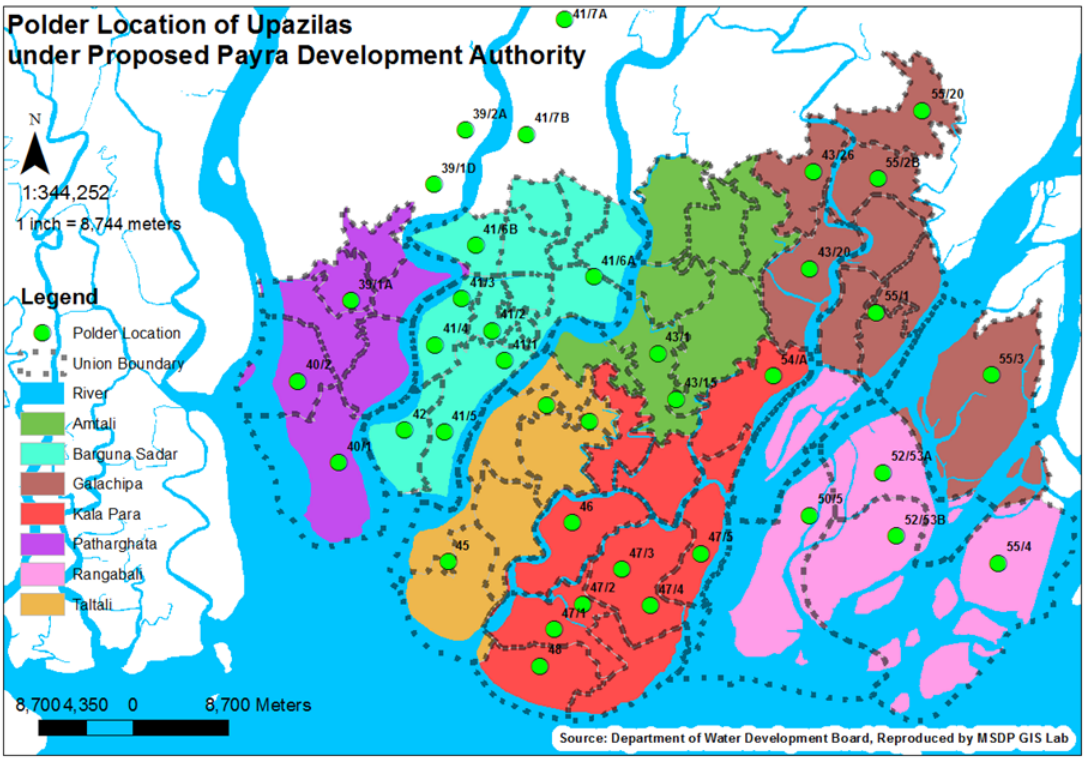


Figure 12-6: Polder Locations in the Region

Flood Control and Drainage:

- Large scale flood control schemes
- Small scale flood control and drainage
- Estuary development to mitigate against river erosion and to prevent saline water intrusions including land settlement

Infrastructure and Urban Services:

Special attention should be given to building resilient infrastructure with particular emphasis on the following:

Roads:

- Raising crest level in view of increased rainfall and flooding.
- Undertaking additional strengthening of embankments on roads in flood areas.
- Assessing need for larger culverts.

Cyclone shelters:

- Raising base level of first floor to avoid higher storm surges.
- Strengthening structures to withstand stronger wind forces.
- Utilizing sand sourced from noncoastal areas to avoid saline contamination.

Drainage and flood control:

- Building new and enhance existing drains, taking into account 2040 rainfall projections.

Water supply investments:

- Drilling deeper tube wells to explore non-saline sources.
- Locating surface water intakes based on salinity tests and assessments of sea-level rise.
- Extending vertical upper-well casing of production tube wells to protect against floods and storms.
- Providing power backup to keep water supply system operational during storms.
- Installing protection measures (embankment with block pitching) around water treatment plants to protect them from cyclones and storm surges.

Sanitation investments:

- Constructing septic tanks and superstructures of public toilets, school toilets, and community latrines above flood level to avoid inundation during monsoon flooding.
- Positioning pit of latrines above the flood level.

Environment Management and Planning, including:

- Capacity strengthening of the concerned institutions, participatory process in planning, advocacy and monitoring of development
- Biodiversity conservation including conservation of reserve forest and forestry resources in coastland and management of wetland biodiversity
- Forest resource management – conservation and afforestation
- Reviewing and updating urban master plans, local building codes, and engineering design standards of the Local Government Engineering Department and Department of Public Health Engineering to incorporate climate change and disaster resilient measures
- Improving water safety planning and groundwater monitoring through the development of water safety plans and guidelines.

River Erosion Control:

Climate change is likely to increase rainfall in the Brahmaputra-Ganges-Meghna basin in the monsoon season. This is likely to cause further instability in the already unstable river system. Higher rainfall in upper catchments may also increases in sediment movements. Overall, river systems are expected to become more unstable as a result of climate change. Effective River training works is the only option as an adaptation measure to control river erosion.

Climate change will affect all areas of development work; mitigation and adaptation policies therefore need to be integrated into all existing projects and programmes. Climate change puts populations, at huge risk of becoming displaced. Increased attention and funding to support adaptation initiatives that enable communities to sustain their livelihoods.

13. MOBILIZATION OF RESOURCES FOR DEVELOPMENT

13.1 Introduction

The Payra-Kuakata coastal zone faces specific issues that constrain development of the area. Exploiting the economic opportunities and addressing the development needs of the region emphasizes the need for an investment strategy that can address the policy prescriptions of the coastal zone policy. These prescriptions include:

i. Reduction of people's vulnerability to natural disaster
ii. Mitigation of environmental deterioration
iii. Improvement of disadvantaged position of the coastal areas
iv. Reduction of poverty among people living in the coastal zone
v. Facilitating potential contribution the coastal zone can make to the national economy

Development of key sectors that offer significant growth opportunities should be facilitated for economic development of the coastal zone. Two sectors are of highest priority, especially in view of the observed interest of the private sector to undertake investments in projects in these two sectors. These are tourism and fisheries. The private sector should be expected to play a dominant role in these sectors, while the government must provide the policy and regulatory frameworks for investment including inducing foreign direct investment.

13.2 Priority Areas

The Coastal Development Strategy puts forward a set of priority areas that should constitute the Investment Strategy which have direct correspondence to the objectives of the investment strategy specified in the coastal zone policy as indicated above. These are as follows:

- Mitigation of natural disasters, safety and protection
- Environmental management – protection and regeneration of the environment
- Water resources management
- Rural livelihoods and sustainable economic opportunities for coastal communities.
- Productive economic activities and focused development of tourism and fisheries sectors
- Infrastructure development
- Social development including health and nutrition, education, and water and sanitation

13.2.1 Program/ Project Prioritization Process

The priority areas constituting coastal development strategy need to be translated into programs and projects. Projects must be formulated through an institutional process (see below). These projects intended for implementation over a specified duration will form part of the Investment Plan to be updated on an annual basis. Projects will have indicative budget requirement and duration of implementation as well as implementation arrangements.

13.3 Mobilization of Resources for Development

Financing of the investment program and projects will have to come from national and local government budgets, private investment (including foreign investment), NGO program resources, and multilateral and bilateral donors.

The CDS points to a multitude of financial sources available for implementation of the CDS. There are three sources of financing the investment level required for coastal zone development: the public sector (central and local government budget), multilateral institutions and donors, and private sector. NGOs can also make a significant contribution to the financing needs of small-scale investment projects.

13.3.1 Public Sector Resources: Central Government

The vulnerability of the coastal zone from natural disasters is indeed an issue, which needs to be addressed. However, it is important to separate the long-term objective of protection and maintenance of the eco-system of the coasts from sudden emergency disasters that affect large numbers of the population annually. The former will require a planned investment strategy whose funding should be ear marked from budgetary commitments of the Government. Environmental management will remain a key task of the government and that limited available finances could best be used through integrated planning and phasing of investments.

Financing of infrastructure projects has traditionally been the domain of public sector development budget. In the past ten years Government has opened up scope for the private sector to participate in investment undertakings in the private sector. There is now an explicit role of private sector participation in infrastructure financing in Government investment policy and its poverty reduction strategy. A large part of the infrastructure projects in the coastal zone would still require Government interventions. These include in particular those which have high social return but less attractive to private investments. Such projects include water resource management, construction of polders and associated physical infrastructures, roads and highways and similar investment projects which would yield financial return in the very long run.

13.3.2 Public Sector Resources: Local Governments

All Local Government Institutions (LGIs) have their own sources of revenue. However, these LGIs are characterized by low revenue mobilization capacities which leave these institutions in constant shortage of funds. The major own sources of revenue of these institutions include taxes, rates, fees and charges imposed by them. Besides, they also receive rents and profits from leased out properties and assets owned by them, and also the sums received by way of providing different types of services. Non-tax revenue sources, although not very common, include contributions from private individuals or entities, grants received from the government, rents and profits received from investments, receipts from charitable trusts placed with local government institutions, loans secured by local government institutions, and proceeds from different services being provided by local government institutions. Holding taxes are the most important source of revenue for local government institutions. In urban areas, local

governments can raise on an average 40-50 per cent of their revenue from own sources, but a significant part of their revenue still comes from government grants (UNESCAP 1999).

Local governments receive additional assistance through other means as well. These include union parishads receiving grants in grains for programmes and schemes such as Test Relief (now known as Rural Infrastructure Maintenance Program), Food for Works, Vulnerable Group Development, Vulnerable Group Feeding and pensions/allowances for widows and Muktijodhha (Freedom Fighter) in cash. These grants are generally used for small-scale local infrastructure development projects. Similarly, municipalities and city corporations also receive such grants for infrastructure development, but these funds are mostly set aside for particular development projects funded by either donors or the central government.

In view of public sector budget deficits and competing demand from social sectors LGIs should place more reliance on local sources (in addition to existing sources) as explained below:

User Charges: User charges are designed to generate revenues to cover operating and finance costs as well as to contribute to investment budgets. Revenues generated by the users should be earmarked for capital investment in the services to ensure their continuous provision and necessary extensions. Capital cost of connecting additional users to an infrastructure network has to be separated from the capital cost of expanding the capacity of the whole system. Expanding the capacity of the whole system often requires large investments which cannot be attributed to a single group of users but should be incorporated into the overall tariff structure. Where possible, user fees should be directly linked to the level of consumption rather than being imposed as monthly charges. Equity should be integrated into a user fee-financed service by offering special programs for those least able to pay, not by lowering price for all consumers but through "lifeline" rates which are set below costs for a minimum level of consumption regarded as basic, then rise with further discretionary usage.

Betterment Levies*:* Provision of infrastructure enhances the value of land which was previously un-serviced. For equity and distributive reasons, it is logical that landowners should return the land-value windfall profit that resulted from public investment. Betterment levies are charges imposed on landowners who are expected to enjoy land-value increases as a result of investment. These levies should be designed to cover the costs of public investment as much as possible. Since the benefits exceed the cost of investment, the landowners are usually left with a private surplus.

Land Readjustment: It can be thought of as an in-kind system of betterment levies appropriate for land development on a large scale. Its success depends on direct participation of the landowners in developing their lands. At first, a plan acceptable to the landowners and the local authority is prepared. The areas required for public use, such as streets, parks, schools and other community facilities are set aside, leaving lots for private development. The cost of providing the infrastructure for the entire area as well as the market value of the improved land is then calculated. A portion of the land, the estimated market value of which equals the cost of development, is then transferred to the local authority in return for carrying out the investment. The major advantage of land readjustment is that land acquisition is not required to provide infrastructure for developing land.

Borrowing: The long service life of infrastructure investments such as water and sewer systems and roads, justifies shifting part of the burden to future generation of users who will benefit from current investments as well as contemporary users. Borrowing, therefore, could be an important funding source. Local governments, however, have limited ability to borrow because of inadequate own-source revenues for debt repayment. One possibility for providing local governments a borrowing option is the use of infrastructure development bank. The creation of 'Municipal Development Fund' (MDF) is a right step in this direction. It should be gradually transformed into an Infrastructure Development Bank with activities guided by market forces. It should also have guidelines on creditworthiness of the borrowing local government.

13.4 Involving Local Stakeholders in Urban Development

Effective partnerships between local governments and the private sector can generate considerable benefits. Private companies, informal sector enterprises, CBOs, and NGOs can provide urban services, mobilize finance (or voluntary labour), introduce innovative technologies and undertake land development activities. For involving private sector in urban development and management activities supportive legal framework should be developed and institutional setting should be ensured. Private sector actors with whom partnership arrangements can be made include the following:

13.4.1 Community-Based Organizations (CBOs)

These organizations are formed when neighborhood residents get organized and join forces to improve local security, housing quality, basic utilities, social services and neighborhood environment. Municipal-community partnership (MCP) has now emerged as an innovative institutional model. MCPs are particularly suitable for delivering specific goods and services, e.g. sanitation, refuse collection, roads and environmental maintenance, social housing etc. MCPs should be developed as part of an overall municipal strategy.

13.4.2 Non-Governmental Organization (NGOs)

Unlike CBOS, non-governmental organizations usually originate outside of the communities with which they work. NGOs may be understood as a "third system" between the public and private, concentrating their support at the community level while at the same time mediating between the community and the government. NGOs are effective agents for building local awareness, for mobilizing community action, enabling access to credit, strengthening CBOs etc. In the context of vast needs, limited capacity and constrained financial resources, the local governments should recognize the role of NGOs as partners in urban development and management activities.

13.4.3 Private Enterprises

These include informal workers and small-scale enterprises as well as large-scale business firms that may be entrusted with the task of operating or developing infrastructure facilities and urban services. The private sector enterprises can play more productive and sustainable roles in urban development by working in partnership with local government, especially in

delivering certain urban services, formulating and implementing local economic development strategies and taking part in philanthropic activities for the promotion of social good and environmental quality. An enabling environment, however, should be developed for ensuring participation of private enterprises in urban development and management activities.

13.5 Performance Based Intergovernmental Transfers

In Bangladesh, central Government Grant is an important source of income for the Paurashavas. Such grant supplements the income of a Paurashava from local sources in order to fulfill its functional responsibilities. At present Central Grants are of following types:

a. Direct grants (Non-development grant)

b. Subvention (Salary Support)

c. Matching grants (Linked to Projects)

d. Development grants (Block grants)

Block grants can be used effectively to influence resource enhancing behaviour of Paurashavas. Block grants, therefore, should be distributed on the basis of a fixed formula. The current distribution mechanism of intergovernmental transfers (ADP block grants) in Bangladesh is not based on any formula. A formula based on Area, Population and level of development of the Paurashava could be adopted. Once adopted, it should not be tampered with or changed for an extended period of time; otherwise, it would lose its effectiveness. For influencing the revenue generation of a Paurashava, allocation of block grant may be done in two stages. In the first stage initial allocation to a Paurashava would be based on the formula. Final allocation could be linked to actual revenue generation of a Paurashava. The final allocation could be more than the initial allocation for Paurashavas with higher revenue collection efficiency while less than the initial allocation for Paurashavas with lower revenue collection efficiency.

13.5.1 Capital Market and Profit Earning Ventures

In order to reduce dependence on traditional system of funding based on plan and budgetary allocation, the urban local bodies need to develop innovative strategies and financial instruments to generate resources. Such strategies may include issuing bonds for developing physical infrastructure facilities, borrowing from commercial banks, making investment in profit earning entures etc. In case of issuing bonds or borrowing from commercial banks the question of credit worthiness of urban local bodies is important. In order to ensure that only credit-worthy local bodies are able to issue bonds or borrow from commercial banks, guidelines will have to be prepared and enforced. For making investments in profit earning ventures the urban local bodies should take market forces into account and carry out appropriate feasibility analysis so that the proposed ventures become profitable.

13.6 Private Sector Resources

Data on the current level of financing by the private sector is not available at this time. A rapid and sustained level of investment for the development of coastal zone, in particular for the establishment of basic infrastructure and development of the tourism and fishery sectors cannot be maintained unless private sector financing is forthcoming. It is therefore critical that the investment strategy provides opportunities for increased role of the private sector investors and that finance in terms of debts and equity are made available.

13.7 NGO Support for Micro Enterprise Development

Micro finance would constitute a key source of financing for micro enterprises at the household and community level. A large number of micro finance organizations and NGOs are presently providing support to micro enterprise income generating activities in the coastal areas. These institutions and projects should be encouraged and supported with additional development funds for expanding and further outreaching their financing and development activities.

13.8 Donor Support for SME Development

Small and medium enterprises are now receiving greater attention of the Government and donor agencies. The Government has formulated guidelines for Government agencies and international development agencies to formulate specific programs for SME development. In response to the Government strategy, a number of the development partners have earmarked funds for augmenting the SME financing capacity. In this regard, the World Bank and Asian Development Bank have designed and approved a sizeable funding program for SMEs. Other donor agencies such as NORAD and CIDA have also approved funding on a smaller scale for enhancing SME access to funds. Additionally, the ADB has a pipeline program that will include a financing component for agribusiness development, of which a large proportion should be expected to comprise SMEs in the agro-based industry. The Norwegian Agency for Development (NORAD) has a long-term program of financing small enterprises through the two nationalized commercial banks.

Besides the financing facility, a number of donor agencies have capacity building support programs for SME development (ADB 2004a). These programs are built on strategies to develop national and local capacity for business development services which can be accessed by SMEs, training for upgrading trade skills and business management capability of enterprises, marketing development support, and technology transfer through technical and joint venture collaboration between Bangladeshi enterprises and foreign investors. The main development partners having such support programs are: Asian Development Bank, Danish International Development Assistance (DANIDA), GTZ German Technical Cooperation, Swiss Development Cooperation (SDC), Swiss International Development Assistance (SIDA), UK's Department for International Development (DFID), and the World Bank including its private sector financing window the International Financial Corporation (IFC).

13.9 Infrastructure Project Financing by Private Sector

However, there is ample scope for private sector investment participation in a wide range of infrastructure projects. Government has been successful in wooing private investment in power projects, telecommunications, airport maintenance and operation, toll bridge operation, land port development, small renewable energy projects, and other infrastructure projects. Government has now formulated mechanisms and incentives for greater participation of private infrastructure projects through the public private partnership modality. Additionally, Government has recently established clear guidelines on private sector investment in infrastructure projects. International development agencies, particularly World Bank and Asian Development Bank have been proactive partners of the Government in formulating strategies and establishing funding schemes for private investment in infrastructure projects. For instance, the ADB through its private sector financing window has taken investment stake in telecommunications projects as well as large scale manufacturing projects. World Bank has assisted Government in establishing the Infrastructure Development Company Limited (IDCOL) for provision of infrastructure financing. The Bank together with DFID and CIDA have addition ally created the Infrastructure Investment Financing Centre (IIFC) to provide technical assistance in formulating and developing feasibility studies and business plans for infrastructure projects. These facilities offer considerable scope for catalyzing private sector investment in infrastructure projects in the coastal zone.

13.10 Financing by Development Partners

Foreign aid and development partners (donors) have played an important role in Bangladesh's growth story. Its importance has also been acknowledged by successive governments in Bangladesh. For instance, in his 2018 budget speech, Bangladesh Finance Minister AMA Muhith noted the importance of improving the utilization of net foreign assistance (foreign aid) in Bangladesh.

The External Resources Division (ERD) of the government deals with the Bilateral Development Partners along with the Multilateral Development Partners in order to mobilize external economic and technical assistances for the development of the Bangladesh. The list (Website link) of major Bilateral Development Partners is given below:

North American countries:

- USA
    - United States Agency for International Development (USAID)
    - United States Department of Agriculture (USDA)
    - Mennonite Central Committee (MCC)
- Canada
    - Canadian International Development Agency (CIDA)
    - International Development Research Centre (IDRC)

European Countries:

- Belgium

- Finland
- Germany
    - GIZ
    - KfW
- Switzerland
- The Netherlands
- United Kingdom
    - Department for International Developemnt (DFID)

NORDIC Countries:

- Denmark
- Norway
    - Nordic Developemnt Fund (NDF)
- Sweden
    - Swedish International Development Cooperation Agency (SIDA)

Middle East Counties (Kuwait, Saudi Arabia, UAE):

- Saudi Fund for Development (SFD)
- Kuwait Fund for Development (KFD)
- Abu Dhabi Fund for Development (ADFD)

Asian Countries:

- China
- India
- Japan
    - Japan International Cooperation agency (JICA)
    - Japan Bank for International Cooperation (JBIC)
    - Japan International Cooperation Center (JICE)
    - Japanese Grant Aid for Human Resource Development Scholarship (JDS)

Among the several sectors of highest priority for Bangladesh, education, health, poverty reduction, and human development rank as the most integral. Besides the sectors mentioned above, environmental management and gender equity, water and sanitation, urban development, private-sector growth are also extremely important.

The focus of the country's development partners vary -- the World Bank on good governance; Asian Development Bank on agriculture and rural development, energy, infrastructure, and transport development; United Nations Development Programme (UNDP) on SDGs, democratic governance, democratic decentralization, climate change adaptation; the European Commission on human development, good governance, decentralization, economic, and trade development; Japan International Cooperation Agency on capacity building; Department for International Development on poverty reduction, governance and urban local

governance; Swiss Agency for development and cooperation, and Danish International Development Agency on local governance.

The International Monetary Fund (IMF), mandated for maintaining macroeconomic stability of the country, is a significant source of external funds. Moreover, plenty of counties exist whose governments directly provide bilateral assistance to Bangladesh, including Japan, Canada, UK, Germany, and so on. Apart from these, a significant number of international civil society or humanitarian organizations support Bangladesh through direct-local fund approach -- partnering with local civil society organizations.

The biggest donors -- World Bank and Asian Development Bank -- provide the major portion of assistance, but almost entirely in the form of loans. Japan is the biggest bilateral donor, which evenly splits the supports between loan and grant. Three development partners -- World Bank, Asian Development Bank, and Japan government -- account for almost 50-75% of the total external support to Bangladesh in recent years.

The National Policy on Development Cooperation (NPDC) provides the policy framework for mobilizing and managing foreign assistance in Bangladesh. The goal of the National Policy on Development Cooperation (NPDC) is to ensure that foreign assistance follows national development priorities as determined by national development plans and strategies and supports the country's development efforts to bring benefits to the lives of the people. The Policy provides guidance to support implementation of domestic and international commitments for development cooperation and its effectiveness. Foreign assistance in this Policy include ODA (grants and concessional loans), vertical funds and funds from international foundations, climate-funds, aid for trade, non-concessional loans, commercial borrowings for public undertakings, and other sources of cooperation such as south-south and triangular cooperation and any form of cooperation commensurate with qualifications of foreign assistance.

As a general principle, the Government will discourage any or all offers of foreign assistance where it considers transaction costs to be unacceptably high, alignment to Government priorities to be insufficient, conditionalities to be excessive and contrary to existing laws, rules and policies of the country, and inadequate compliance with the principles and modalities of this policy.

REFERENCES

Ahsan, M. E. (2013). *Coastal Zone of Bangladesh: Fisheries Resources and its Potentials.* Lambert Academic Publishing. doi:DOI: 10.13140/2.1.1253.7928

Andrews, R. B. (1953). Mechanics of the Urban Economic Base: Historical Development of the Base Concept. In R. B. Andrews, *Land Economics* (Vol. 2, pp. 161-167). University of Wisconsin Press. Retrieved from http://www.jstor.org/stable/3144408

BBS. (2011). *District Statistics.* Dhaka: Bangladesh Bureau of Statistics.

BBS. (2011). *Population and Housing Census 2011: Zila Report Patuakhali.* Bangladesh Bureau of Statistics, Statistics and Informatics Division. Ministry of Planning.

Brammer, H. (2014). Bangladesh's dynamic coastal regions and sea-level rise. *Climate Risk Management, 1*, 51-62. doi:https://doi.org/10.1016/j.crm.2013.10.001

Bureau of South and Central Asian Affairs. (2008, March). *Background Note: Bangladesh*.

District Administration Patuakhali. (2017). *Zila Branding Book.*

FAO. (1988). *Land Resources Appraisal of Bangladesh for Agricultural Development- Report 2: Agroecological regions of Bangladesh.* Rome: Food and Agriculture Organization of the United Nations.

Ibrahim, M., Zaman, M. A., Mostafizur, A. B., & Shahidullah, S. M. (2017). Diversity of Crops and Land Use Pattern in Barisal Region. *Bangladesh Rice Journal, 21*(2), 57-72.

Indiana Department of Workforce Development. (2006). *In Context: Indiana's Workforce and Economy.* Indiana. Retrieved November 2017

Isserman, A. M. (1977). The Location Quotient Approach to Estimating Regional Economic Impacts. *Journal of the American Institute of Planners, 43*(1). doi:10.1080/01944367708977758

Leigh, R. (1970, May). The Use of Location Quotients in Urban Economic Base Studies. *Land Economics, 46*(2), 202-205.

Siegel, R. A. (1966). *The Economic Base and Multiplier Analysis.*

ANNEXURE-I

Table 1: Distribution of Population (Source: BBS, 2011)

	Area of Residence	Male	(%)	Female	(%)	Total
Galachipa	Urban	13246	(51.11)	12671	(48.89)	25917
	Rural	114003	(49.01)	118595	(50.99)	232598
	Total	127249	(49.22)	131266	(50.78)	258515
Kalapara	Urban	18385	(52.00)	16969	(48.00)	35354
	Rural	102129	(50.44)	100348	(49.56)	202477
	Total	120514	(50.67)	117317	(49.33)	237831
Rangabali	Urban	0	(0.00)	0	(0.00)	0
	Rural	52403	(50.88)	50600	(49.12)	103003
	Total	52403	(50.88)	50600	(49.12)	103003
Patharghata	Urban	14231	(49.90)	14290	(50.10)	28521
	Rural	66313	(48.97)	69093	(51.03)	135406
	Total	80544	(49.13)	83383	(50.87)	163927
Taltali	Urban	0	(0.00)	0	(0.00)	0
	Rural	43707	(49.66)	44297	(50.34)	88004
	Total	43707	(49.66)	44297	(50.34)	88004
Barguna Sadar	Urban	16697	(51.80)	15538	(48.20)	32235
	Rural	111883	(48.83)	117225	(51.17)	229108
	Total	128580	(49.20)	132763	(50.80)	261343
Amtali	Urban	10905	(50.00)	10903	(50.00)	21808
	Rural	77556	(48.17)	83434	(51.83)	160990
	Total	88461	(48.39)	94337	(51.61)	182798

Table 2: Distribution of Types of Structures (Source: BBS, 2011)

		Pucca	%	Semi-Pucca	%	Kutcha	%	Jhupri	%	Total
Galachipa	**Urban**	508	8.35	1300	21.37	4117	67.64	161	2.64	6087
	Rural	290	0.57	1218	2.38	45779	89.31	3972	7.75	51260
	Total	799	1.39	2519	4.39	49896	87.01	4133	7.21	57347
Kalapara	**Urban**	539	6.37	1023	12.09	6655	78.66	244	2.88	8461
	Rural	395	0.81	887	1.82	42042	86.20	5448	11.17	48772
	Total	934	1.63	1910	3.34	48697	85.09	5692	9.95	57233
Rangabali	**Urban**	0	0.00	0	0.00	0	0.00	0	0.00	0
	Rural	65	0.29	1254	5.56	13084	58.06	8135	36.10	22537
	Total	65	0.29	1254	5.56	13084	58.06	8135	36.10	22537
Patharghata	**Urban**	377	5.19	671	9.26	6082	83.85	123	1.70	7253
	Rural	356	1.00	1102	3.10	33070	93.00	1031	2.90	35559
	Total	732	1.71	1774	4.14	39152	91.45	1154	2.70	42812
Taltali	**Urban**	0	0.00	0	0.00	0	0.00	0	0.00	0
	Rural	108	0.51	527	2.51	17897	85.37	2433	11.60	20964
	Total	108	0.51	527	2.51	17897	85.37	2433	11.60	20964
Barguna Sadar	**Urban**	1009	14.30	1905	27.00	4029	57.10	113	1.60	7056
	Rural	710	1.30	1911	3.50	50896	93.20	1092	2.00	54609
	Total	1719	2.79	3816	6.19	54925	89.07	1205	1.95	61665
Amtali	**Urban**	392	7.77	937	18.55	3604	71.35	117	2.32	5051
	Rural	253	0.68	1093	2.95	33625	90.75	2080	5.61	37051
	Total	645	1.53	2030	4.82	37229	88.43	2198	5.22	42102

Table 3: Distribution of Type of Sources of Drinking Water (Source: BBS, 2011)

		Tap	%	Tube-Well	%	Other	%	Total
Galachipa	**Urban**	803	9.49	7547	89.20	111	1.31	8461
	Rural	20	0.04	48302	99.04	450	0.92	48772
	Total	823	1.44	55849	97.58	561	0.98	57233
Kalapara	**Urban**	803	9.49	7547	89.20	111	1.31	8461
	Rural	20	0.04	48302	99.04	450	0.92	48772
	Total	823	1.44	55849	97.58	561	0.98	57233
Rangabali	**Urban**	0	0	0	0	0	0	0
	Rural	7	0.03	21736	96.45	794	3.52	22537
	Total	7	0.03	21736	96.45	794	3.52	22537
Patharghata	**Urban**	1994	27.50	3096	42.68	2163	29.82	7253
	Rural	747	2.10	18242	51.30	16570	46.60	35559
	Total	2741	6.40	21337	49.84	18733	43.76	42812
Taltali	**Urban**	0	0	0	0	0	0	0
	Rural	13	0.06	20336	97.01	614	2.93	20964
	Total	13.309	0.06		0.00		0.00	20964
Barguna Sadar	**Urban**	120	1.70	6929	98.20	7	0.10	7056
	Rural	164	0.30	51278	93.90	3167	5.80	54609
	Total	284	0.46	58207	94.39	3174	5.15	61665
Amtali	**Urban**	637	12.62	4356	86.24	57	1.14	5051
	Rural	118	0.32	36400	98.24	533	1.44	37051
	Total	755	1.79	40756	96.80	591	1.40	42102

Table 4: Distribution of Type of Toilet Facilities (Source: BBS, 2011)

		Sanitary (With Water Seal)	%	Sanitary (No Water Seal)	%	Non-Sanitary	%	None	%
Galachipa	**Urban**	2626	43.13	1787	29.35	1572	25.83	103	1.69
	Rural	8414	16.41	25118	49.00	14630	28.54	3099	6.05
	Total	11039	19.25	26904	46.92	16202	28.25	3201	5.58
Kalapara	**Urban**	3995	47.22	2936	34.70	1462	17.28	68	0.80
	Rural	12925	26.50	20679	42.40	12827	26.30	2341	4.80
	Total	16920	29.56	23616	41.26	14289	24.97	2409	4.21
Rangabali	**Urban**	0	0.00	0	0.00	0	0.00	0	0.00
	Rural	2302	10.21	9537	42.32	7727	34.29	2971	13.18
	Total		0.00		0.00		0.00		0.00
Patharghata	**Urban**	2612	36.02	3456	47.65	1119	15.43	65	0.90
	Rural	9174	25.80	17993	50.60	7965	22.40	427	1.20
	Total	11787	27.53	21449	50.10	9084	21.22	492	1.15
Taltali	**Urban**	0	0.00	0	0.00	0	0.00	0	0.00
	Rural	5162	24.62	10104	48.20	4889	23.32	809	3.86
	Total	5162	24.62	10104	48.20	4889	23.32	809	3.86
Barguna Sadar	**Urban**	2949	41.80	2773	39.30	1263	17.90	71	1.00
	Rural	12342	22.60	27031	49.50	13816	25.30	1420	2.60
	Total	15291	24.80	29804	48.33	15079	24.45	1490	2.42
Amtali	**Urban**	1680	33.27	1911	37.84	1301	25.75	159	3.15
	Rural	7233	19.52	16114	43.49	11906	32.13	1799	4.85
	Total	8913	21.17	18025	42.81	13207	31.37	1958	4.65

Table 5: Percentage distribution of Employment in 2013 (Source: BBS, 2013)

	Mining and Quarrying	Manufacturing	Electricity, Gas and water Supply	Construction	Wholesale and Retail Trade	Hotel and Restaurant	Transportation, Storage and Communication	Bank, Insurance and Financial Activities	Real Estate and renting	Public Administration and Defense	Education	Health and Social Work	Community, Social and Personal
Galachipa	0.01%	6.80%	0.00%	0.04%	41.73%	13.52%	3.05%	2.81%	0.00%	2.12%	11.77%	0.94%	17.23%
Kalapara	0.08%	13.74%	0.62%	0.01%	31.67%	11.10%	1.42%	5.49%	0.08%	4.96%	17.26%	1.40%	12.15%
Rangabali	0.00%	4.87%	0.00%	0.00%	49.86%	14.03%	2.16%	3.45%	0.00%	1.92%	10.08%	0.79%	12.84%
Patharghata	0.00%	13.47%	0.90%	0.00%	32.33%	10.93%	1.20%	4.99%	0.00%	3.68%	14.39%	1.82%	16.30%
Taltali	0.00%	4.50%	0.00%	0.00%	43.07%	8.05%	1.74%	6.36%	0.00%	1.85%	15.46%	1.25%	17.71%
Barguna Sadar	0.00%	12.32%	0.67%	0.24%	25.27%	11.79%	1.20%	8.82%	0.24%	5.83%	18.46%	2.55%	12.59%
Amtali	0.00%	11.87%	0.15%	0.00%	29.12%	12.62%	1.40%	6.39%	0.00%	4.19%	16.40%	2.30%	15.56%
Barguna District	0.00%	13.21%	0.43%	0.07%	28.45%	11.71%	1.24%	6.20%	0.07%	4.35%	16.13%	1.80%	16.34%
Barisal Division	0.03%	12.78%	0.31%	0.04%	41.39%	10.42%	1.78%	3.29%	0.03%	3.27%	11.95%	1.86%	12.84%
National	0.26%	29.32%	0.29%	0.19%	34.28%	4.96%	8.10%	1.95%	0.18%	2.97%	6.05%	1.71%	9.74%

Table 6: Distribution of employment among the sectors compared to sector total employment in 2013 (Source: BBS, 2013)

	Mining and Quarrying	Manufacturing	Electricity, Gas and water Supply	Construction	Wholesale and Retail Trade	Hotel and Restaurant	Transportation, Storage and Communication	Bank, Insurance and Financial	Real Estate and renting	Public Administration and Defense	Education	Health and Social Work	Community, Social and Personal
Galachipa	13%	16%	0%	16%	29%	27%	41%	13%	0%	14%	19%	14%	28%
Kalapara	87%	22%	28%	4%	15%	15%	12%	16%	22%	21%	18%	14%	13%
Rangabali	0%	4%	0%	0%	12%	10%	10%	5%	0%	4%	6%	4%	7%
Patharghata	0%	16%	30%	0%	11%	11%	8%	11%	0%	12%	11%	13%	13%
Taltali	0%	3%	0%	0%	8%	4%	6%	7%	0%	3%	7%	5%	8%
Barguna Sadar	0%	23%	36%	81%	14%	18%	12%	31%	78%	30%	23%	30%	16%
Amtali	0%	16%	6%	0%	12%	15%	11%	17%	0%	16%	15%	20%	15%
Sector Percentage	0.01 %	10.13 %	0.35%	0.06%	34.94%	12.07 %	1.83%	5.41%	0.06 %	3.71%	14.95 %	1.62 %	14.86 %

Table 7: Industrial Structure analysis of Economic Activities, Galachipa

	E_0	E_t	E_{j0}	E_{jt}	G_j	NS	IM	RM	Net Shift Component
Mining and Quarrying	14699	64444	0	2	2	0	0	0	0
Manufacturing	2975580	7183446	687	1705	1018	806	166	46	212
Electricity, Gas and Water Supply	29499	71318	21	0	-21	25	5	-51	-46
Construction	36212	46552	7	9	2	8	-6	0	-6
Wholesale and Retail Trade	4510325	8398810	6471	10465	3994	7592	-2013	-1585	-3598
Hotel and Restaurant	694865	1214455	1319	3390	2071	1547	-561	1085	524
Transportation, Storage and Communication	240672	1985332	106	765	659	124	644	-109	535
Bank, Insurance and Financial Activities	231810	477393	357	705	348	419	-41	-30	-71
Real Estate and renting	127409	43296	224	0	-224	263	-411	-76	-487
Public Administration and Defense	341015	727158	976	531	-445	1145	-40	-1550	-1590
Education	853326	1483441	1979	2952	973	2322	-860	-488	-1349
Health and Social Work	231299	418548	104	235	131	122	-38	47	9
Community, Social and Personal services	987311	2386657	1570	4320	2750	1842	383	525	908
Total	11274022	24500850	13821	25079	11258	16215	-2772	-2187	-4959

Table 8: Industrial Structure analysis of Economic Activities, Rangabali

	E_0	E_t	E_{j0}	E_{jt}	G_j	NS	IM	RM	Net Shift Component
Mining and Quarrying	14699	64444	0	0	0	0	0	0	0
Manufacturing	2975580	7183446	212	426	214	249	51	-86	-35
Electricity, Gas and Water Supply	29499	71318	0	0	0	0	0	0	0
Construction	36212	46552	7	0	-7	8	-6	-9	-15
Wholesale and Retail Trade	4510325	8398810	3040	4362	1322	3567	-946	-1299	-2245
Hotel and Restaurant	694865	1214455	413	1227	814	485	-176	505	329
Transportation, Storage and Communication	240672	1985332	32	189	157	38	194	-75	119
Bank, Insurance and Financial Activities	231810	477393	119	302	183	140	-14	57	43
Real Estate and renting	127409	43296	18	0	-18	21	-33	-6	-39
Public Administration and Defense	341015	727158	92	168	76	108	-4	-28	-32
Education	853326	1483441	650	882	232	763	-283	-248	-531
Health and Social Work	231299	418548	51	69	18	60	-19	-23	-42
Community, Social and Personal services	987311	2386657	480	1123	643	563	117	-37	80
Total	11274022	24500850	5114	8748	3634	6000	-1116	-1249	-2366

Table 9: Industrial Structure analysis of Economic Activities, Kalapara

	E_0	E_t	E_{j0}	E_{jt}	G_j	NS	IM	RM	Net Shift Component
Mining and Quarrying	14699	64444	0	13	13	0	0	0	0
Manufacturing	2975580	7183446	764	2247	1483	896	184	403	587
Electricity, Gas and Water Supply	29499	71318	0	102	102	0	0	0	0
Construction	36212	46552	0	2	2	0	0	0	0
Wholesale and Retail Trade	4510325	8398810	6128	5180	-948	7189	-1906	-6231	-8137
Hotel and Restaurant	694865	1214455	1037	1816	779	1217	-441	4	-438
Transportation, Storage and Communication	240672	1985332	75	233	158	88	456	-386	70
Bank, Insurance and Financial Activities	231810	477393	155	898	743	182	-18	579	561
Real Estate and renting	127409	43296	386	13	-373	453	-708	-118	-826
Public Administration and Defense	341015	727158	137	811	674	161	-6	519	513
Education	853326	1483441	1508	2823	1315	1769	-656	201	-454
Health and Social Work	231299	418548	191	229	38	224	-69	-117	-186
Community, Social and Personal services	987311	2386657	1002	1987	985	1176	245	-435	-191
Total	11274022	24500850	11383	16354	4971	13355	-2919	-5581	-8501

Table 10: Industrial Structure analysis of Economic Activities, Patharghata

	E_0	E_t	E_{j0}	E_{jt}	G_j	NS	IM	RM	Net Shift Component
Mining and Quarrying	14699	64444	0	0	0	0	0	0	0
Manufacturing	2975580	7183446	513	1622	1109	602	124	384	507
Electricity, Gas and Water Supply	29499	71318	2	108	106	2	0	103	104
Construction	36212	46552	0	0	0	0	0	0	0
Wholesale and Retail Trade	4510325	8398810	2952	3894	942	3463	-918	-1603	-2521
Hotel and Restaurant	694865	1214455	453	1317	864	531	-193	525	333
Transportation, Storage and Communication	240672	1985332	58	144	86	68	352	-334	18
Bank, Insurance and Financial Activities	231810	477393	150	601	451	176	-17	292	275
Real Estate and renting	127409	43296	45	0	-45	53	-83	-15	-98
Public Administration and Defense	341015	727158	411	443	32	482	-17	-433	-450
Education	853326	1483441	1009	1734	725	1184	-439	-20	-459
Health and Social Work	231299	418548	345	219	-126	405	-125	-405	-531
Community, Social and Personal services	987311	2386657	991	1964	973	1163	242	-432	-190
Total	11274022	24500850	6929	12046	5117	8129	-1073	-1939	-3012

Table 11: Industrial Structure analysis of Economic Activities, Barguna Sadar

	E_0	E_t	E_{j0}	E_{jt}	G_j	NS	IM	RM	Net Shift Component
Mining and Quarrying	14699	64444	0	0	0	0	0	0	0
Manufacturing	2975580	7183446	1407	2365	958	1651	339	-1032	-693
Electricity, Gas and Water Supply	29499	71318	35	129	94	41	9	44	53
Construction	36212	46552	3	46	43	4	-3	42	39
Wholesale and Retail Trade	4510325	8398810	5605	4850	-755	6576	-1744	-5587	-7331
Hotel and Restaurant	694865	1214455	994	2263	1269	1166	-423	526	103
Transportation, Storage and Communication	240672	1985332	100	231	131	117	608	-594	14
Bank, Insurance and Financial Activities	231810	477393	660	1693	1033	774	-75	334	259
Real Estate and renting	127409	43296	164	46	-118	192	-301	-10	-310
Public Administration and Defense	341015	727158	1093	1119	26	1282	-45	-1212	-1256
Education	853326	1483441	2384	3542	1158	2797	-1037	-602	-1639
Health and Social Work	231299	418548	395	490	95	463	-144	-225	-368
Community, Social and Personal services	987311	2386657	1248	2415	1167	1464	305	-602	-297
Total	11274022	24500850	14088	19189	5101	16528	-2510	-8917	-11427

Table 12: Industrial Structure analysis of Economic Activities, Taltali

	E_0	E_t	E_{j0}	E_{jt}	G_j	NS	IM	RM	Net Shift Component
Mining and Quarrying	14699	64444	0	0	0	0	0	0	0
Manufacturing	2975580	7183446	149	292	143	175	36	-68	-32
Electricity, Gas and Water Supply	29499	71318	0	0	0	0	0	0	0
Construction	36212	46552	0	0	0	0	0	0	0
Wholesale and Retail Trade	4510325	8398810	1415	2792	1377	1660	-440	157	-283
Hotel and Restaurant	694865	1214455	133	522	389	156	-57	290	233
Transportation, Storage and Communication	240672	1985332	14	113	99	16	85	-2	83
Bank, Insurance and Financial Activities	231810	477393	118	412	294	138	-13	169	156
Real Estate and renting	127409	43296	11	0	-11	13	-20	-4	-24
Public Administration and Defense	341015	727158	80	120	40	94	-3	-51	-54
Education	853326	1483441	593	1002	409	696	-258	-29	-287
Health and Social Work	231299	418548	24	81	57	28	-9	38	29
Community, Social and Personal services	987311	2386657	469	1148	679	550	114	14	129
Total	11274022	24500850	3006	6482	3476	3527	-565	514	-51

Table 13: Industrial Structure analysis of Economic Activities, Amtali

	E_0	E_t	E_{j0}	E_{jt}	G_j	NS	IM	RM	Net Shift Component
Mining and Quarrying	14699	64444	0	0	0	0	0	0	0
Manufacturing	2975580	7183446	361	1699	1338	424	87	827	914
Electricity, Gas and Water Supply	29499	71318	30	22	-8	35	7	-51	-43
Construction	36212	46552	0	0	0	0	0	0	0
Wholesale and Retail Trade	4510325	8398810	1953	4168	2215	2291	-608	531	-76
Hotel and Restaurant	694865	1214455	549	1807	1258	644	-234	847	614
Transportation, Storage and Communication	240672	1985332	52	200	148	61	316	-229	87
Bank, Insurance and Financial Activities	231810	477393	60	914	854	70	-7	790	784
Real Estate and renting	127409	43296	112	0	-112	131	-205	-38	-243
Public Administration and Defense	341015	727158	203	600	397	238	-8	167	159
Education	853326	1483441	981	2348	1367	1151	-427	643	216
Health and Social Work	231299	418548	203	329	126	238	-74	-38	-112
Community, Social and Personal services	987311	2386657	720	2227	1507	845	176	487	662
Total	11274022	24500850	5224	14314	9090	6129	-976	3937	2961

Given,

E_0 = Total Employment of Bangladesh of the Year 2003
E_t = Total Employment of Bangladesh of the Year 2013
E_{j0} = Total Employment of District j of the Year 2003
E_{jt} = Total Employment of District j of the Year 2013
G_j = Growth of employment
NS = National Share Component
IM = Industrial Mix Component
RS = Regional Shift Component

Table 14: Unionwise Basic Data for Determination of Development Potential

Sl_No	Union	Road Length_km	Structure_No	Facility No.	Area (sq_km.)	Population Thousand	Population Density	Road per_sq. km.	Structure per_sq. km.	Facility per_1000
1	Amkhola	95.80	3009.00	11.00	31.35	27.18	867	3.06	95.99	0.40
2	Amtali	127.66	4479.00	14.00	44.36	24.16	544	2.88	100.96	0.58
3	Amtali Paurashava	41.13	2206.00	8.00	10.73	17.31	1614	3.83	205.62	0.46
4	Arpangashia	72.32	2758.00	21.00	31.41	14.87	473	2.30	87.80	1.41
5	Atharagashia	113.90	3120.00	24.00	34.49	23.44	680	3.30	90.47	1.02
6	Ayla Patakata	66.79	2636.00	8.00	32.26	19.78	613	2.07	81.71	0.40
7	Badarkhali	94.39	3124.00	5.00	33.41	26.20	784	2.83	93.50	0.19
8	Bakulbaria	126.61	3474.00	11.00	43.40	14.73	340	2.92	80.05	0.75
9	Baliatali	105.22	2670.00	16.00	47.78	16.29	341	2.20	55.88	0.98
10	Bara Baisdia	108.72	3708.00	13.00	203.41	26.47	130	0.53	18.23	0.49
11	Barabagi	76.86	2737.00	18.00	43.99	18.40	418	1.75	62.22	0.98
12	Barguna	76.08	2528.00	0.00	21.85	20.60	943	3.48	115.68	0.00
13	Barguna Sadar Paurashava	74.10	4124.00	17.00	14.65	32.24	2201	5.06	281.53	0.53
14	Burir Char	114.07	3768.00	1.00	40.19	29.54	735	2.84	93.76	0.03
15	Chakamaiya	88.36	2815.00	26.00	35.90	16.47	459	2.46	78.42	1.58
16	Chalitabunia	39.46	1272.00	4.00	80.82	7.40	92	0.49	15.74	0.54
17	Champapur	82.72	2501.00	11.00	32.88	10.86	330	2.52	76.06	1.01
18	Char Biswas	76.35	3233.00	10.00	79.33	20.16	254	0.96	40.76	0.50
19	Char Duanti	78.81	4306.00	19.00	60.03	24.56	409	1.31	71.73	0.77
20	Char Kajal	109.09	4583.00	6.00	124.15	25.27	204	0.88	36.92	0.24
21	Char Montaz	86.82	2845.00	4.00	167.82	19.57	117	0.52	16.95	0.20
22	Chhota Bagi	55.75	1815.00	8.00	24.09	13.20	548	2.31	75.33	0.61
23	Chhota Baisdia	120.07	3412.00	23.00	103.28	20.07	194	1.16	33.04	1.15
24	Chiknikandi	115.32	3532.00	10.00	45.63	15.58	341	2.53	77.41	0.64
25	Chowra	86.37	2303.00	13.00	30.52	20.80	682	2.83	75.46	0.62
26	Dakua	85.62	2642.00	13.00	34.31	19.53	569	2.50	77.00	0.67
27	Dalbuganj	29.89	932.00	7.00	15.37	10.92	711	1.94	60.64	0.64
28	Dhalua	101.73	3491.00	7.00	39.99	25.70	643	2.54	87.30	0.27
29	Dhankhali	66.38	2033.00	15.00	28.30	26.07	921	2.35	71.85	0.58
30	Dhulasar	53.27	2384.00	19.00	49.53	18.24	368	1.08	48.13	1.04
31	Gajalia	25.86	1058.00	6.00	14.88	12.60	847	1.74	71.11	0.48
32	Galachipa	70.33	2404.00	9.00	32.37	19.04	588	2.17	74.26	0.47
33	Galachipa Paurashava	22.46	1968.00	1.00	4.51	21.20	4703	4.98	436.57	0.05
34	Gaurichanna	78.65	2862.00	4.00	23.45	27.68	1180	3.35	122.07	0.14
35	Golkhali	162.14	5137.00	30.00	70.27	32.17	458	2.31	73.10	0.93
36	Gulisakhali	115.94	3509.00	26.00	46.34	28.46	614	2.50	75.73	0.91
37	Haldia	191.68	5400.00	39.00	69.75	29.73	426	2.75	77.42	1.31
38	Kakchira	62.33	2398.00	5.00	33.70	20.72	615	1.85	71.15	0.24
39	Kalagachia	16.50	642.00	3.00	8.32	16.08	1933	1.98	77.17	0.19

Sl_ No	Union	Road Length _km	Structure _No	Facility No.	Area (sq_km.)	Population Thousand	Population Density	Road per_sq. km.	Structure per_sq. km.	Facility per_1000
40	Kalapara Paurashava	17.07	1209.00	10.00	3.71	17.33	4668	4.60	325.64	0.58
41	Kalmegha	119.62	4422.00	14.00	44.80	25.89	578	2.67	98.70	0.54
42	Kanthaltali	93.45	3598.00	19.00	40.91	19.79	484	2.28	87.96	0.96
43	Karaibaria	124.49	3057.00	14.00	44.45	12.92	291	2.80	68.77	1.08
44	Keorabunia	63.61	2289.00	2.00	23.28	17.76	763	2.73	98.32	0.11
45	Kuakata Paurashava	15.64	790.00	5.00	5.01	9.18	1830	3.12	157.55	0.54
46	Kukua	129.71	3329.00	22.00	36.11	24.03	665	3.59	92.19	0.92
47	Lalua	108.54	3334.00	28.00	56.02	21.56	385	1.94	59.52	1.30
48	Lata Chapli	115.35	4474.00	24.00	52.18	25.93	497	2.21	85.75	0.93
49	M.Baliatali	171.53	5996.00	22.00	68.15	28.94	425	2.52	87.98	0.76
50	Mahipur	113.05	4404.00	34.00	41.76	20.89	500	2.71	105.45	1.63
51	Mithaganj	74.15	1982.00	22.00	32.30	11.59	359	2.30	61.36	1.90
52	Nachna Para	70.97	2496.00	5.00	23.73	12.48	526	2.99	105.19	0.40
53	Naltona	98.39	3484.00	12.00	45.69	19.71	431	2.15	76.26	0.61
54	Nilganj	133.88	4528.00	34.00	67.12	29.02	432	1.99	67.46	1.17
55	Nishanbaria	37.83	1427.00	2.00	34.66	12.93	373	1.09	41.17	0.15
56	Pancha Koralia	101.46	2916.00	12.00	44.66	11.49	257	2.27	65.29	1.04
57	Panpatty	70.03	2142.00	6.00	29.77	14.89	500	2.35	71.95	0.40
58	Patharghata	91.49	5316.00	17.00	111.24	28.49	256	0.82	47.79	0.60
59	Patharghata Paurashava	30.25	2646.00	6.00	7.42	17.18	2315	4.08	356.67	0.35
60	Phuljhury	68.62	1626.00	5.00	20.96	13.21	630	3.27	77.58	0.38
61	Raihanpur	88.50	2864.00	6.00	24.21	14.81	612	3.66	118.31	0.41
62	Rangabali	111.27	3926.00	13.00	140.74	29.49	210	0.79	27.90	0.44
63	Ratandi Taltali	87.22	2149.00	3.00	30.62	20.09	656	2.85	70.18	0.15
64	Sarikkhali	37.78	852.00	6.00	9.40	7.80	830	4.02	90.62	0.77
65	Sonakata	79.90	2332.00	7.00	73.18	11.27	154	1.09	31.87	0.62
66	Tiakhali	90.06	3343.00	35.00	33.58	14.34	427	2.68	99.55	2.44

ANNEXURE-II

Determination of Population Threshold for Settlement Function

Population threshold is the minimum number of population or user or customer required to support a given facility. For example, if the threshold population for any service facility i.e. school is 1500, it means that any Mauza with a population of 1500 must contain a school.

In this research, population threshold for facilities have been calculated using Reed-Muench method which had been further developed by Hagget and Gunawardena.

For calculating the threshold population for any service facility, existing number of that service facility per administrative units (i.e. Mauza or Union of the study area) has to be identified. Threshold population usually varies according to hierarchy of services. Thus, it can be said that threshold population for a college is expected to be higher from the threshold population of a school. Therefore if we use Mauza population for calculating threshold population of a school, we may use Union population for calculating threshold population of a college.

Initially using a table (shown in Table 1 and table 2) two index values are developed. One denotes (Ag) index of administrative unit with a particular service facility absent at a particular level of population and greater levels of population. Another index value (Ps) indicates index of administrative unit with a particular service facility present at a certain level of population and lower levels of population. Both of these indices can be expressed using the general equation of straight line (linear function). At this stage, population threshold (PT) is calculated either graphically or mathematically.

Table 15: Calculation of threshold population for high school (union as spatial unit)

Population	<10000	10001--15000	15001-20000	20001-25000	25001-30000	>30000
Mid Value (Population)	7500	12500	17500	22500	27500	32500
No. of Union	3	16	16	13	16	2
With High School	2	6	6	5	6	2
Without High School	1	10	10	8	10	0
With High School absent at this level or greater level(Ag)	39	38	28	18	10	0
With High School present at this level or lower level(Ps)	2	8	14	19	25	27

While determining PT graphically, the x axis contains mid points of population threshold, while y axis contains the value of Ag and Ps for the given facility. Then the x axis value at intersecting point of these straight lines is denoted as threshold population of that particular facility (Figure 1).

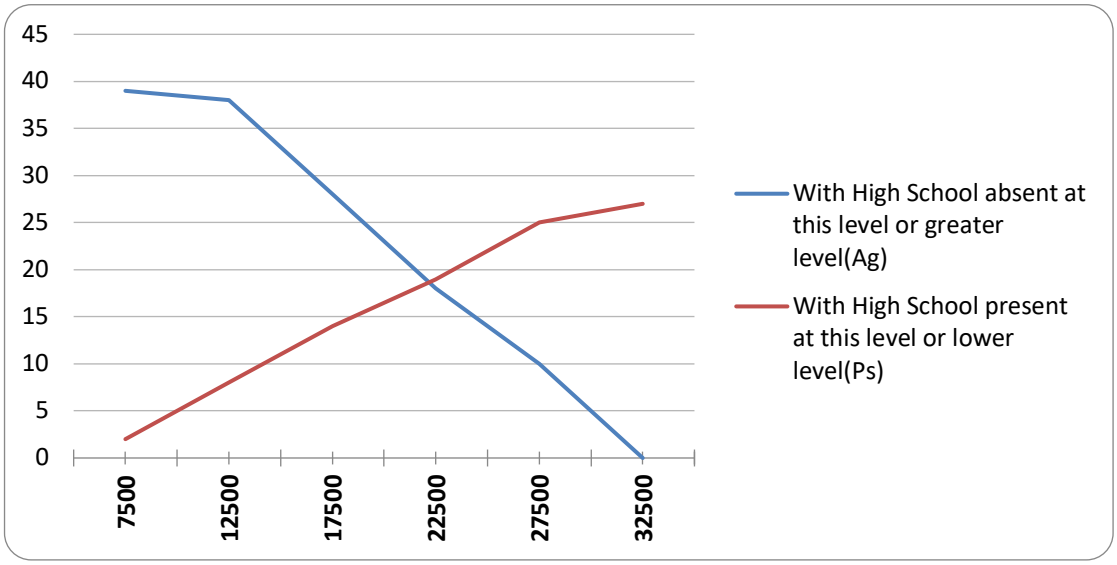


Figure 1: Determining threshold population for high school

From the figures, it can be said that the threshold population for about 3 high school is approximately 22307 (There are 3.09 high school in a union on an average in the study area).

To determine PT mathematically, the linear functions for Ag and Ps are used.

Ag= a+bp ……(1)

Ps= c+dp……(2)

Where b, d are slopes and a,c are intercepts of the straight lines.

Population threshold (PT) can be found where Ag and Ps intersect.

Thus, *PT=Ag=Ps……(3)*

Substituting (1) and (2) into (3),

a+bp= c+dp;

or, a-c=dp-bp;

or, (a-c)/(d-b)=(d-b)p/(d-b)

Thus, p=(a-c)/(d-b)……(4)

Substituting (4) into (1) ,

PT=Ag= a+b{(a-c)/(d-b}

Or, PT=a{(d-b)/(d-b)} + b{(a-c)/(d-b}

Or, PT = (ad-bc)/(d-b)……(5)

Using least square method and values from table 1.1

a=3307.58 b=589.87

c=4911.37 d=952.96

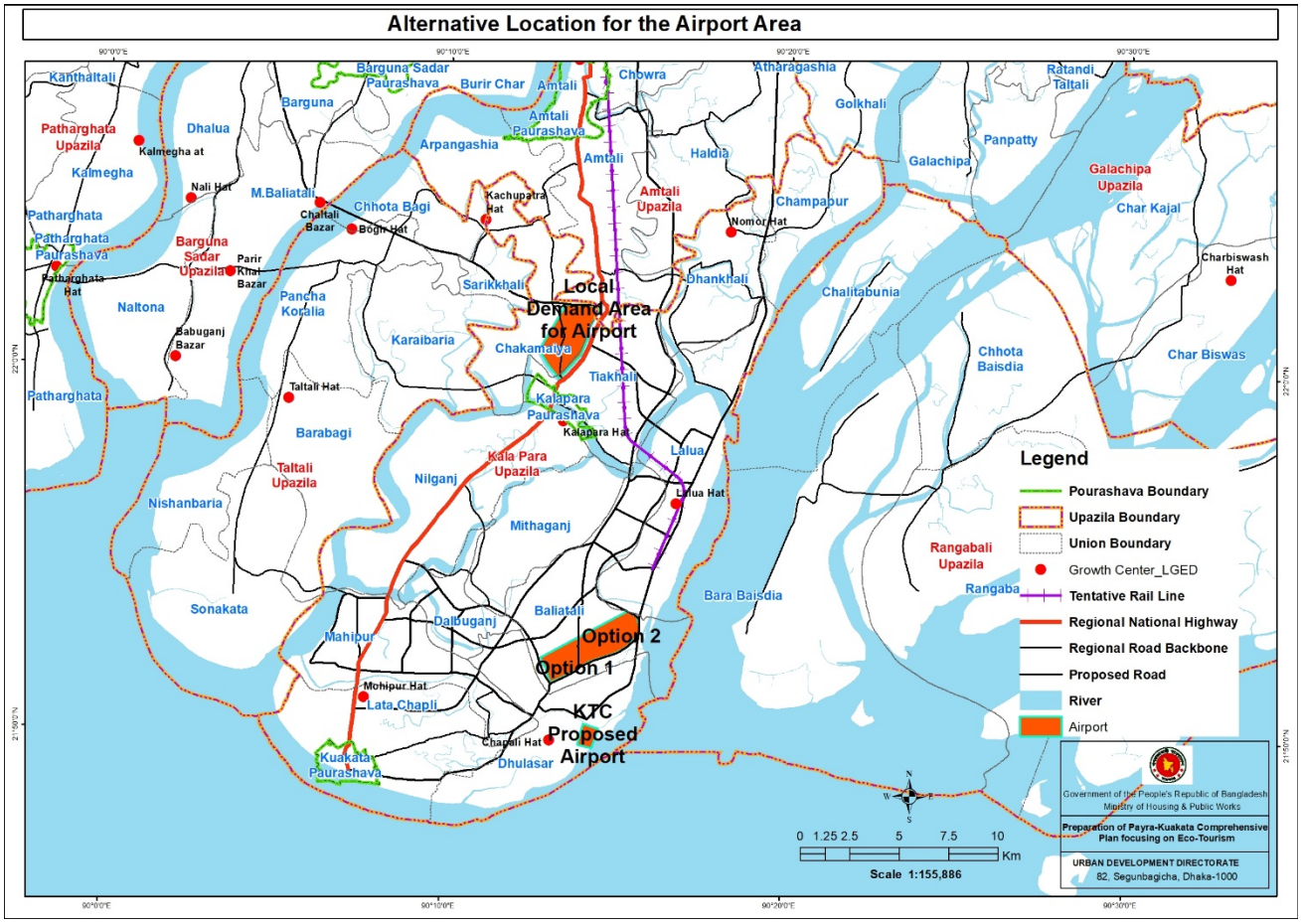
PT = (ad-bc)/(d-b) = 22307.54

Thus, population threshold for 3 high schools is 22307.54

Therefore, PT for 1 high school is 7219 (There are 3.09 high school in a union on an average)

ANNEXURE-III

Alternative Locations for the Airport



ANNEXURE-IV

Development Projects and Activities in the Region

প্রকল্পের অন্তর্ভুক্ত এলাকাসমুহে বিভিন্ন দপ্তর কর্তৃক প্রকল্প সংক্রান্ত সরবরাহকৃত তথ্যাবলীর সংক্ষিপ্ত তালিকার সূচীপত্র

'পায়রা বন্দর নগরী ও কুয়াকাটা উপকুলীয় অঞ্চলের পরিবেশভিত্তিক সমন্বিত পরিকল্পনা প্রনয়ন' প্রকল্পের অন্তর্ভুক্ত এলাকাসমুহে বিভিন্ন দপ্তর কর্তৃক প্রকল্প সংক্রান্ত সরবরাহকৃত তথ্যাবলীর সংক্ষিপ্ত তালিকা'

১। কর্তৃপক্ষ: আশুগঞ্জ পাওয়ার স্টেশন লিমিটেড

প্রকল্পের নামঃ পটুয়াখালী ১৩২০ মেগাওয়াট সুপার থার্মাল পাওয়ার প্লান্ট নির্মান প্রকল্প

প্রাপ্ত দলিলসমুহঃ প্রকল্পের প্রস্তাবিত জমির দাগসুচী এবং মৌজা ম্যাপ

প্রস্তাবিত জমির সরবরাহকৃত দাগসুচীর তালিকাঃ

1. মৌজাঃ পাচজুনিয়া জে এল নম্বরঃ ৭১ সিট নম্বরঃ ০৩ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া,
2. মৌজাঃ ধানখালী জে এল নম্বরঃ ১২ সিট নম্বরঃ ০১ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
3. মৌজাঃ দেবপুর জে এল নম্বরঃ ৬৯ সিট নম্বরঃ ০১ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
4. মৌজাঃ চালিতাবুনিয়া জে এল নম্বরঃ ৭০ সিট নম্বরঃ ০৩ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া,

সরবরাহকৃত মৌজা ম্যাপের তালিকাঃ

1. মৌজা ম্যাপঃ পাচজুনিয়া সিট নম্বরঃ ০৩ জে এল নম্বরঃ ৭১
2. মৌজা ম্যাপঃ চালিতাবুনিয়া সিট নম্বরঃ ০৩, ০৫ জে এল নম্বরঃ ৭০
3. মৌজা ম্যাপঃ দেবপুর সিট নম্বরঃ ০১ জে এল নম্বরঃ ৬৯

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

২। কর্তৃপক্ষ: নর্থ ওয়েস্ট পাওয়ার স্টেশন কোম্পানি লিমিটেড

প্রকল্পের নামঃ পায়রা ১৩২০ মেঃ ওঃ তাপ বিদ্যুৎ কেন্দ্র সংযোগ সড়ক ও আনুষঙ্গিক অবকাঠামো নির্মান প্রকল্প

প্রাপ্ত দলিলসমুহঃ প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচী এবং মৌজা ম্যাপ

প্রস্তাবিত জমির সরবরাহকৃত দাগসুচীর তালিকাঃ

1. মৌজাঃ রজপাড়া, জে এল নম্বরঃ ৯ সিট নম্বরঃ ০১ ও ০২ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া,
2. মৌজাঃ টিয়াখালী, জে এল নম্বরঃ ১০ সিট নম্বরঃ ০১ ও ০২ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া,
3. মৌজাঃ মধুপাড়া, জে এল নম্বরঃ ১২ সিট নম্বরঃ ০১, ০২ ও ০৩ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
4. মৌজাঃ নিশানবাড়িয়া, জে এল নম্বরঃ ১২ সিট নম্বরঃ ০১ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া

সরবরাহকৃত মৌজা ম্যাপের তালিকাঃ

1. মৌজাঃ রজপাড়া, জে এল নম্বরঃ ৯ সিট নম্বরঃ ০১ (বিএস মৌজা)
2. মৌজাঃ রজপাড়া, জে এল নম্বরঃ ৯ সিট নম্বরঃ ০২ (বিএস মৌজা)
3. মৌজাঃ টিয়াখালী, জে এল নম্বরঃ ১০ সিট নম্বরঃ ০১ ও ০২
4. মৌজাঃ নিশানবাড়িয়া, জে এল নম্বরঃ ১২ সিট নম্বরঃ ০১
5. মৌজাঃ মধুপাড়া, জে এল নম্বরঃ ১২ সিট নম্বরঃ ০১
6. মৌজাঃ মধুপাড়া, জে এল নম্বরঃ ২২ সিট নম্বরঃ ০২ ও ০৩ (বিএস মৌজা)

1

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

৩। কর্তৃপক্ষ: সেনা কল্যাণ সংস্থা
প্রকল্পের নামঃ সেনা কল্যাণ সংস্থার পাওয়ার প্লান্ট নির্মানের জন্য ভুমি অধিগ্রহন
প্রাপ্ত দলিলসমুহঃ প্রকল্পের প্রস্তাবিত জমির সরবরাহকৃত দাগসুচী
প্রস্তাবিত জমির দাগসুচীর তালিকাঃ

1. মৌজাঃ ধানখালী, জে এল নম্বরঃ ১২ সিট নম্বরঃ ০৪, ০৫, ০৬ জেলাঃ পটুয়াখালী উপজেলাঃ কলাপাড়া (বিএস মৌজা)

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

৪। কর্তৃপক্ষ: রুরাল পাওয়ার প্লান্ট কোম্পানী লিমিটেড
প্রকল্পের নামঃ ১৩২০ মেগাওয়াট সুপার থার্মাল পাওয়ার প্লান্টের অধিগ্রহন
প্রাপ্ত দলিলসমুহঃ

1. লোকেশন ও মৌজা সিডিউল প্রেরন প্রসঙ্গে পত্র এবং ইমেইল এর কপি
2. প্রকল্পের তথ্য, লোকেশন ম্যাপ এবং মৌজা সিডিউল
3. প্রস্তাবিত জমির দাগসুচী (মসজিদ, শিক্ষা প্রতিষ্ঠান ও কবর সমুহের দাগের সুচীপত্র এবং ভুমি অধিগ্রহনের ফলে ক্ষতিগ্রস্ত পরিবারদের পূর্নবাসনের জন্য প্রস্তাবিত জমির দাগসূচীসহ)

প্রস্তাবিত জমির সরবরাহকৃত দাগসুচীর তালিকাঃ

1. মৌজাঃ লোন্দা জে এল নম্বরঃ ১১ সিট নম্বরঃ ০২, ০৩, ০৪, ০৫ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া (মসজিদ, শিক্ষা প্রতিষ্ঠান ও কবর সমুহের দাগের সুচীপত্র এবং ভুমি অধিগ্রহনের ফলে ক্ষতিগ্রস্ত পরিবারদের পূর্নবাসনের জন্য প্রস্তাবিত জমির দাগসূচীসহ)
2. মৌজাঃ নিশানবাড়িয়া জে এল নম্বরঃ ২১ সিট নম্বরঃ ০৩ ও ০৪ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া (মসজিদ, শিক্ষা প্রতিষ্ঠান ও কবর সমুহের দাগের সুচীপত্রসহ)
3. মৌজাঃ ধানখালী জে এল নম্বরঃ ৭২ সিট নম্বরঃ ০৫ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

৫। **কর্তৃপক্ষঃ সামরিক ভূমি ও ক্যান্টনমেন্ট অধিদপ্তর, প্রতিরক্ষা মন্ত্রনালয়**
প্রকল্পের নামঃ নৌ বাহিনী কর্তৃক ভূমি অধিগ্রহন
প্রাপ্ত দলিলসমুহঃ

1. নৌ বাহিনীর বাস্তবায়নাধীন/প্রস্তাবিত প্রকল্প সংশ্লিষ্ট অধিগ্রহণকৃত ও অধিগ্রহণ প্রক্রিয়াধীন জমিসমূহের মৌজা এবং দাগ নং সম্বলিত দাগসূচি প্রেরণ প্রসঙ্গে পত্র
2. নৌ বাহিনীর বাস্তবায়নাধীন/প্রস্তাবিত প্রকল্প সংশ্লিষ্ট অধিগ্রহণকৃত ও অধিগ্রহণ প্রক্রিয়াধীন জমিসমূহের মৌজা এবং দাগ নং সম্বলিত দাগসূচির বিস্তারিত বিবরন
3. গোল্‌বুনিয়া মৌজার অধিগ্রহণকৃত জমির দাগসূচী
4. গোল্‌বুনিয়া, লালুয়া ও বানাতিপাড়া মৌজার অধিগ্রহণ প্রস্তাবিত জমির দাগসূচী
5. লতাচাপলী মৌজার অধিগ্রহণ প্রস্তাবিত জমির দাগসূচী
6. প্রকাশিত গেজেটের ফটোকপি

অধিগ্রহণকৃত জমির সরবরাহকৃত দাগসূচীর তালিকা

1. মৌজাঃ গোল্‌বুনিয়া, জে এল নম্বরঃ ১৩ সিট নম্বরঃ ০১, ০২ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া

অধিগ্রহণ প্রস্তাবিত জমির সরবরাহকৃত দাগসূচীর তালিকা

1. মৌজাঃ গোল্‌বুনিয়া, জে এল নম্বরঃ ১৩ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
2. মৌজাঃ লালুয়া, জে এল নম্বরঃ ১৪, ১৫ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
3. মৌজাঃ বানাতিপাড়া, জে এল নম্বরঃ ১৫ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
4. মৌজাঃ লতাচাপলী, জে এল নম্বরঃ ৩৪ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

৬। কর্তৃপক্ষঃ পায়রা বন্দর কর্তৃপক্ষ
প্রকল্পের নামঃ পায়রা বন্দর কর্তৃক ভূমি অধিগ্রহন

প্রাপ্ত দলিলসমুহঃ
1. প্রকল্পের অধিগ্রহণকৃত জমির দাগসূচী (লালুয়া -১৪)
2. প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচী
3. মৌজা ম্যাপের ফটোকপি

প্রকল্পের অধিগ্রহণকৃত জমির সরবরাহকৃত দাগসূচী
মৌজাঃ লালুয়া, জে এল নম্বরঃ ১৪ সিট নংঃ ০২, ০৪ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
অধিগ্রহণ প্রস্তাবিত জমির সরবরাহকৃত দাগসূচীর তালিকাঃ
1. চর বালিয়াতলী -৪৬ সিট নংঃ ০১, ০২ ০৩ (বি এস মৌজা)
2. মৌজাঃ চান্দুপাড়া জে এল নম্বরঃ ১৭ সিট নংঃ ০১, ০২ ০৩, ০৪, ০৫, ০৬, ০৭ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
3. মৌজাঃ নয়াকাটা, জে এল নম্বরঃ১৬ সিট নংঃ ০১, ০২ ০৩, ০৪ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
4. মৌজাঃ বানাতিপাড়া, জে এল নম্বরঃ ১৫ সিট নংঃ ০১, ০২, ০৩ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
5. মৌজাঃ লেমুপাড়া, জে এল নম্বরঃ ১৯ সিট নংঃ ০৪, ০৫ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া
6. মৌজাঃ ধুলাসর , জে এল নম্বরঃ ৩২ সিট নংঃ ০২, ০৪, ০৫, ০৬ জেলাঃ পটুয়াখালী, উপজেলাঃ কলাপাড়া

সরবরাহকৃত মৌজা ম্যাপের তালিকাঃ
1. চর বালিয়াতলী -৪৬ সিট নংঃ ০১
2. চান্দুপাড়া জে এল নম্বরঃ ১৭
3. মৌজাঃ বানাতিপাড়া, জে এল নম্বরঃ ১৫ সিট নংঃ ০১, ০২, ০৩

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

৭। কর্তৃপক্ষঃ পায়রা বন্দর কর্তৃপক্ষ
প্রকল্পের নামঃ কোল টার্মিনাল প্রকল্প
প্রাপ্ত দলিলসমুহঃ
1. প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচী
2. মউজা ম্যাপ

অধিগ্রহণ প্রস্তাবিত জমির সরবরাহকৃত দাগসূচীর তালিকাঃ
নিশানবাড়ীয়া – ২১ , সিটঃ ০১,০২,০৩ (বি এস মৌজা)
সরবরাহকৃত মৌজা ম্যাপের তালিকাঃ
নিশানবাড়ীয়া – ২১ , সিটঃ ০১,০২,০৩ (বি এস মৌজা)
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

৮। কর্তৃপক্ষঃ পায়রা বন্দর কর্তৃপক্ষ
প্রকল্পের নামঃ ফোর লেন রোড প্রকল্প

প্রাপ্ত দলিলসমুহঃ

1. প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচী
2. মৌজা ম্যাপ

প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের সরবরাহকৃত দাগসুচীর তালিকা
ইটবাড়ীয়া – ০৮
রজপাড়া – ০৯
অধিগ্রহণ প্রস্তাবিত জমির সরবরাহকৃত দাগসূচীর তালিকাঃ
রজপাড়া –০৯ সিট নং ০৩, ০৪, ০৫ (বি এস মৌজা)
মৌজা ম্যাপের তালিকাঃ
রজপাড়া –০৯ সিট নং ০৩, ০৪, ০৫ (বি এস মৌজা)

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

৯। কর্তৃপক্ষঃ পায়রা বন্দর কর্তৃপক্ষ
প্রকল্পের নামঃ পায়রা বন্দরের বাতিঘর ও নিরাপত্তা ব্যারাক নির্মাণ
প্রাপ্ত দলিলসমুহঃ

1. প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচাই
2. মৌজা ম্যাপ

অধিগ্রহণ প্রস্তাবিত জমির সরবরাহকৃত দাগসূচীর তালিকাঃ
কাউয়ার চর –৫০ সিট নং ০২ (বি এস মৌজা)
মৌজা ম্যাপের তালিকাঃ
কাউয়ার চর –৫০ সিট নং ০২ (বি এস মৌজা)

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

১০। কর্তৃপক্ষঃ পায়রা বন্দর কর্তৃপক্ষ
প্রকল্পের নামঃ পায়রা বন্দরের ট্রাক টার্মিনাল এর বর্জ্য নিষ্কাশন
প্রাপ্ত দলিলসমুহঃ

1. প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচী

প্রকল্পের অধিগ্রহণকৃত জমির সরবরাহকৃত দাগসূচী
ইটবাড়ীয়া – ০৮ সিট নং ০২

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

১১। কর্তৃপক্ষঃ পায়রা বন্দর কর্তৃপক্ষ
প্রকল্পের নামঃ ভূমি অধিগ্রহনের ফলে ক্ষতিগ্রস্ত পরিবারদের পূনর্বাসন
প্রাপ্ত দলিলসমুহঃ

1. প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচী

প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের সরবরাহকৃত দাগসুচী

1. লোন্দা – ১১ সিট নং ০৪
2. লালুয়া – ১৪ সিট নং ০৪
3. চান্দুপাড়া- ১৭ সিট নং ০৪

* প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে

১২। কর্তৃপক্ষ: বাংলাদেশ পানি উন্নয়ন বোর্ড
প্রকল্পের নামঃ Coastal Embankment Improvement Project, Phase -1 (CEIP-1)
প্রাপ্ত দলিলসমুহঃ প্রকল্পের প্রস্তাবিত জমির দাগসুচী এবং জমির নকশা

প্রকল্পের প্রস্তাবিত জমির দাগসুচী এবং জমির নকশার তালিকাঃ

- আমখোলা-২৬ সিট - ১ আমখোলা গলাচিপা পটুয়াখালী
- বদরপুর-১০৯ গোলখালী গলাচিপা পটুয়াখালী
- বড় গাবুয়া-১১১ সিট - ১ গোলখালী গলাচিপা পটুয়াখালী
- বড় লবনগোলা-২৮ সিট - ৩ বুড়ির চর বরগুনা সদর বরগুনা
- বরইতলা-২৮ সিট - ২ পাথরঘাটা পাথরঘাটা বরগুনা
- বাউরিয়া চরিয়ানি-১৭ আমখোলা গলাচিপা পটুয়াখালী
- ভাংড়া-২৫ সিট - ২ আমখোলা গলাচিপা পটুয়াখালী
- বুড়ির চর-২৩ সিট - ২ বুড়ির চর বরগুনা সদর বরগুনা
- চর আমখোলা-২৮ আমখোলা গলাচিপা পটুয়াখালী
- চর চাপলী -৩৬ সিট - ১, ২, ৩, ৪ ধূলাসর কলাপাড়া পটুয়াখালী
- চর চড়কগাছিয়া-২৪ সিট - ১,২,৪ বুড়ির চর বরগুনা সদর বরগুনা
- চর দুয়ানী-২২ সিট - ১,২,৩,৪,৫ চর দুয়ানী পাথরঘাটা বরগুনা
- চর হরিদেবপুর-২০ সিট - ১,২ গোলখালী গলাচিপা পটুয়াখালী
- চাইলাবানিয়া-১০ সিট - ১,২ আমখোলা গলাচিপা পটুয়াখালী
- ছোট গাবুয়া-১৮ গোলখালী গলাচিপা পটুয়াখালী
- ছোট লবণগোলা-২৬ সিট - ১,২,৩ বুড়ির চর বরগুনা সদর বরগুনা
- ছোট টেংরা-২৬ সিট - ৩ চর দুয়ানতি পাথরঘাটা বরগুনা
- ডালবুগঞ্জ-২৯ সিট - ১,২,৩,৪,৫,৬,৭,৮ খাপড়াভাঙ্গা কলাপাড়া পটুয়াখালী
- দাড়ি বাহেরচর-২৭ সিট - ১,২,৩ আমখোলা গলাচিপা পটুয়াখালী
- গাবতলী-১৮ সিট - ২,৩ আয়লা পাতাকাটা বরগুনা সদর বরগুনা
- গহরপুর-৩৫ সিট - ১ পাথরঘাটা পাথরঘাটা বরগুনা
- গঙ্গামতি-৩৫ সিট - ১,৩,৫ ধূলাসর কলাপাড়া পটুয়াখালী
- ঘুটাবাচ্চা-১২ সিট - ৫ কালমেঘা পাথরঘাটা বরগুনা
- গোলখালী-১১২ ১,২ গোলখালী গলাচিপা পটুয়াখালী
- হাতেমপুর-২৭ সিট - ২ পাথরঘাটা পাথরঘাটা বরগুনা

- হোগলাপাশা-২০ সিট - ১,২,৩,৪ চর দুয়ানতি পাথরঘাটা বরগুনা
- ইটবাড়িয়া-২১ সিট - ২,৩,৪ আয়লা পাতাকাটা বরগুনা সদর বরগুনা
- কালির চর -১১০ সিট - ২ গোলখালী গলাচিপা পটুয়াখালী
- করাইতলা মৈঠা-২৭ সিট - ১,২,৩ বুড়ির চর বরগুনা সদর বরগুনা
- কাউয়ার চর-৩৭ সিট - ১,২ ধূলাসর কলাপাড়া পটুয়াখালী
- লতাচাপলী-৩৪ সিট - ১,২,৩,৪,৫,৮,১০,১১,১৪,১৬,১৯,২২,২৫ লতাচাপলী কলাপাড়া পটুয়াখালী
- নাপিতখালী-২৫ সিট - ২ বুড়ির চর বরগুনা সদর বরগুনা
- নীল লাঠিমারা -২৯ ২ পাথরঘাটা পাথরঘাটা বরগুনা
- পাথরঘাটা-৩৬ ৩ পাথরঘাটা পাথরঘাটা বরগুনা
- পোড়াকাটা-২২ সিট - ১,২,৩,৪ আয়লা পাতাকাটা বরগুনা সদর বরগুনা
- পূর্ব গোলখালী-১১৩ ১,৩ গোলখালী গলাচিপা পটুয়াখালী
- সুহারী-২৩ ১,২ গোলখালী গলাচিপা পটুয়াখালী
- সুহারী নিজ চর -২১ গোলখালী গলাচিপা পটুয়াখালী
- তাফালবাড়িয়া-২৩ সিট - ১,২,৩ চর দুয়ানতি পাথরঘাটা বরগুনা
- তালুক চর দুয়ানি -১৯ সিট - ২ কানঠাতলি পাথরঘাটা বরগুনা

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

১৩। কর্তৃপক্ষ: বাংলাদেশ পানি উন্নয়ন বোর্ড
প্রকল্পের নামঃ Blue Gold Program
প্রাপ্ত দলিলসমুহঃ প্রকল্পের প্রস্তাবিত জমির দাগসুচী এবং জমির নকশা

প্রকল্পের প্রস্তাবিত জমির দাগসুচী এবং জমির নকশার তালিকাঃ

- বড় বালিয়াতলী-৩০ সিট- ২,৩ মিঠাগঞ্জ কলাপাড়া পটুয়াখালী
- বাউলতলী-৩৯ সিট- ১,২,৫ ধূলাসর কলাপাড়া পটুয়াখালী
- চর বালিয়াতলী-৩১ সিট- ১,২ মিঠাগঞ্জ কলাপাড়া পটুয়াখালী
- ছোট বালিয়াতলী-১৮ সিট- ১ মিঠাগঞ্জ কলাপাড়া পটুয়াখালী
- ধূলাসর-৩২ সিট- ১,২,৩,৪,৫ ধূলাসর কলাপাড়া পটুয়াখালী
- হরিদেবপুর খেপরাভাঙ্গা-৩৩ সিট- ২,৩ খেপরাভাঙ্গা কলাপাড়া পটুয়াখালী
- লেমুপাড়া-১৯ সিট- ১,২,৪ মিঠাগঞ্জ কলাপাড়া পটুয়াখালী
- মধুখালী-৪৪ সিট- ১,২,৫,৬ মিঠাগঞ্জ কলাপাড়া পটুয়াখালী
- মানসাতলী-২৮ সিট- ১,২,৩ খেপরাভাঙ্গা কলাপাড়া পটুয়াখালী
- মিঠাগঞ্জ-২১ সিট- ১,২,৩,৪ মিঠাগঞ্জ কলাপাড়া পটুয়াখালী
- সোনাপাড়া-৩৮ সিট- ১ মিঠাগঞ্জ কলাপাড়া পটুয়াখালী
- তেগাছিয়া-৪৩ সিট- ১,৩,৪,৫ মিঠাগঞ্জ কলাপাড়া পটুয়াখালী

*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

১৪। কর্তৃপক্ষঃ জেলা প্রশাসকের কার্য্যালয়, বরগুনা
প্রকল্পের নামঃ জেলা প্রশাসক কার্যালয়, বরগুনা কর্তৃক চলমান/প্রস্তাবিত প্রকল্প

প্রাপ্ত দলিলসমুহঃ

1. প্রকল্পের কাজের জন্য ভূমি অধিগ্রহণ সংক্রান্ত তথ্যাদি প্রেরণ প্রসঙ্গে পত্র
2. ২০১২-২০১৩ হতে ২০১৭-২০১৮ পর্যন্ত বিভিন্ন উন্নয়নমূলক কাজের ভূমি অধিগ্রহণ সংক্রান্ত তথ্য (বরগুনা সদর, আমতলী, পাথরঘাটা ও তালতলী উপজেলা)
3. বরগুনা গণপূর্ত বিভাগের অধীন চলমান/প্রস্তাবিত প্রকল্প সমূহের তথ্য

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

১৫। কর্তৃপক্ষঃ জেলা প্রশাসকের কার্য্যালয়, পটুয়াখালী
প্রকল্পের নামঃ জেলা প্রশাসক কার্যালয়, পটুয়াখালী কর্তৃক চলমান/প্রস্তাবিত প্রকল্প

1. পটুয়াখালী গণপূর্ত বিভাগের অধীন চলমান/প্রস্তাবিত প্রকল্প সমূহের তথ্য
2. জেলা প্রশাসক পটুয়াখালী এর চলমান/প্রস্তাবিত প্রকল্প সমূহের তথ্য

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

১৬। কর্তৃপক্ষঃ বন অধিদপ্তর
প্রকল্পের নামঃ বন অধিদপ্তরের চলমান/প্রস্তাবিত প্রকল্পসমুহ

প্রাপ্ত দলিলসমুহঃ

1. মৌজা এবং দাগ নং সম্বলিত দাগসূচি প্রেরণ প্রসঙ্গে পত্র
2. বন অধিদপ্তরের চলমান/ প্রস্তাবিত প্রকল্পসমুহের দাগসুচী

*** মৌজা ম্যাপ /চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

১৭। কর্তৃপক্ষঃ জাতীয় গৃহায়ন কর্তৃপক্ষ
প্রকল্পের নামঃ পটুয়াখালী জেলার গলাচিপা উপজেলায় বঙ্গবন্ধু উপশহর কাম আবাসিক এলাকা উন্নয়ন
প্রাপ্ত দলিলসমুহঃ

1. মৌজা এবং দাগ নং সম্বলিত দাগসূচি প্রেরণ প্রসঙ্গে পত্র
2. প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচাই

অধিগ্রহণকৃত জমির সরবরাহকৃত দাগসূচীর তালিকাঃ
গলাচিপা – ৪৯ উপজেলাঃ গলাচিপা জেলাঃ পটুয়াখালী (১৬.৫০ একর জমি)

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

১৮. কর্তৃপক্ষঃ মৎস উন্নয়ন কর্পোরেশন
প্রকল্পের নামঃ মৎস অবতরণ কেন্দ্র স্থাপন প্রকল্প
প্রাপ্ত দলিলসমুহঃ
1. আলিপুর ও মহিপুর মৎস অবতরণ কেন্দ্র সংক্রান্ত তথ্য

* প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে

১৯। কর্তৃপক্ষঃ পানি সম্পদ মন্ত্রনালয়
প্রাপ্ত দলিলসমুহঃ
1. প্রকল্পের অন্তর্ভুক্ত এলাকাসমূহে বাস্তবায়নাধীন/প্রস্তাবিত প্রকল্পের তথ্যাদি প্রেরণ প্রসঙ্গে পত্র
2. পানি সম্পদ মন্ত্রনালয় এর অধীন বাংলাদেশ পানি উন্নয়ন বোর্ডের আওতায় বাস্তবায়নাধীন/প্রস্তাবিত প্রকল্পের যাচিত তথ্য

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

২০। কর্তৃপক্ষঃ কৃষি সম্প্রসারণ অধিদপ্তর
প্রকল্পের নামঃ বন অধিদপ্তরের চলমান/প্রস্তাবিত প্রকল্পসমুহ
কৃষি সম্প্রসারণ অধিদপ্তর (ডিএই) কর্তৃক বাস্তবায়নাধীন প্রকল্পসমূহ
প্রাপ্ত দলিলসমুহঃ
1. প্রকল্পের অন্তর্ভুক্ত এলাকাসমূহে বিভিন্ন দপ্তরের প্রকল্প সংক্রান্ত তথ্যাদি প্রেরণ প্রসঙ্গে পত্র
2. প্রকল্পের অন্তর্ভুক্ত এলাকায় কৃষি সম্প্রসারণ অধিদপ্তর (ডিএই) কর্তৃক বাস্তবায়নাধীন প্রকল্পসমূহের তথ্য

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

২১। কর্তৃপক্ষঃ সেতু বিভাগ
প্রকল্পের নামঃ সেতু বিভাগের আওতায় গৃহীত প্রকল্পসমুহ
প্রাপ্ত দলিলসমুহঃ
1. প্রকল্পের অন্তর্ভুক্ত এলাকাসমূহে সেতু বিভাগের আওতায় গৃহীত প্রকল্পের তথ্যাদি
2. প্রকল্প এলাকায় সেতু বিভাগ এর প্রকল্প সংক্রান্ত তথ্য
3. লোকেশন ম্যাপ

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

২২। কর্তৃপক্ষঃ পায়রা কাস্টমস হাউস কর্তৃপক্ষ
প্রকল্পের নামঃ পায়রা কাস্টম হাউস কর্তৃক জমি অধিগ্রহন
প্রাপ্ত দলিলসমুহঃ
1. প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচাই
2. মৌজা ম্যাপ

প্রস্তাবিত জমির সরবরাহকৃত দাগসুচীর তালিকাঃ
লালুয়া -১৪ সিটঃ ০৪ উপজেলা- কলাপাড়া, জেলা – পটুয়াখালী
সরবরাহকৃত মৌজা ম্যাপের তালিকাঃ
লালুয়া -১৪ সিটঃ ০৪ উপজেলা- কলাপাড়া, জেলা – পটুয়াখালী

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

২৩। কর্তৃপক্ষঃ শিল্প মন্ত্রনালয়
প্রকল্পের নামঃ জাহাজ পুনঃপ্রক্রিয়াজাতকরন শিল্প স্থাপনের লক্ষ্যে জমি অধিগ্রহণ
প্রাপ্ত দলিলসমুহঃ

1. প্রকল্পের প্রস্তাবিত জমি অধিগ্রহনের দাগসুচি
2. মৌজা ম্যাপ

প্রস্তাবিত জমির সরবরাহকৃত দাগসুচীর তালিকাঃ
ছোট নিশানবাড়িয়া – ৪১ সিট নং ০৪, উপজেলা তালতলী, জেলা- বরগুনা
সরবরাহকৃত মৌজা ম্যাপের তালিকাঃ
ছোট নিশানবাড়িয়া – ৪১ সিট নং ০৪, উপজেলা তালতলী, জেলা- বরগুনা

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**
*** প্রকল্পটি জি আই এস ডাটাবেস এ চিহ্নিত করা হয়েছে**

২৪। কর্তৃপক্ষঃ দূর্যোগ ব্যবস্থাপনা অধিদপ্তর
প্রকল্পের নামঃ উপকূলীয় ও ঘূর্ণিঝড় প্রবন এলাকায় বহুমুখী ঘূর্ণিঝড় আশ্রয়কেন্দ্র নির্মাণ প্রকল্প
প্রাপ্ত দলিলসমুহঃ

- গ্রামীণ মাটির রাস্তাসমুহ টেকসইকরণের লক্ষ্যে হেরিং বোন বন্ড (এইচবিবি) করণ প্রকল্পের কাজের বিবরণী
- জেলা ত্রাণ গুদাম কাম দূর্যোগ ব্যাবস্থাপনা তথ্যকেন্দ্র প্রকল্পের কাজের অবস্থা সম্বলিত তথ্য
- গ্রামীন রাস্তায় কম/বেশী ১৫ মিঃ দৈর্ঘ্যের সেতু/ কাল্‌ভার্ট নির্মান কাজের অবস্থা সম্বলিত তথ্য প্রকল্প

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**

২৫। কর্তৃপক্ষঃ ভূমি রেকর্ড ও জরিপ অধিদপ্তর
প্রকল্পের নামঃ ডিজিটাল পদ্ধতিতে ভূমি জরিপ করার জন্য ভূমি রেকর্ড ও জরিপ অধিদপ্তরের ডিজিটাল জরিপ পরিচালনার সক্ষমতা বৃদ্ধিকরণ প্রকল্প

প্রাপ্ত দলিলসমুহঃ

- প্রকল্পের অন্তর্ভুক্ত এলাকাসমুহে ভুমি রেকর্ড ও জরিপ অধিদপ্তর কর্তৃক পটুয়াখালী ও বরগুনা জেলায় প্রস্তাবিত প্রকল্পের আওতায় জিওডেটিক সার্ভে পিলার নির্মাণ / স্থাপনের জন্য মৌজাসমূহের তালিকা

*** মৌজা ম্যাপ / চিহ্নিত সাইট প্ল্যান সরবরাহ করা হয়নি**

২৬। কর্তৃপক্ষঃ বাংলাদেশ ভূতাত্ত্বিক জরিপ অধিদপ্তর
প্রাপ্ত দলিলসমুহঃ
২ টি প্রতিবেদনঃ

- Geological Appraisal on Payra Port and Adjoining Areas of Kalapara and Amtali, Bangladesh
- Geology of Barguna District

Summary of the report on Geological Appraisal on Payra Port and Adjoining Areas of Kalapara and Amtali, Bangladesh:

- There is no immediate threat of land erosion in the prograding part of the area of Payra Port
- Hydrological study is needed as the ground water data is rare.
- Development activities should be conduct as such that there is no hamper of tidal activities due to the development effect.
- Further study is needed to unravel the soft sediment thickness of Holocene age and geotechnical characteristics of Payra Port and adjoining areas.
- As the Payra port is susceptible to moderate cyclone surge, the structure of the Port needs to be built in such a way that it can withstand tidal surge of 7m from the mean sea level with wind speed of 240 km/hr.
- Development activities should be done in a way so that it doesn't damage the southern coastal plain of Kalapara Upazila and the mangrove forest in the south east part of the area.
- Crop production should be taken into consideration for taking and development.

Summary of the report on Geology of Barguna District

- Sluice gates on the mouth of tidal channels should be kept open during the monsoon to lessen coastal erosion and prevent water logging.
- Ponds, tanks and artificial reservoirs should be extensively used by pisciculture by raising their banks to avoid overflooding.
- Detailed hydrological studies of the region should be undertaken to provide data for planned development of water supply facilities for irrigational and domestic uses.
- Judging the stability of the area, construction cost and susceptibility to hazards the tidal flats, especially the lower tidal flats, should be avoided for any engineering construction such as construction of roads and highways as well as buildings etc.
- Embankments about the height of 5 meters from the msl may protect the island from inundating by tidal surges. Geo-textiles may be used for the construction of embankments for their low cost and high durability.
- Cyclone-shelters in Barguna district are not adequate in numbers and in most cases, these are not well maintained. As such, to fulfil the long-term requirements and to avoid above mentioned problems; mosques, schools and administrative buildings in sufficient numbers are to be built a few meters above the ground level on pillars (preferably 4 to 6 meters above the ground level) only within the supratidal flat of the island.

২৭। কর্তৃপক্ষঃ বাংলাদেশ পর্যটন কর্পোরেশন
প্রাপ্ত দলিলসমুহঃ

১ টি প্রতিবেদনঃ

- Feasibility Study of Establishment of Exclusive Tourist Zone at Sonar Char Under Rangabali Upazilla for Foreign Tourist

Summary of the Report:
The report concludes that Developing tourist center at Rangabali Upazila would not be feasible because of inadequate accommodation facilities, very poor communication system and lack of other necessary utility (electricity, water supply, gas) facilities. Also according to the cost-benefit analysis of the investment, the project is neither financially or economically viable at this stage.

List of On-going Projects and Implementing Authority

SN	Project Name	Authority	Mouza Name	Comments
1	132/33kv Grid Power Plant	DC Office, Barguna	Khajurtala_8	Marked in map
2	1320 Mega Watt Super Thermal Power Plant based on Coal at Patuakhali	Rural Power Company Limited	Londa_73, Nishanbaria_11	Marked in map
3	1320-Megawatt Thermal Power Plant	North West Power Generation Com Ltd	Tiakhali_10, Nishanbaria_11, Madhupara_12	Marked in map
4	Amtali Farmer Tanning Institute Construction	DC Office, Barguna	Amtali_31	Marked in map
5	Amtali Police Station	DC Office, Barguna	Amtali_31	Marked in map
6	Amtali Sub Registry Office	DC Office, Barguna	Amtali_31	Marked in map
7	Amtali Upazila Land Office	DC Office, Barguna	Amtali_31	Marked in map
8	Ashugonj 1320-Megawatt Super Thermal Power Plant	Ashugonj Power Station Com. Ltd	Dhankhali_12, Debpur_69	Marked in map
9	Bangabandhu Upashahar Cum Residential Area Development Project	National Housing Authority	Galachipa_49	Marked in map
10	Bangladesh Bridge Authority	Bangladesh Bridge Authority		Marked in map (Location Based)
11	Barguna circuit house	DC Office, Barguna	Karaitala Maitha_27	Marked in map
12	Barguna Sadar Model Mosque	DC Office, Barguna	Barguna_30	Marked in map
13	BWDB Polder Project	Bangladesh Water Development Board		Marked in map (Mouza Wise)
14	Chief Judicial Court	DC Office, Barguna	Karaitala Maitha_27	Marked in map
15	Construction of Electricity Distribution Center	Barguna Electricity Supply WZPDCL	Karaitala Maitha_27	Marked in map
16	Costal Embankment Improvement Project	Bangladesh Water Development Board	Porakata_22, Chhota Labangola_26, Bara Labangola_28	Marked in map
17	Coastal Town Development Project	DC Office, Barguna	Barguna_30	Marked in map
18	DAE Project	Department of Agricultural Extension		Marked in map (Upazila Wise)
19	Eco-Tourism Aquaculture Park, Marine Aquarium and Museum Complex	Bangladesh Fisheries Development Corporation	Kawar Char_37	Marked in map
20	Embankment Improvement Project	Bangladesh Water Development Board	Amkhola_26, Atkhali_47, Badarpur_109, Badura Natunchar_114, Bara Gabua_111, Baraitala_28, Bauria Chariani_17, Bauria Kismat_14, Bhangra_25, Char	Marked in map

SN	Project Name	Authority	Mouza Name	Comments
			Amkhola_28, Char Duani_22, Char Haridebpur_20	
21	Embankment/Sluice gate Construction Project	Bangladesh Water Development Board	Burir Char_23, Dalbhanga_51, Charak Gachhia_36, Karaitala Maitha_27	Marked in map
22	Exclusive Tourist Zone (ETZ)	Bangladesh Parjatan Corporation	Kawar Char_37	Mouza Wise
23	Fire service and civil defense station construction project at galachipa upazila	DC Office, Patuakhali	Galachipa_49	Marked in map
24	Four lane connection road of national highway with Payra port	Roads and Highways Department	Raja Para_9, Itbaria_8	Mouza Wise
25	Kuakata Duck Banglo construction	DC Office, Patuakhali	Latachapli_34	Marked in map
26	Kuakata police officers mess construction	DC Office, Patuakhali	Latachapli_34	Marked in map
27	Kuakata Sub Divisional Office and compound project	DC Office, Patuakhali	Latachapli_34	Marked in map
28	Mahipur Motsho obotoron kendro	Bangladesh Fisheries Development Corporation	Shibbaria_26, Latachapli_34	Marked in map
29	Navy Land Acquisition	Department of Military Lands & Cantonments, Ministry of Defence	Lalua_14, Golbania_13, Banatipara_13, Latachapli_34	Marked in map
30	NSI Office Barguna	DC Office, Barguna	Karaitala Maitha_27	Marked in map
31	Patharghata Circle ASP Office	DC Office, Barguna	Patharghata_36	Marked in map
32	Patharghata Farmer Tanning Institute Construction	DC Office, Barguna	Patharghata_36	Marked in map
33	Patharghata Model Mosque	DC Office, Barguna	Patharghata_36	Marked in map
34	Payra Port Land Acquisition	Payra Port Authority	Chandu Para_17, Debpur_69, (Lalua_14 Mouza Wise)	Marked in map
35	Payra Custom House Authority, Official Building	Payra Custom House Authority	Lalua_14	Marked in map
36	Payra Port Authority, Truck Terminal and Borjo Nirman	Payra Port Authority	Itbaria_8	Marked in map
37	Payra Port Construction Project	Payra Port Authority	Banatipara_15, Lalua_14, Nayakata_16	Marked in map
38	Proposed project under implementation of Forest Department	Forest Department	Baoalkar_3, Bain Chutki_6, Bara Tengra_30, Dhulasar_32, Gangamati_35, Char Lathimara_38, Kumirmara_41, Khajura_50, Char Bagla Alias Jahajmara_143, Char Agasti_167, Sonar Char_183	Marked in map
39	Public Library	DC Office, Barguna	Karaitala Maitha_27	Marked in map

SN	Project Name	Authority	Mouza Name	Comments
40	Road Construction Project	Roads and Highways Department, Barguna	Phuljhuri_10	Marked in map
41	Sena Kollan Organization Power Plant Land Acquisition	Sena Kollan Organization	Dhankhali_12	Marked in map
42	Ship construction and improvement project	Shipyard Ltd.	Chhota Nishanbaria Chak_41	Marked in map (Mouza Wise)
43	Sundarbans ECA area Demarcation	Forest Department		Marked in map
44	Taltoli Fire Service Office	DC Office, Barguna	Barabagi_44	Marked in map
45	Taltoli Sub Registry Office	DC Office, Barguna	Barabagi_44	Marked in map
46	Taltoli Upazila Land Office	DC Office, Barguna	Barabagi_44	Marked in map
47	Textile Vocational at Barguna	DC Office, Barguna	Karaitala Maitha_27	Marked in map
48	Treasury building construction at Barguna	DC Office, Barguna	Karaitala Maitha_27	Marked in map

LAND ACQUISITION INFORMATION OF PROJECT IMPLEMENTING BY RESPECTIVE ORGANIZATION