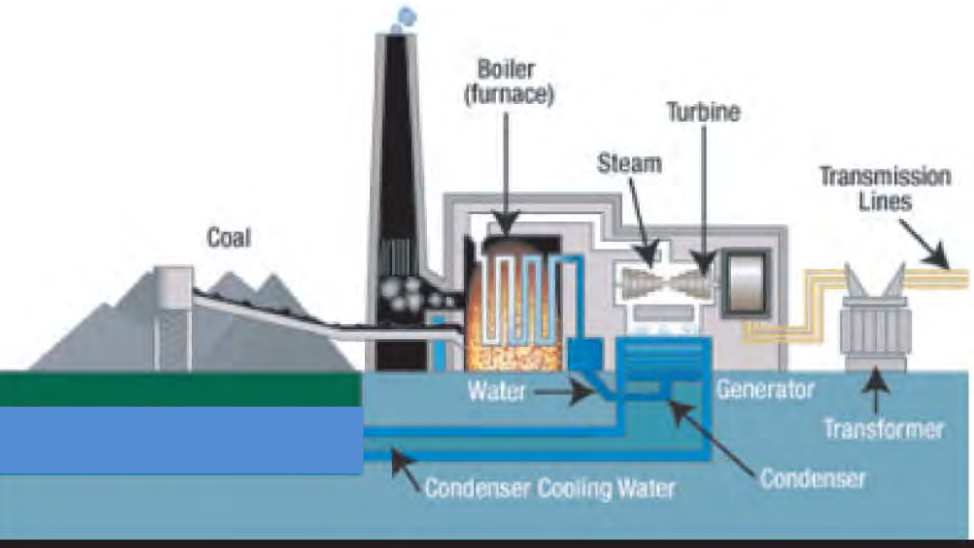
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF POWER, ENERGY & MINERAL RESOURCES
(Power Division)
Bangladesh Power Development Board (BPDB)

Final Report on Environmental Impact Assessment of 2x (500-660)MW Coal Based Thermal Power Plant to be Constructed at the Location of Khulna







January 2013

Dhaka

Submitted by:

CEGIS

Center for Environmental and Geographic Information Services

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POWER DIVISION

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Abbreviations and Acronyms

AD	Air Dried
ADB	Asian Development Bank
AEZ	Agro-Ecological Zone
AHP	Ash Handling Plant
AR	As received
ASB	Asiatic Society of Bangladesh
BACT	Best Available Control Technology
BBS	Bangladesh Bureau of Statistics
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BOD	Biological Oxygen Demand
BPDB	Bangladesh Power Development Board
BWDB	Bangladesh Water Development Board
CAAB	Civil Aviation Authority of Bangladesh
CAS	Catch Assessment Survey
CEGIS	Center for Environmental and Geographic Information Services
CF	Capacity Factor
CHP	Coal Handling Process
CITES	Convention on International Trade of Endangered Species
COD	Chemical Oxygen Demand
CW	Cooling Water
CWPH	Cooling Water Pump House
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DEM	Digital Elevation Model
DGPS	Differential Global Positioning System
DM	Demineralization
DO	Dissolve Oxygen
DoE	Department of Environment
DoF	Department of Fisheries
DPHE	Department of Public Health Engineering
DSP	Demand Supply Management
DTW	Deep Tube Well
ECA	Environment Conservation Act /Ecological Critical Area
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules
EGCB	Electricity Generation Company of Bangladesh
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EOT	Electrical Overhead Travelling
EPC	Engineering Procurement and Construction
EPZ	Export Processing Zone
ESBN	Estuarine Set Bag Nets
ESP	Electrostatic Precipitator
FAO	Food and Agricultural Organization
FD	Force Draft
FGD	Focus Group Discussion
FGD	Flue Gas Desulfurization
FRSS	Fishery Resources Survey System

GAR	Gross As Received
GCP	Ground Control Point
GCV	Gross Calorific Value
GDP	Gross Domestic Product
GIIP	Good International Industry Practice
GSB	Geological Survey of Bangladesh
HAVC	Heating Ventilation and Air Conditioning
HAZMAT	Hazardous Material
HCSD	High Concentration Slurry Disposal System
HFO	Heavy Fuel
HHV	High Heating Value
HP	High Pressure
HYV	High Yielding Variety
ID	Induced Draft
IEE	Initial Environmental Examination
IESCs	Important Environmental and Social Components
IMO	International Maritime Organization
IPP	Independent Power Producer
KII	Key Informants Interview
KV	Kilo Volt
KWh	Kilo Watt hour
LGED	Local Government Engineering Department
LP	Low Pressure
MEAs	Multilateral Environmental Agreements
MoU	Memorandum of Understanding
MPA	Mongla Port Authority
MW	Mega Watt
NCA	Net Cultivable Area
NCS	National Conservation Strategy
NEMAP	National Environmental Management Action Plan
NEP	National Environmental Policy
NGO	Non-Government Organization
NOC	No Objection Certificate
NOx	Oxides of Nitrogen
NTPC	National Thermal Power Corporation
NWRD	National Water Resources Database
OD	Operation Directorates
OP	Operational Policy
PAP	Project Affected Person
PCM	Public Consultation Meeting
PL	Post Larva
PPM	Parts Per Million
PPP	Public Private Partnership
PRA	Participatory Rural Appraisal
PSMP	Power System Master Plan
PWD	Public Works Department
RO	Reverse Osmosis
RRA	Rapid Rural Appraisal
RS	Remote Sensing
SCC	Site Clearance Certificate
SOx	Oxides of Sulfur
SPM	Suspended Particulate Matter

SRDI	Soil Resource Development Institute
STW	Shallow Tube-Well
SWRO	Sea Water Reverse Osmosis
TDS	Total Dissolved Solid
ToR	Terms of Reference
TPH	Ton Per Hour
UFO	Upazila Fisheries Office
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Program
UNO	Upazila Nirbahi Officer
WARPO	Water Resources Planning Organization
WZPDCL	West Zone Distribution Company Ltd

Units

ppb	Parts per Billion
ppm	Parts per Million
hr	Hour
Kg	Kilogram
m	Meter
mg	Milligram
µg	microgram
MT/Year	Million Ton per Year
MW	Mega Watt
Nm	Normal Meter
s	Seconds
TPD	Ton per Day
TPH	Ton per Hour
KV	Kilo Volt

Glossary

Aila: Major Cyclone, which hit Bangladesh coast on May 25, 2009

Aman: Group of rice varieties grown in the monsoon season and harvested in the post-monsoon season. This is generally transplanted at the beginning of monsoon from July-August and harvested in November-Dec. Mostly rain-fed, supplemental irrigation needed in places during dry spell.

Aus: Group of rice varieties sown in the pre-monsoon season and harvested in the monsoon season. These are broadcasted/transplanted during March-April and harvested during June-July. Generally rain-fed, irrigation needed for HYV T. Aus.

B: When preceding a crop means broadcast (B. Aus)

Bagda: Shrimp (*Penaeus monodon),* brackish/slightly saline water species.

Bazar: Market

Beel: A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.

Boro: A group of rice varieties sown and transplanted in winter and harvested at the end of the pre-monsoon season. These are mostly HYV and fully irrigated, planted in December-January and harvested before the onset of monsoon in April- May.

Golda Prawn *(Macrobrachium rosenbergii*), non-saline/fresh water species

Gher Farm lands converted into ponds with low dykes and used for cultivation of shrimp/prawn/fish.

Haat: Market place where market exchanges are carried out either once, twice or thrice a week, however not every day.

Jaal: Different types of fishing net to catch fish from the water bodies.

Kacha: A house made of locally available materials with earthen floor, commonly used in the rural areas.

Khal: A drainage channel usually small, sometimes man-made. The channel through which the water flows. These may or may not be perennial.

Kharif: Pre-monsoon and monsoon growing season. Cropping season linked to monsoon between March-October, often divided into kharif-1 (March-June) and kharif-2 (July-October).

Perennial Khal: Water available in the khal all the year round.

Pacca: Well constructed building using modern masonry materials.

Rabi: Dry agricultural crop growing season; mainly used for the cool winter season between November and February.

Ring Slab: The simple pit latrine consists of a hole in the ground (which may be wholly or partially lined) covered by a squatting slab or seat where the user defecates. The defecation hole may be provided with a cover or plug to prevent the entrance of flies or egress of odor while the pit is not being used.

Seasonal Khal: Water not available in the khal all the year round.

Sidr: Major Cyclone, which hit Bangladesh coast on November 15, 2007.

T. *Aman*: When preceding a crop means transplanted (T. Aman).

Upazila: Upazila is an administrative subdivision of a District.

Water sealed: A water sealed latrine is simply a pit latrine that has a water barrier to prevent odors. These latrines are simply pits dug in the ground in which human waste is deposited. A water sealed latrine has a bowl fixture that has a set amount of water retained in it. It is operated on the pour to flush system. These types of latrines can be connected to a septic tank system.

Unit Conversion Table

General Units

1 meter = 3.28 ft

1 kilometer = 0.621371192 mile

1 nautical mile = 1.852 kilometer

1 kilogram = 2.20 pound

1 metric ton = 1000 kg

1 barrel = 42 U.S. gallons = 159.0 liters

1 liter = 0.264172052 gallon (US)

1 square mile = 640 acres = 2.590 km^2

1 hectare = 10^{-2} km^2 = 2.471 acres

1 Pascal = 1 N/m^2= 0.01 millibar

1 liter = 0.001 cubic meter

1^0C = 274.15K=33.8^0F

1 mg/m^3 = 1 µg /L

1 mg/L ≈ 1 g/m^3 ≈ 1 ppm (w/w)

1 ≈ g/L ≈ 1 mg/ m^3 ≈ 1 ppb (w/w)

Energy Units

1 Cal = 4.19 J

1 Btu = 1055.87J

1 Btu = 251.9958 cal

1 joule = 0.239 cal

1 kWh = 3412 Btu.

1MW=1000KW=10^6 W

1 kWh = 3.6 x 10^6 J

1 kWh = 859.85 kcal

1 horsepower = 746 W

1 GWyr = 8.76 x 10^9 kWh

Executive Summary

Background

Sustainable power supply is a major precondition for the socio-economic development of Bangladesh. The Government has given top priority to the development of power sector considering its importance in overall development of the country. To this end, the government has set the goal of providing electricity to all citizens by 2020. At present about 53% of the total population of Bangladesh has access to electricity and per capita Electricity generation is only 272 KWh but reliable and quality supply of power is still a faraway. In financial year 2012, total electricity generation capacity is 8,100 MW including 3,771 MW from private sector and electricity demand growth 10% per annum. Country's maximum electricity demand will be 13,000 MW in 2017 and 34,000 MW in year 2030. To meet up these, the Government of Bangladesh has formulated a Power System Master Plan (PSMP). Power System Master Plan (PSMP 2010) recommends diversification of fuel used for electricity generation because present primary energy i.e. natural gas supply will decrease after 2017 and opt coal as a prime energy for electricity generation. The Master plan targets, by 2030, 50% of power generation would be coal based (domestic and imported). Coal import has two advantages, BPDB may choose coal of having low Sulfur content from international sources, and may avoid coal washing and processing related hazard at plant site.

In this regard, BPDB plans for installation of three coal based mega thermal power stations. One of the proposed power stations is **Khulna 1320MW Coal based Power plant.** The proposed thermal power plant will be a joint venture of BPDB and NTPC Ltd., India under the name of **Bangladesh-India Friendship Power Company**. Accordingly, BPDB and NTPC have signed a Joint Venture Agreement on 29 January 2012.

BPDB has entrusted CEGIS the responsibility for conducting the IEE and EIA studies with the aim of obtaining Site Clearance Certificate and Environmental Clearance Certificate from DoE. The IEE study has been completed and submitted to DoE. The project proponent has already obtained Site/Location Clearance Certificate from DoE on 23 May, 2011 upon submission of the IEE report. This report presents the Environmental Impact Assessment prepared as per the ToR approved by the DoE.

There are two major environmentally sensitive zone situated to the south (*e.g.* Sundarbans) and north (e.g. Khulna city) of the proposed project. The presence of those two major sensitive areas, the EIA of the project has been studied very carefully.

Points of interest	Distance in Km from plant
Zero point of Khulna City	23
Rampal Upazila Head quarter	11
Mongla Port	14
Proposed Khan Jahan Ali Air Port	12
Sundarbans	14
ECA Boundary including 10 km zone of Sundarbans	4
World Heritage site of Sundarbans	70
Hiron Point of Sundarbans	97

The IEE study advocated Sapmari Katakhali, Rampal as the suitable site in comparison to Labanchara, Khulna site for the proposed coal based thermal power plant. The Rampal site is located around 23 km southward from the Khulna City, 11 km North-eastward

from Rampal Sadar Upazila, 14 km North-eastward from Mongla port, 14 km north-westward from the nearest point of Sundarbans and 4km north-westward from the declared Ecologically Critical Area of Sundarbans (including 10 km radius from forest boundary).

Policy, Legal and Administrative Framework

A set of Policy, Acts and Administrative Framework require for a new coal based thermal power plant. According to the ECR, 1997 this power plant project falls under red category where environmental clearance certificate from DoE is obligatory. This study has been detail out of the relevant national acts and rules in different phases of the power plant project. Chapter 2 figure out the specific laws or legislatives works related to power plant construction and operation process. National and international acts are identified for the coal-based power plant and for the transportation, handling process. In addition, national environmental standard limit has been specified and it has been compared to the international standard for the best practice of this project. This document focuses on the issues addressing the specific impacts which have been evaluated, mitigated and suggested the management and monitoring plan within the standard practices.

Approach and methodology

The study has been conducted following the ToR approved by the DoE. The approach and methodology adopted for this study complies with the DoE and World Bank's Guideline of Environmental Impact Assessment. The international standardized multidisciplinary approaches and tools along with participation of local people and stakeholders were adopted in carrying out the study. In the EIA study, attempts were made to identify and evaluate all potential impacts through Delphi method and develop the Environmental Management Plan including hazard and risk management plan and Monitoring Plan for mitigation of the negative impacts, enhancing the positive impacts and monitoring the impacts and responses of the measures as mentioned in the EMP. The details of the methodology have been described in Chapter 3.

Evaluation of alternative sites

DoE has already issued Site Clearance Certificate on 23 May 2011 upon evaluation of alternatives sites reported in IEE. The evaluation has further been reconciled taking consideration of comments of DoE and other experts. Chapter 4 describes detail of the evaluation of alternative sites for selection the project location.

The Rampal site is finalized comparing the two alternative sites: Labanchara, Khulna and Sapmari Katakhali, Rampal, Bagerhat. Due to less availability of land, dense settlement, chances of significant impact on air quality of the nearby city, low depth of Kazi Bacha River, the Labanchara site was found less feasible for the proposed project. On the other hand, the Sapmari Katakhali site is located 4 km away from the ECA boundary, 14km away from the Sundarbans, and 70km away from the world heritage site. Navigability of Passur river, low density of settlement, direction of prevailing wind, feasibility of coal transportation system, less chances of impact on air quality beyond the project boundaries, are the prime factors in selecting the Sapmari Katakhali site. The project location covers Sapmari Katakhali and Kaigar Daskati Mauza of Rajnagar Union. Besides, the land requirement has also been revised minimizing 475 acre (192.226 ha) of land and avoiding around 150 households at

the preliminary survey period. The comparison matrix between the two alternative sites is presented in Table A.

Table A: Comparison matrix of alternative sites

Criteria	Indicator	Site 1: Labanchara	Site 2: Sapmari Katakhali
Minimum disturbance to the society	Population density	647 persons per sq km	121 persons per sq km
	Sensitive cultural heritage	1 Mosque, 1 Shrine	1 Madrasa
	Occurrence of city at downwind direction	Khulna city is only 2 km northeast. Therefore, prevailing wind transport the power plant emission to the city maximum time in the year	Khulna city is 23 km Northeast direction. Hence, emission from the power plant will hardly reach to the city and will barely have any effects on community.
Minimum disruption to water resources	Obstruction to drainage system	Potential to obstruct local surface runoff	Insignificant obstruction to the drainage systems
Minimum use of agricultural/fisheries land	Total cropped area in ha (Cropping Intensity x cultivable area)	Net cultivable land is high due to high crop intensity 3055 ha (1358 x 2.25)	Net cultivable land is low due to low crop intensity 866 ha (866 x 1)
	Fisheries habitat (natural and aquaculture)	1. No use of open water fish habitat 2. Some acres of shrimp/ prawn gher are present in the proposed acquisition plan 3. There are some freshwater fish ponds in the proposed project boundary	1. No use of open water fish habitat except some creeks that have been occupied by the shrimp farming 2. Most of the land to be acquired are occupied by shrimp farming 3. No fresh water fish pond exists within the project boundary
	Fish landing sites/centers	No	Exist of local fish landing center
Minimum Ecosystem destruction	Location and distance from Sundarbans	33 km (satisfies ECR 1997) South-west. Only during winter (November to February) wind prevails from North west to south east.	14 km (satisfies ECR 1997) south west. Only during winter (November to February) wind prevails from North west to south east and rest of the year it flows toward northwest.
Minimum disturbance to ecotourism	Distance from world heritage site	103 km	70 km

Criteria	Indicator	Site 1: Labanchara	Site 2: Sapmari Katakhali
Use of maximum *Khas* land	Amount of *Khas* land	Less than 5%	5-10%
Coal transportation and supply	Maximum Allowable Draught	2-3 m	Up to Mongla port Jetty: 6 to 6.5 m Mongla port to project location: 6.5 to 7.5m
	River sedimentation	Around the project area	At Right Bank of Passur near project location and at the North-western edge of the project boundary
Construction facilitation	Construction materials, transportation and labor	Available	Available
Site suitability	Land price	25,000-30,000 per decimal	8,000 -10,000 per decimal
	Average land elevation	7 m PWD	2 m PWD
	Historical Maximum Surge Height	10 m PWD (during SIDR as per perception of the local people)	5 m PWD (during AILA as per perception of the local people)
	Land filling (average)	(+) 3m land filling will be required	Ground level should be raised to RL (+) 5.0 m above MSL
	Extent of erosion	Minor	Minor
Communication	Road communication	6 km pavement road Khanjahan Ali Bridge to Batiaghata Upazila across the site	1. Three connecting roads (Brick Soiling and Earthen) from Dhaka-Mongla high way the Project location 2. A proposed road of 40ft width from Dhaka-Mongla highway (Bhanga point) of Kaigar Daskati
	Railway communication	No	Proposed railway network (from Khulna to Mongla)
	Waterway communication	Kaji Bacha River	1. Passur River 2. Maidara River 3. Other Rivers
Sharing the benefit	Equitable distribution	Respondents are hopeful about getting benefits	Respondents are hopeful about getting benefits

Project brief

The proposed project will us modern technology of a super critical pulverized coal fired thermal power plant with a capacity of 1320MW having two units of 660 MW each with

provision of further installation of two units with rated capacity of 1320MW in future. The plant will be designed in such a way so as it will ensure minimum environmental pollution and maintain all standards of MoEF. Surface water of the nearby Passur River will be used for meeting different demand including makeup of circulating water systems (cooling, boiler, etc), service water, domestic water, water for ash management, etc. Coal in the range of 5800 to 6100 Kcal/kg, having low Sulfur content (less than 0.6%), and max. 15% ash content shall be imported from Indonesia, Australia and South Africa. The coal will be imported through Mongla Port Navigational facilities (not berthing facilities). The project's salient components include two units steam turbine of 660MW each, two forced draft cooling tower stations of the wet type, cooling water intake station at riverside including proper intake piping and discharge channel, stacks of 275 m each, residential and social area, water treatment plant, sub-station, coal terminal, coal handling and coal silo, ash disposal area, and greenbelt. Project design and description is elaborately described in Chapter 5.

Proposed project at a glance

Component	Design condition
Plant type	Supercritical Pulverized Coal
Carbon capture	No
Net power output	1320 MW
Primary fuel (type)	Bituminous or Sub-bituminous coal
Coal requirement	12,920 MT/Day (for 100% Plant factor)
Ash production	15%
Flue gas flow	4.47 x 10^6 Nm^3/hr
Temperature of flue gas at stack	125^0 temperature
Emission SOx max	819 g/s from each unit
Emission NOx max	490 g/s from each unit
Particulate matter	100 µg/Nm^3 from each unit
Stack height	275 m
Water intake (Make up water, 2.5417 m^3/s)	9,150 m^3/hr (<0.04% of the dry season discharge of the Passur)
Water discharge (within ECR 1997 standard)	5,150 m^3/hr
Water consumed	4,000 m^3/hr
Thermal Plume/Heated Water Discharge	No discharge of heated water

Source: Feasibility Study Report

Total cost will be covered from investment of Bangladesh Power Development Board (BPDB) and NTPC Ltd., India (30%) with 50:50 equity and loans from external sources (70%).

Environmental and Social baseline conditions

The proposed site in Sapmari Katakhali, Rampal is located in the region of tidal delta that is geologically described as paludal deposits. The project location is seismically lower active zone with the seismic co-efficient 0.04g. The noteworthy aspects of the physical environment include rural setting with dominating shrimp farms, flat topography with some low lying area, tidal flushing, salinity dominant in both surface and ground water, scattered forest along the tidal flood plain of the inter tidal canals and rivers exposed to extreme cyclone and storm surges. Similar to the other parts of the country, southerly monsoon wind is dominant in the study area. Only during November to February wind flows from north to southwards.

Passur and Sibsa are the two major rivers in the study area. The project area is surrounded by the Passur river and the Maidara-Ichamoti system. Tidal range in the Passur-Sibsa

system varies between 1.2 m and 3.1 m. The semi diurnal tide enters the tidal flood plain by numerous tidal creeks. However, in the project area, local shrimp farmers raised natural levee of the riverbank to prevent tidal inundation.

The Passur river is the only approach river of Mongla port. Water depth varies at different reach of the river. Near Akram point, water depth of the Passur near is more than 20m where near the Port jetty the depth is only 6 m to 7 m. However, adjacent to the project site the river depth varies 5m to 6m. Maximum $12.95x10^5$ m^3 of surface runoff per day from the project site will join to the nearby Maidara and Passur River during high rainfall. The river plays an important role in water communication and transportation in the region.

The area is remotely accessible due to poor road and communication network. Pedestrian access through some rural earthen roads, which easily become muddy and damaged due to rain, is the modest mode of communication. The area is low densely populated and shrimp farming is dominating source of living. The lives and livelihood assets of the local people are very vulnerable to natural disaster due to inadequate cyclone shelter and poor road and communication system.

The study area (project 1,834 acre and around 10 km) comprises of the Ganges tidal floodplain. The net cultivable area is about 75.4% of the gross study area where only 0.5% intertidal, 0.2% forest, 0.1% water bodies, 9.3% rivers, 0.41% roads and 14.1% settlements. In the project area, all the lands are used for mono-cropped as T. Amon. In the Rabi and *Kharif-I* season, the lands remains as fallow. However, the proposed project area contributes about 467 tons of paddy production. The inhabitants of the study area domesticate poultry and livestock for household economic support.

The fisheries sectors of the study area dominate with the estuarine fisheries providing support to a number of marine and fresh water fishes. The culture fishery resource is dominated with shrimp farms, pond fisheries, and brackish and fresh water fishes. The estimated total fish production from the project area is about 569.41 million ton where only capture fisheries are 4.79 million ton & culture fisheries is about 564.62 million ton.

The study area is also ecologically very important due the world famous Sundarbans mangrove Forest. A detail features of the Sundarbans ecosystem have been elaborated under the base line study since the nearest point of Sundarbans is located about 14 km from the plant location. Brackish water ecosystem is the noteworthy aspect the ecological condition of the study area. The study area is also rich in biodiversity. The detail of the ecosystem and have been discussed in the Chapter 6.

The selected study area (e.g. including the project) includes 10 Unions and 29 Mauzas. About 3,378 households settle in the study area with the average of 4.9 persons per household and 1.16 rate of growth. In the study area, day laborer is higher in number than other services as most of them directly or indirectly related with shrimp farms or agricultural actives. Eventually, Shrimp cultivation is no more beneficial at presents due to viral attacks. The remaining benefits from the shrimp farms go to the owners not for the laborers. Insufficient communication network, remote location, lack of literacy and traditional expertise are some other obstacles for alternative options of income opportunity. Moreover, frequent cyclones, storm surges, tidal floods and salinity reducing the quality of life and

livelihoods of the population of the study which subsequently makes them to force migration.

In addition, the baseline of the study has been carried out considering the temporal and spatial specification in order to management and monitoring the projects in different phases.

Important environmental and social components

The potential environmental and socioeconomic impacts have identified considering the existing environmental and social aspects of the study area. Impacted components have been identified during pre-construction, during construction and post construction/operation stages. Each of the affected or potentially affected components of physical environment (*e.g.* landscape and scenic beauty, heat radiation, air quality and noise etc), water resources (*e.g.* surface water quality and quantity, ground water availability, accretion and erosion etc), transportation system (*e.g.* traffic load, navigation etc) land resources (*e.g.* land use, land nutrients, soil status etc) agriculture (*e.g.* crop production, loss etc) and fisheries (fish diversity, fish production etc) ecology (*e.g.* Sundarbans ecosystems, flora, fauna, benthic community etc) socio-economic (population density, occupation, health etc) have been rationally identified in the Chapter 7. Those selected components are very much related with the coal based thermal power plant and its handling, transportation process particularly in Sundarbans region.

Environmental and Social Impacts

Environmental and social impacts have been estimated according to the project description and scheduling of the feasibility report. The potential impacts for important components are described one after another.

Impacts on landscape

Impacts of landscape during pre-construction & construction stage might be lessen the scenic beauty and topography of the project area for a certain period of time. Most of the impacts related to landscape are described in section 8.2.3 and impacts of landscape during operation stage are also described elaborately in section 8.3.3. Site establishment and construction activities may be an issue of visual intrusion only. After completion, the eco-park, buffer zone and plantation program etc with the project development, the landscape and scenic beauty are no more issues during operation period.

Impacts on air quality

During construction activities, minor increase of Suspended Particulate Matter (SPM) in the local air within the close proximity of the construction yard within the project area may be noticed due to sourcing of fugitive particulate matter from different construction activities and vehicle movements on earthen roads. Adoption of air quality management plan during construction phase would keep the SPM within the limit of ECR 1997.

During power plant operation, the emission from SO_x, NO_x, and fly ash might not be significant as the plant will be designed adopting environmental protective measures to limit within the standard of emission. All the gaseous pollutants will be discharged after treatment and through the stack of 275 m height. For reducing SO_x emission low Sulfur content coal (less than 0.6%) will be used. In addition, provision has been kept for future installation of Flue Gas Desulfurization (FGD) plant to limit SOx emission within the ECR 1997 standard in case of taking decision for importing higher Sulfur containing (e.g. >0.6%) coal.

Supercritical boiler reduces the carbon emission compared to other existing technologies by JVC.

1-hr and 24-hr Ground Level Concentration (GLC) of SO_x and NO_x have been estimated using USEPA approved SCREEN 3.0.0 model. The model predicts maximum Ground Level Concentration (1-hr and 24 hr) at 1.5 km down wind direction which is within the project area. However, beyond the project area emitted SOx, NOx and SPM dispersion will be below the ambient air quality standard. The contribution (GLC) of SO_x and NO_x in the ambient standards would be insignificant to have impact on air quality.

In the Sundarbans region, the resultant concentration of the ambient air quality would be much below the ambient air quality standard of MoEF. The following Table-B briefly summarizes the impacts of emission on air quality of Sundarbans.

Table B: Summary of Resultant Impact of Plant Emission on Air Quality of Sundarbans

Emission	Emission contribution of from each unit (24 hr avg.)	Emission contribution of from two units (24 hr avg.)	Concentration in ambient air (24 hr avg.) near Sundarbans	Resultant concentration in air (24 hr avg.) near Sundarbans	MoEF's Standard (ECR 1997)
SO_x	21.2 µg/m^3	42.4 µg/m^3	8 – 11 µg/m^3	50.4 – 53.4 µg/m^3	80 µg/m^3
NO_x	15.6 µg/m^3	31.2 µg/m^3	16 – 20 µg/m^3	47.2 – 51.2 µg/m^3	80 µg/m^3

Chances of shoreline fumigation may be very low due to wind condition, flat terrain and undisturbed dispersion of emissions. The long term concentration of SOx and NOx may not be significant as the site is located in an area prone to frequent cyclone that may periodically disperse the pollutants.

Impacts of air quality during pre-construction and construction stages are described in section 8.2.5. Similarly, impacts of ambient air during operation stage are described in section 8.3.5. Impacts of ambient air quality during coal transportation, transshipment and handling is discussed in section 8.4.1.

Noise

The proposed plant may produce noise but very limited noise outside the project boundary. The project's purpose planted greenbelt and boundary wall will act as noise barrier. All the potential sources of noise during pre-construction, construction and operation stages have been identified and discussed in 8.2.6 and 8.3.7 respectively. Noise from coal transportation and handling and its impacts are also discussed in section 8.4.2.

Solid waste

Solid waste disposal during operation stage is described elaborately in section 8.3.8. During construction phase, different kind of construction solid waste may be generated from construction activities and shall be managed properly to prevent any impact on surrounding environmental quality. During operation, coal dust, bottom ash and domestic waste may also be the major types of solid waste, which may be generated from the plant and as such proper EMP has been suggested. More than 99.9% efficient ash collection and management plan has been adopted to limit the ash emission within the limit of ECR 1997.

Impacts on water resources

The power plant will withdraw 9,150 m^3/hour (e.g. 2.54 m^3/s) from the Passur River for operating the project. This water is only 0.04% of the lowest flow e.g. 6,000 m^3/s condition of Passur River. Finally, 5,150 m^3 per hr water will be discharged to the same river after appropriate treatment from central effluent monitoring systems. The project adopts integrated water management system; hence no waste water shall be discharged directly to the river without treatment satisfying the standard of ECR 1997. No thermal plume shall be discharged to the river as the plant adopts closed cycle cooling system. The waste water may include wash off from coal stockpile, boiler blow down, plant processes water, and domestic waste water. The amount of wastewater will be reduced through recycling and reusing the boiler blow down and cooling water. The inbuilt measures provide reuse and recycle option, central effluent treatment and final disposal. The details of the impacts on water resources described in sections 8.2.8, 8.3.9 and 8.4.4.

Impacts on land and agricultural resources

Acquisition of 1,834 acre (742.20 ha) of land mostly using for shrimp farming and one season rice cultivation may reduce crop production of the locality. During operation phase, the impact of the plant on surrounding agricultural land would be minimum. On the other hand, use of ash may increase land fertility as well as crop production. The plant shall be operating with automated monitoring system and central controlling system to prevent any accidental event. Impacts on agricultural resources during pre-construction and post construction stage is described elaborately in section 8.2.10 and impacts on agricultural resources during operation stage is described in section 8.3.12.

Impact on fisheries

Acquisition of shrimp farming land may reduce only the culture fish production of the area. Only some minor immediate and short term impacts on fish habitat may be observed in case of dredging activities for sand filling for site development. Water intake, discharge of treated water and coal transportation activities may cause limited impact on fisheries of the study area. The details of the impact on fisheries during pre-construction and construction stages are discussed in section 8.2.12. Moreover, Section 8.3.14 describes details of the impacts of plant operation on fisheries habitat, production, and diversity while section 8.4.7 describes impacts of coal transportation on fisheries.

Impact on ecosystem

Impact of ecosystem during pre-construction and construction stage is described elaborately in section 8.2.13.The existing mangrove strip along the Passur River within the project site shall be conserved limiting the vegetation clearance activities. Special care shall be taken to minimize all kind of base stripping activities. Site establishment may require clearing of bushes. The existing shrimp farming ponds that serve habitat and food sources for a number of aquatic birds including heron, egrets, kingfisher, etc may be shifted as an area of 1,834 acre (742.20 ha) has been acquired and to be developed for site establishment.

Impacts during operation phase is discussed in section 8.3.15.The operation of the plant possesses less impact on ecosystem as it will emit extremely low SO_x and NO_x. The dispersion of the air pollutants will not cause any affect on Sundarbans ecosystem. The emitted pollutants may reach the Sundarbans within the limit of ECR 1997 as the nearest

point of Sundarbans is located 14 km away from the plant. Moreover, maximum time of a year (e.g. about eight months) the prevailing wind flows towards North eastern direction (opposite to Sundarbans). Only during November to February, wind prevails mostly towards South and South East. Therefore, SO_x and NO_x contribution from the power plant in the Sundarbans regions would be insignificant to have impact on air quality of Sundarbans. It is estimated, using USEPA approved Air Quality Dispersion Model (SCREEN 3.0.0) that the resultant concentration of the SO_x and NO_x would be maximum 53.4 µg/Nm^3 and 51.2 µg/Nm^3 respectively including base line concentration whereas, the ambient air quality standard for SO_2 and NO_2 is 80 µg/Nm^3. Hence, it can be presumes that the ecosystem of the Sundarbans would not be affected due to the emission from the power plant.

Disturbance to habitats of birds and mammals in Sundarbans, dolphins, crocodiles in Passur River and their migration are also considered during coal transportation. The route of coal transportation is exactly same used for Mongla port and the width of the Passur river is more than 2 km inside the Sundarbans. Moreover, adoption of biodiversity conservation program, proper management plant and enforcement of ECR 1997, IMO Conventions, and other relevant environmental regulations will keep the habitants sustainable for dolphins or crocodile.

The other impacts of coal transportation e.g. shoreline erosion, fuel contamination in water column, coal pollution, coal dust generation, noise, etc would be limited due to enforcement of ECR 1997, IMO Convention and other relevant laws as discussed in Chapter 2. Oil spillage, coal spillage, pollution from ships and wrecks shall be within the acceptable limit due to enforcement of the laws, IMO Conventions, etc by MPA, BIWTA and DG Shipping and implementation of the suggested EMP by the Coal Transportation Agency. The details of the impacts of coal transportation on ecology are provided in section 8.4.

Impact on socio-economy

BPDB acquired 1,834 acre (742.20 ha) of land for the project purpose. Land acquisition may cause Property loss (agricultural land, shrimp farming land and house) and loss of income generating activities of the Project Affected Persons (PAPs). The acquisition requires resettlement of households. BPDB has paid compensation money amounting BDT. 625 million from the DC office as per the Acquisition and Requisition of Immovable Property Ordinance, 1982 that may help the PAPs to recover their losses. On the other hand, the power plant may trigger positive impacts like regional development, creation of employment opportunity, and thereafter improvement of livelihood. The proposed thermal power plant will bring social and economic development of the region through infrastructural improvement, rural electrification and industrial development. These developments might reduce the poverty of the region through generation of employment opportunity and income generating activities. Impact on socio-economy during pre-construction and construction stage is described in section 8.2.14. All the potential negative and positive impacts of the proposed power plant on socio-economy are discussed in section 8.3.16.

Impact evaluation

Potential impacts have been identified of the proposed power plant in detail. Their mode of impacts are identified in multiple aspects for taking appropriate controlling measurement. Chapter nine (9) represents a detail evaluation of the impacts on the basis of nature, extend, temporal, spatial, reversibility and likelihoods in matrix form. After taking the inbuilt

pollution abetment measures , those impacts have been ultimately categorized into different classes like minor, moderate, significant etc. Loss of shrimp farm or agricultural land (*e.g.* 1,834 acre in total) and aquatic birds feeding ground are significantly impact during preconstruction for land development. In the mean time, communication network will be improving significantly and flourishing livelihood opportunities during the construction period. Releasing of CO_2 is the major resultant pollutants after using high efficient modern thermal power plant. However, socio-economic improvement will be the significant insights for the south-west region in future.

Measures for Impacts

Mitigation of negative impacts and enhancing the positive impacts are the prime intent of this environmental study that represent in a separate chapter (*e.g.* Chapter 10). Potential impacts of the proposed power plant have been identified at every steps of development, the mode of impacts have been detailed ins and outs to understand its significance towards the adjacent Sundarbans ecosystems, socio-economic, ambient environment, landscape and water resources. Aftermath, this study suggests necessary mitigation measures to the project with the objective of limiting negative impacts as minimum as possible in compliance with ECA 1995 and enhancing ecological and societal benefit. Therefore, all of the identified impacts have been further evaluated without and with mitigation measures. The resultant impacts will reduce considerably after taking the suggested measures. Effective and timely compensation both for properties and livelihoods loss would attenuate the socio-economic impacts of the project affected people. In addition, introducing awareness and capacity building activities, technical training, incentives, safety net program, disaster management program and infrastructure development would flourish the positive benefits into the society. Installation of modern technologies like ESP, Supercritical boiler, automatic pollution monitoring stations will reducing the negative externalities of the project significantly. Regular training, monitoring, greenbelt development program, fish sanctuary, dolphin conservation program will be the landmark paradigm in this project. However, the project benefit is significantly depends on effective spatial and temporal monitoring, compliance monitoring and stack holder consultation regularly.

Hazard and risk assessment

Hazard and risk assessment is important for any energy related industries. Chapter 11 describes hazard and risk assessment. The proposed project may possess mechanical risk from turbine and generator; electrical risk from power transformer, switchyard, 400 KV & 230 KV switchyard control room, 400 KV & 230 KV transmission line; risk of fire and explosion from boiler, live steam line, and fuel stockpile; risk of toxic/carcinogenic chemical exposure from chemical storage and accidental discharge of sulfuric acid from SOx absorber. In addition, some hazards may be produced from malfunctioning of machinery and equipment like filter, ESP, air pollution control devices, air circulating system of boiler, lightning arrestor, safe working place, etc. To mitigate these risks, necessary the specific measures have been identified in this report. As the project activities include working on height, near rotary machinery and parts, high pressure parts and pipeline, high voltage yards and handling of hazardous materials, the project may possess occupational health risk. The risk includes: risk of stick by falling/moving parts, rotary parts; fire; explosion; falls from high height; electrocution; intoxication; spreading of contagious diseases.

Hazards and risk related to shipping and barging activities for coal transportation have also been assessed. Hazard and risk management plan has been prepared to limit the risks of any accidental hazards.

Environmental management plan

As per the scope of EIA study, a detail Environmental Management Plan (EMP) has been developed that shall be duly implemented in project preconstruction, during construction and operation phase in order to minimize the negative impacts. The management plan has been categorized into inbuilt abatement measures and external management measures that have been described elaborately in Chapter 12.

The inbuilt environmental management plan

- Air quality management plan
- Noise management plan
- Waste management plan
- Coal stock yard management plan
- Coal transportation management Plan
- Waste water management plan
- Hazard and Risk management plan
- Health and safety management plan

Additional environmental management plan

- Water resources management plan
- Land and agriculture management plan
- Fisheries management plan
- Dolphin conservation plan
- Ecosystem management plan
- Afforestation plan
- Socio-economy management plans
- Awareness and skill development training

These plans suggest mitigation, enhancement, contingency, and compensation measures for implementation in pre-construction, during construction and post construction/operation stages. The EMP has been evaluated through analyzing the impact with and without EMP implementation. It has been found that EMP will mitigate most of the negative impacts significantly and enhance the benefits as much as possible. Based on feasibility report, the inbuilt abatement measurers will cost about BDT. 12561.00 million. In addition, environmental management plan will be provided with the cost about BDT. 369.00 million in different phases of power plant. The Government of Bangladesh decides to spend 0.03 BDT/kWh against the fund of CSR (Corporate Social Responsibility) for regional social development activities. Responsible authorities like BPDB, Joint Venture Company, EPC contractor, local administration has been identified separately for carrying out environmental management plan properly. Nevertheless, the environmental management plan will be updated and improved more precisely in future based on the monitoring consequences and results of the implemented environmental management plan.

Environmental monitoring plan

Successful implementation of the EMP depends on regular monitoring with the selective indicators at specified locations. The automatic inbuilt mentoring devices regularly update every potential source of hazards and the project personnel will submit the performance report particularly the level of emissions compliance to ECR 1997. Therefore, an individual environmental monitoring team has been proposed under the department of environmental health and safety. Environmental quality and safety department for monitoring the EMP implementation in pre construction, during construction and operation phase of the project. A number potential location has been identified outside of the power plant for measuring the ambient pollution level which has been expressed in chapter 13. The potential pollutants of air, water and acoustic environment will be identified through the real time automatic pollution monitoring devices during construction, operation of the power plants as well as transportation and handing of required coal. Moreover, compliance monitoring has been suggested mandatory for this project due to the presence of Sundarbans. The environmental monitoring officer should monitor the EMP implementation and submit a quarterly report to the concerned department. The monitoring cost has been incorporated during estimation of EMP cost. Additionally, another yearly monitoring report with quarterly monitoring data should be submitted to the DoE.

Benefit and cost assessment

Benefit and cost (BC) analysis of the proposed projects is an inherently uncertain enterprise because it involves the future, which is influenced with multiple phenomena. The project compensation cost BDT 625 million has not been included in this analysis. The opportunity cost of the project (*e.g.* leasing cost BDT 50,000/acre per year) and maintenance dredging cost BDT. 320 million in a year has been included in financial and economic analysis into the project feasibility study. According to the feasibility study, the financial outputs (NPV-BDT.-593.0.4 million, BCR-0.99 & IRR-8.53%) has estimated considering the discounting rate 9% where economic output (NPV-BDT.-1217 million, BCR-1.0 & IRR-11.9%) has estimated considering the discounting rate 12% and 8.5% plant factor. Detail financial and economic analysis has been carried out by the main consultant in the feasibility report.

The potential impacted elements or processes have been indentified from direct, indirect, optional and intrinsic values where only the tangible values has been taken for economic and financial analysis. Project compensation, land lease, capital, operation, maintaining, monitoring cost were been accounted in feasibility study. A number of inbuilt pollution abetment measures will be taken care to keep the ambient environment clean during the project life and strictly monitoring any kind of negative externalities related to the power plant project. About BDT. 12,930 million will be the estimated cost of the pollution abatement measures along with additional environmental management plan. GoB has approved to spend about BDT. 277.2 million per year for regional socio-economic development. Because of increasing the social and ecological benefit, the predicted tariff of will be raised to 8.49 BDT/kWh for first year and 8.04 BDT/kWh for the following years according to the feasibility report. Reliable supply of electricity to the national grid *e.g.* BDT. 74281.5 million revenue per year will be the direct benefit of this project. However, with the electricity supply a number of primary, secondary and tertiary benefits will be taken places. The intangible benefit of this project has been expressed in Chapter 14.

Stakeholder or public consultation and outcomes

A series of effective methods: PCM, KII, interviews were applied during stakeholder consultation to harness the stakeholders opinions, comments and suggestion towards the proposed project. The stakeholders consulted were from three tiers: Local people, Local Government Authorities and Government Departments. The local people have come to know about the project through the print media, Radio news, and local politicians. Most of the people are supportive towards the project considering the potential regional development, except the landowners whose lands were being acquired. However, this dissatisfaction gradually disappeared due to consultation and appropriate convincing measures taken by BPDB and the district administration. The Project Affected People (PAP) is conversant about the economical benefits and livelihood improvement from the project. Proper resettlement and compensation as per Government's Regulation and employment opportunity for the local people might resolve the public concerns and would make them cooperative towards the project. The major findings of the EIA along with the project planning information were disclosed at the local level through regular Public Disclosure Meetings. The Mayer of Khulna city corporation presided over a large public consultation meeting about the coal based power plant which was held at the study area (e.g. Rampal) with presence of local peoples, local administrations, local authorities, DoE and other organizations. The details of the stakeholder consultation processes, methodology, findings, and opinions are described elaborately in Chapter 15.

Conclusion

Bangladesh is improving with lots of shortfalls like natural disasters, population pressure, lower income etc. In order to progress the country (*e.g*. middle income) in accord with the international growth or regional (*e.g.* Asia) development and improve the countrymen standard quality of life, the Government of Bangladesh extremely realize the necessity of power generation. The present electricity crisis and rising electricity demand urge installation of new power plant. GOB has taken immediate response for installing coal based thermal power plant due to reducing the pressure on the limited reserve natural gas.

Under the Environment Conservation Act, 1995 the first set of rules promulgated is the Environment Conservation Rules, 1997. The Rules have provided categorization of industries where coal based thermal power plant falls into red category (Category –D). Besides, the presence of Sundarbans near to the proposed plant added especial attention to this EIA study. About 1320 MW electricity will be generated from imported coal as the coalmine of Bangladesh is yet under developing. Modern technologies with the sufficient environmental protection measures will be used for pollution abetment and mitigating the negative impacts. Numbers of measures and management plan have been distinctly instructed in this EIA study. However, the national demand on electricity generation have enormous positive feedback which will compensate the negative impacts after screening by the prescribed EMP.

Apart from the potential negative impacts, this coal-based thermal power plant will try to fulfill the regional electricity demand. The proposed project will create enormous potentiality of regional economic and social development. It will offer large number of job opportunity, industrial revival of Khulna region, infrastructural revolution, revive of Mongla port, increasing social security, communication network development, cultural improvement and

livelihood security in the south west region of Bangladesh. At the end, it can be justified that the potential benefits may outweigh the negative impacts if the suggested EMP and recommendations are taken care.

Recommendation

- Proper Resettlement and Rehabilitation plan is necessary for proper compensation and rehabilitation to the Project Affected People (e.g. properties and livelihoods)
- Findings and suggestion of EIA study in project planning, design and operation should be considered and implement with strong monitoring
- The plant should be operated ensuring all pollution abatement measures e.g. ESP, FGD (based on the coal quality e.g. sulfur contain is more than 0.6%), De-NOx burner, effluent treatment plant, etc are in order and regular monitoring has to be done to evaluate their performance
- Environmental Management Plan and, Hazard and Safety Management Plan should be implement at every suggested steps of plant pre construction, construction and operation
- Establishing Institutional arrangement with proper logistic and training for Environment, Health and Safety in Project Management Unit during pre-construction, construction and operation phases of the project

Chapter 1: Introduction

1.1 Background

Electricity is the key to all development. Sustainable power supply is a major precondition for the socio-economic development of Bangladesh. Access to electricity is now being recognized as a fundamental right. Notwithstanding the medium growth rate of our GDP, the per capita electricity generation, only 272 KW (BPDB, 2012), is very meager. Through, at present, 53% of the total population has access to electricity but reliable and quality power generation and supply is still a faraway. The Government assigns top priority to the development of power sector realizing its importance in economy, industrial and social development of the country. To this end, the government has set the goal of providing electricity to all citizens by 2020. In financial year 2012, total electricity generation capacity is 8,100 MW including 3,771 MW from private sector and electricity demand growth 10% per annum. Government forecasts that the maximum electricity demand would be 13,000MW in 2017 and 34,000 MW in 2030. To meet up this, the Government of Bangladesh has formulated a Power System Master Plan (2010). Taking consideration of high dependency on natural gas (77% of power generation comes from natural gas based units), Power System Master Plan (PSMP 2010) recommends diversification of fuel used for electricity generation because present primary energy i.e. natural gas supply will decrease after 2017 and opt coal as a prime energy for electricity generation. The Master plan, targets composition of power supply as of 2030 is set at 50% for domestic and imported coal, 25% for domestic and imported (in the form of LNG) natural gas and 25% for other sources such oil, nuclear power and renewable energy. The coal based generation is the least cost option in consideration to present economy.

In this regard, BPDB plans for installation of three mega coal based thermal power stations. One of the proposed power stations is Khulna 1320MWx2 Coal based Power plant. The plant shall be based on imported coal as the present indigenous production (only in Barapukuria) is not sufficient and the proposed power plant may be commissioned before development of coal mines in other coal fields. Besides, there are some advantages in case of imported coal, BPDB may choose low Sulfur content coal from international sources, which would not have to bear environmental hazards related with coal washing and processing (that to be made at mine mouth of the sources).

The proposed power plant shall be joint venture of Bangladesh Power Development Board (BPDB) and NTPC Ltd., India. In this context, BPDB and NTPC Ltd., India has signed the Joint Venture Agreement at Dhaka on 29 January, 2012. Name of company shall be "Bangladesh-India Friendship Power Company". Bangladesh and India (50:50) would invest 30 percent of its total cost for the coal-fired project while the remaining 70 percent would be obtained through loans from external sources. The proposed project is to be constructed in Rampal that covers Sapmari Katakhali and Kaigar Daskati Mauza of Rajnagar Union under Rampal Upazila in the district of Bagerhat (Map 1.1). The project is located at 22^{o}37'0''N to 22^{o}34'30''N and 89^{o}32'0''E to 89^{o}34'5''E and around 23 km south from the Khulna City, 11.5 km Northeast from Rampal Sadar Upazila, 14 km North-east from Mongla port and 14 km north-west from the nearest point of Sundarbans (Map 1.2). The location is 4 km away from

the declared Ecological Critical Area of Sundarbans[1] i.e. the Sundarbans within 10 Km radius around its boundary. Table 1.1 shows the aerial distance of surrounding important locations and structures from the proposed project site (center point of the project site).

Table 1.1: Aerial distance of different point of interest from the proposed project location

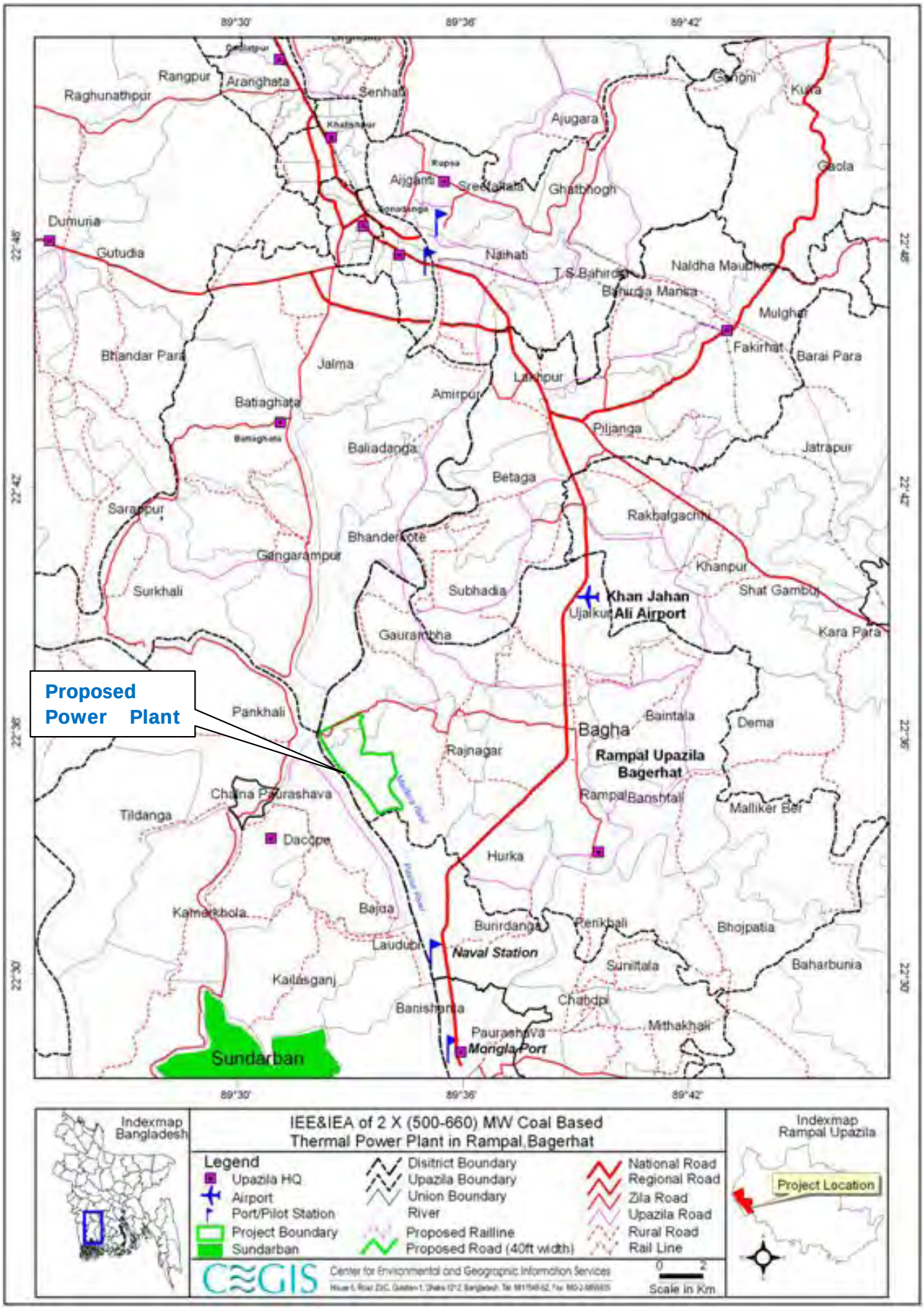
Sl. No.	Point of interest	Distance in Km
1	Proposed Khan Jahan Ali Air Port	12.12
2	Zero point of Khulna City	23.33
3	Rampal Upazila Head quarter	11
4	Mongla Port	14.16
5	Naval pilot station	9.76
6	Chalna	3.18
7	Khan Jahan Ali Bridge on Rupsha river	19.92
9	Road distance: Kaigar Daskati Boat point – Bagha Bazar (existing road)	14.46
10	Sundarbans Reserve Forest boundary	14
11	10 Km radius boundary from Sundarbans	4
12	Akram point of Sundarbans	67
13	Proposed Deep sea anchorage near Akram point	70
14	World Heritage site of Sundarbans	69.6
15	Hiron Point of Sundarbans	97

Sources: CEGIS Study

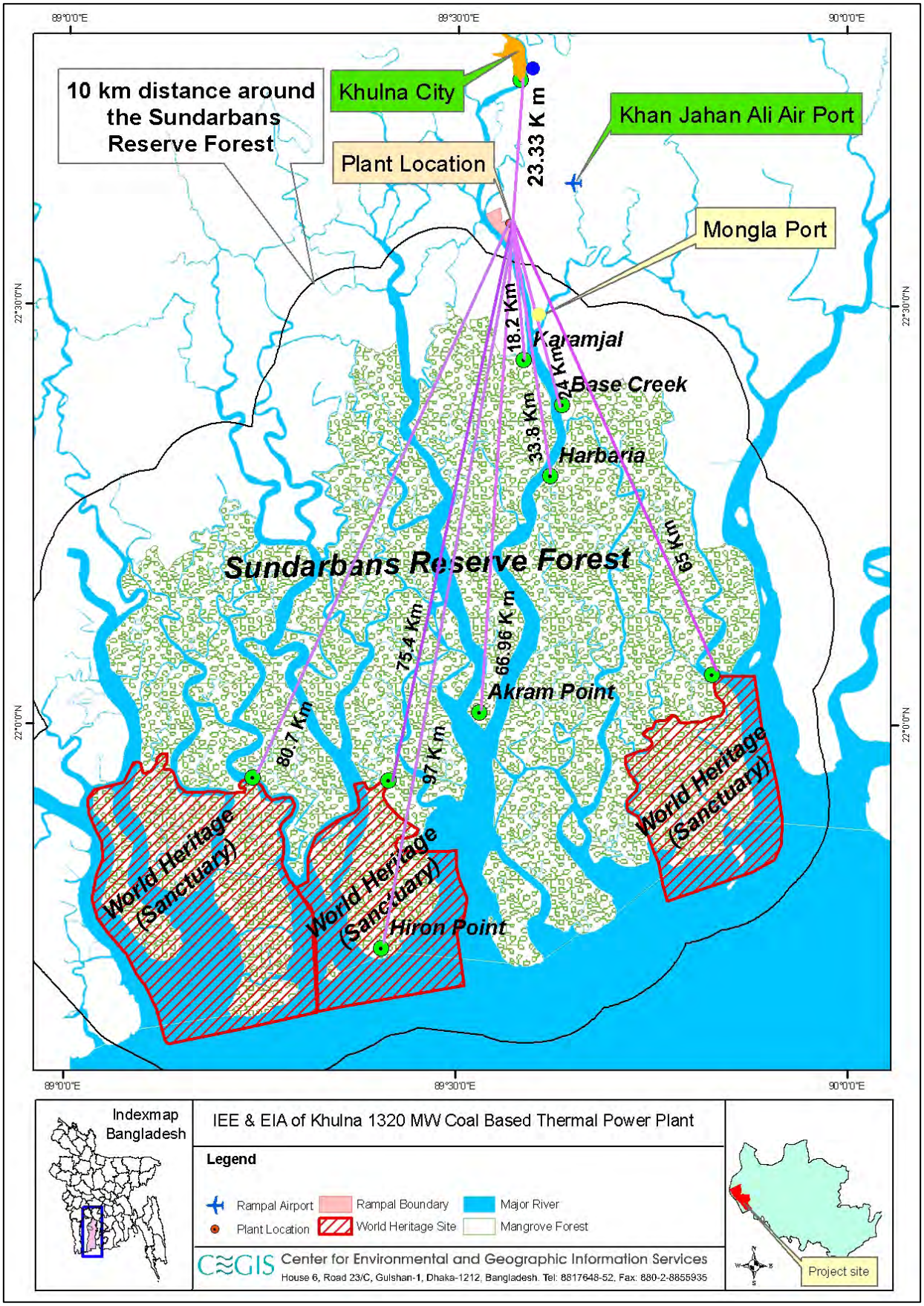
As stipulated in the Environmental Conservation Acts, 1995, no project shall be established without obtaining Environmental Clearance from the DOE and the detail procedure and steps have been described in the Environment Conservation Rules, 1997. The proposed project falls under the Red category of industrial classification made under the Environment Conservation Rules (ECR), 1997 which requires Location Clearance Certificate and Environmental Clearance Certificate from the Department of Environment (DoE). As such, for obtaining these aforementioned clearance certificates from DoE, the project proponent, BPDB entrusted CEGIS the responsibility of conducting Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) study under a Contract signed on 13th July, 2010 between BPDB and CEGIS.

The project proponent has already received Location/Site Clearance Certificate on 23 May, 2011 from DoE. This report presents the findings of the EIA study in the manner of DoE prescribed format and following the ToR approved by DoE, so that the project proponent can obtain the Environmental Clearance Certificate from DoE after submitting the EIA report to the DoE. The EIA report includes selection of alternative site through multi-criteria analysis, briefing of proposed project activities, prediction of potential environmental and socioeconomic impact, and development of an environmental management plan.

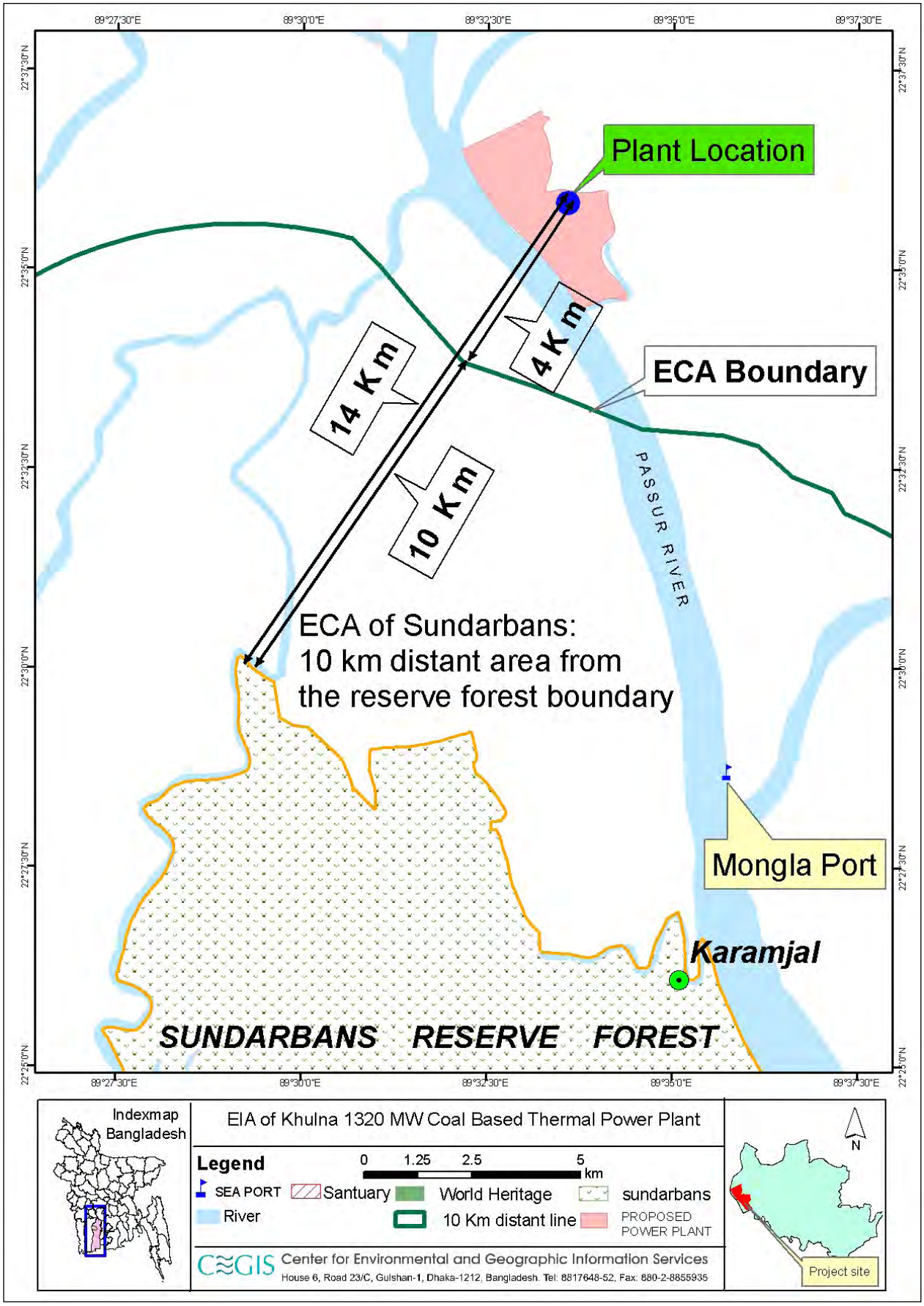
[1] The entire Sundarbans and its adjoining areas of 10 Km buffer outside the forest boundary have been declared as Ecological Critical Area through a notification issued under ECR, 1997 on 1999.



Map 1.1: Location of the proposed 1320 MW coal based thermal power plant



Map 1.2: Map showing distance of important features from proposed power plant



Map 1.3: Distance between Sundarbans and the proposed power plant

1.2 Purpose of the study

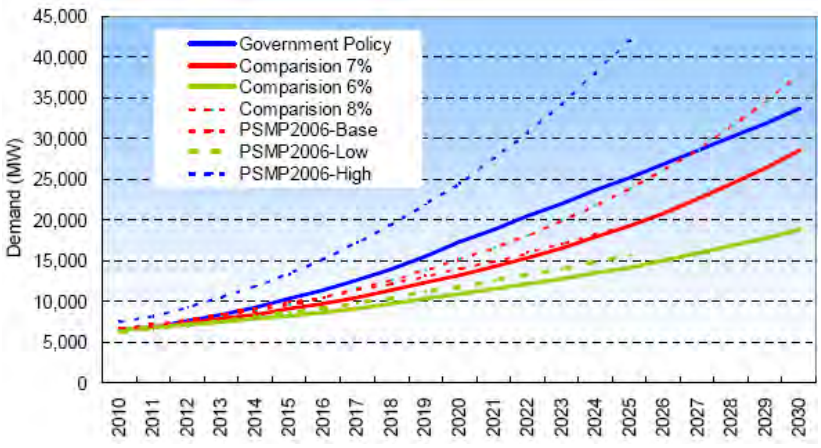
The proposed coal based thermal power plant falls under the Red category project as per ECA, 1995 and the followed up rules ECR, 1997, and needs Site Clearance Certificate and Environmental Clearance Certificate from Department of Environment (DoE). The IEE report has already been submitted to DoE and BPDB has already received Location/Site Clearance Certificate on 23 May, 2011 (Appendix V). This EIA study has been commenced with the objective of obtaining Environmental Clearance Certificates from DoE.

The overall objective of the study is to conduct Environmental Impact Assessment (EIA) study of the proposed 2 x 660 MW coal based thermal power plant with the purpose of obtaining Environmental Clearance Certificate from the DoE. The specific objectives of the study are;

- Analysis of alternative sites
- Identification of national and international legal environmental requirements
- Establishment of environmental and socio-economic baseline condition of the study area
- Prediction and evaluation of potential environmental and socio-economic impacts
- Assessment of occupational risk and hazard
- Identification of mitigation and abatement measures
- Development of Environmental Management Plan (EMP)

1.3 Need of the Project

At present, a total number of 79 Power Plants having total capacity of 7613 MW generate 4000 MW to 5500 MW on an average. Against this generation, the daily average demand at the generation end varies about 5100 - 6000 MW. In accordance to an unofficial calculation, the average shortfall is about 2000 MW per day. The demand of power is rising with the economic development of the country. MoPEMR has forecast power demand growth in line with the desired economic growth of the country under Power System Master Plan (PSMP, 2010). As per the forecast, with government policy scenario the power demand will reach 17000 MW in 2017 and 34,000MW by 2030. The PSMP also forecasts the demand as per different GDP growth rate. Figure 1.1 shows power demand forecasts of PSMP, 2010 up to 2030.



Source: PSMP, 2010

Figure 1.1: Power demand forecast for different scenarios

The present electricity crisis is hindering the national economic development by discouraging the foreign investment, disturbing the national industrial production and dropping the quality of living standard (Mozumdaer and Marathe, 2007). A research on electricity consumption and GDP growth reveals that Bangladesh losses industrial production about $1billion per year that reduces 0.5% of the GDP due to power outage. To mitigate the prevailing crisis of electricity demand as well as to achieve the desirable overall development of the country, the BPDB/GOB has adopted a power generation increase plan upto 2016 in line with the PSMP (2010). The summary of the plan is shown in the Table 1.2.

Table 1.2: Summary of the power generation increase plan

Year Type	2012 (MW)	2013 (MW)	2014 (MW)	2015 (MW)	2016 (MW)	Total (MW)
Public	632	1467	1660	1410	750	5919
Private	1354	1372	1637	772	1600	6735
Power Import	---	500	---	----	---	500
Total	1986	3339	3297	2182	2350	13154

Source: BPDB, 2012

Taking consideration of national gas reserves which is the primary energy of power generation of the country at present (79% of total power generation from gas based units), the PSMP recommends diversification of fuel for electricity generation and opts coal based power generation as least cost option to reduce the dependency on natural gas. In this line, Government has taken initiatives to install the proposed thermal power plant in Rampal, Bagerhat under the name of Bangladesh-India Friendship Power Company.

1.4 Importance of the Project

The proposed power plant will add 1300MW electricity to our national grid that will improve our present electricity generation significantly and as well as trigger our national economic development. Not only that, industrial development will be initiated after implementation. Additionally, it will create employment opportunity to the local people and improve transportation system in the project area, which will ultimately play an important role in poverty reduction and develop social safety net condition. Moreover, this coal based power plant will thereby play an important role in fuel diversification in electricity generation and reduce pressure on natural gas reserve.

1.5 Scope of the EIA study

The scope of the study includes identification of statutory requirements, prediction of potential environmental and socio-economic impacts and formulation of EMP. Detailed scope of this study are:

1. Investigation and survey
    - Topographic survey
    - Water quality data collection and analysis

- Physical observation for hydrological and morphological assessment
- Soil investigation
- Meteorological, air quality and noise level investigation
- Ecological survey
- Occupational Risk and Hazard analysis

2. Environmental policy and legal requirement analysis: both Statutory and World Bank Group's
    - for emission control
    - for handling and disposal of generated ash
    - for health and safety
    - Identification of obligatory requirements of World Banks Group's health and safety guidelines

3. Establishment of the environmental and social baseline conditions in respect of
    - Physical,
    - Biological and
    - Socio-economic condition.
4. Impact assessment
    a. Prediction and evaluation of potential environmental impacts
    b. Prediction and evaluation of potential socio-economic impacts
5. Identification of suitable control measures for emissions
    a. Control measures for SOx, NOx, CO_2
    b. Exhaust stack requirements
6. Preparation of Environmental Management Plan (EMP)
7. Preparation of the EIA report on the basis of DoE approved TOR for obtaining Environmental Clearance from the DoE

1.6 Study limitations

The major limitation of this study was unavailability of historical air quality data in and around Sundarbans regions. Another major limitation is unavailability of historically observed discharged data of Passur river as there is no discharge station of Bangladesh Water Development Board. However, attempts were made to overcome these limitations.

1.7 EIA team

The CEGIS has formed a multidisciplinary team of professionals having experience of conducting Environmental Impact Assessment and Social Impact Assessment of large scale industrial and infrastructural development projects. Table 1.3 presents the professionals' names with their positions.

Table 1.3: Team composition

Name of Professional	Area of Expertise	Position Assigned
Mujibul Huq	Environmental Assessments, Environmental Management, Natural Resources Management	Environmental Expert and Team Leader
Md Sarfaraz Wahed	Environmental Assessments, Water Resources Assessments, Planning, Water Quality Assessment	Water Resources Engineer
Engr. Md Fazlul Haque	Power Plant Planning, Implementation, Operation and Supervision.	Electrical Engineer
Dr Maminul Haque Sarker	River Morphology	Morphologist
Md Abdur Razzaque Sarder	Power Plant Planning, Implementation, Operation and Supervision.	Mechanical Engineer
Dr.SMA Rashid	Wildlife biodiversity, Ecological Assessment, Sundarbans Biodiversity, Environmental Assessments	Ecologist
Ashoke Kumar Das	Fisheries Resources Assessment and Management, Environmental Assessments	Fisheries Specialist
Dr Anil Chandra Aich	Agricultural and Social Resources Assessment, Environmental Assessments	Soil and Agriculture Specialist
Dr Dilruba Ahmed	Socio-economic Assessments, Environmental Assessments, Health and Safety Assessment	Socio-Economist
Ms Halima Neyamat	Environmental Acts, Rules, and Regulation	Environmental Law Specialist
Most Nazneen Akter	Environmental Engineering	Junior Environmental Engineer
Md Rayan Hosaain	Field Survey and Data Collection for Environmental Assessments	Field Researcher
Mohammad Masudur Rahman	Field Survey and Data Collection for Environmental Assessments	Field Researcher

In addition, to the above mentioned professionals some additional professionals listed below were also engaged in this study to complete it within the stipulated time.

Name of the professional	Area of Expertise	Assigned designation
Dr. K B Sajjadur Rasheed	Review of the Final EIA Report	Environmental Specialist
Md. Waji Ullah	Environmental Assessments, Water Resources Assessments, Planning, Water Quality Assessment	Water Resources Management Expert
Md. Maqbul-E-Elahi	Energy policy Assessment Risk and	Primary Energy Expert

Name of the professional	Area of Expertise	Assigned designation
	hazard assessment	
Kazi Kamrull Hassan	Environmental Assessments, Water Resources Assessments, Planning, Water Quality Assessment	Water Resources Specialist
Md. Shibly Sadik	Environmental Assessments (IEE, EIA, ESHIA, etc), Environmental Auditing and Inspection, Air Quality Assessment, Air Pollution Dispersion Modeling, Project Management	Environmental Specialist and Project Leader
Pronab Kumar Halder	Environmental Quality and Auditing	Environmental Specialist
Sabria Afrin	Environmental Health and Safety	Environmental Monitoring Specialist
Md. Golam Mustafa	Fisheries Resources Assessment, Environmental Assessment	Jr. Fisheries Biologist
Shahriar Rahman	Environmental Assessments, Water Resources Assessments	Jr. Environmental Specialist
Md Rashedul Alam	Field Survey and Data Collection for Environmental Assessments	Jr. Socio-economic Specialist
Syeda Mohsina Muhit	Environmental Policy, Legislation and Act	Jr. Occupational Health and Safety Specialist
Md. Sharif Hossain Sourav	Biodiversity Assessment, Ecological Survey, and Ecological Impact Assessment	Jr. Ecologist and Wildlife biologist

1.8 Report format

The report fulfills the requirements of EIA study under ECR, 1997 and has been prepared in accordance with the ToR approved by the DoE. The report contains thirteen chapters and the chapter details are outlined below:

Chapter 1 describes the introduction containing background, objectives of the EIA study, limitations, scope of the study and list of the members of EIA study team.

Chapter 2 is on policy, legal and administrative framework describing the relevant policy and legal frameworks for the EIA process.

Chapter 3 contains details of approach and methodologies used to complete the EIA study.

Chapter 4 describes the detail analysis for evaluation of alternative sites including the methodology followed

Chapter 5 .covers detailed project description of the proposed power plant.

Chapter 6 describes the environmental and social baseline conditions with detail on physical environment, water resources, land resources, agricultural resources, fisheries, ecosystem and socio-economic condition.

Chapter 7 is on the important environmental and social components of the physical environment, water resources, land and agriculture, fisheries, ecosystem and socio-economic condition.

Chapter 8 presents all the predicted impacts of the project during pre-construction, construction and post-construction phases and evaluates all the predicted impacts as per DoE suggested methodology.

Chapter 9 evaluated all the identified impacts

Chapter 10 identifies mitigation measures and responsible institutes

Chapter 11 outlines all possible hazards and risks associated with the proposed thermal power plant, and also suggests safety requirements.

Chapter 12 describes the Environmental Management Plan (EMP) with mitigation measures for minimizing the effect of the negative impacts and enhancement measures for increasing the benefits of the positive impacts and a monitoring plan.

Chapter 13 describes the Environmental Monitoring Plan

Chapter 14 describes the benefit and cost assessment of the power plant project

Chapter 15 comprises public consultation and disclosures conducted at different sites of the study area.

Chapter 16 is the concluding chapter of the EIA report with conclusion and recommendations.

Chapter 17 lists all references cited in the report.

In addition, Environmental Standards, Site Clearance Certificates, Letter from CAAB regarding no objection certificate, a photo album, etc are attached as Annexes.

Chapter 2: Policy, Legal and Administrative Framework

The Government of Bangladesh proposed to establish a coal based thermal power plant 2x (500-660) MW capacity in Khulna, which is expected to curtail the national generation shortfall apart from expediting the industrialization process. To do so the respective authority required to conduct Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) as it is obligatory under the national law of Bangladesh. According to the Environment Conservation Act, 1995, no industrial unit or project will be established or undertaken without obtaining an Environmental Clearance Certificate from the Department of Environment.

Along with the environmental assessment, relevant legal provisions, policies, strategies and institutional issues of planned projects/industries are very important for any project proponent or developer before they actually execute a program or plan. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. Before initiating any development project, it is hence required to obtain environmental clearance from the Department of Environment. The activities of the proposed coal based thermal power plant project of Bangladesh Government fall under the 'red' category according to the Bangladesh Environment Conservation Rules; 1997 and therefore need to conduct IEE and EIA studies to obtain site/location and environmental clearance from the Department of Environment.

In respect of legal obligations and policy guidelines under the EIA study of the coal based power plant in Khulna the following activities have been carried out:

- Identification of national legal obligations in relation to the interventions which will be required to review under the EIA study of the proposed thermal power plant;
- Exploration of the national legislative provisions and policy guidelines on environmental sectors;
- Identification of the international legal obligations and relevant provisions of multilateral environmental agreements related to the proposed project interventions;
- Exploration of national and international legal provisions on coal and power plant development sector; and
- Identification of the standard guidelines at regional and international level related to the thermal power plant setup.

National laws, by-laws and official resolutions relevant to coal based thermal power plant installation, operation and maintenance and associated activities have been identified under this study. Under the national legal framework the proposed intervention needs to comply with the environmental legislations of the country and needs to fulfill the requirements to obtain required permissions to implement these activities.

As per the requirement, IEE report was prepared and submitted to the Department of Environment for the purpose of obtaining Site/Location Clearance Certificate and accordingly, DoE issued the Location Clearance Certificate on 23 May 2011. In this present EIA report, the provisions of laws and policies presented in the IEE have been further updated and reconciled with the Department of Environment's expectation, Power Development Board's comments on IEE reports, requirements of the feasibility study team,

local people's perception and expert opinion of the local Government Authority and ToR approved by the DoE.

2.1 Applicable Policies and Legal Provision

All legal provisions relevant to environmental protection applicable to the planning, construction, operation and coal transportation were identified under the scope of the EIA. Table 2.1 below summarizes all relevant legal provisions:

Table 2.1: National Legal provisions applicable to the proposed power plant for ensuring environmental protection

Issue	Bangladeshi Legislation or Regulation
Governance of Power Generation and Management System	• Bangladesh Energy Regulatory Commission Act, 2003 • Power System Master Plan, 2010 • National Energy Policy
Coal Sourcing	• Bangladesh Coal Policy (Draft) • Master Plan on Coal Power Development, 2010 • Import and Export Control Act, 1950
Coal Transportation	• Terrestrial Water and Maritime Zones Act 1974 & Rules 1977 • The Ferries Act, 1885 • Ports Act, 1908 • Bangladesh Merchant Shipping Ordinance 1983 • The Prevention of the Interference With Aid to Navigable Waterways Ordinance, 1962 • Mongla Port Authority Ordinance, 1976 • Chittagong Port Authority Ordinance, 1976
Prevention of pollution, and Protection of Environment, Sundarbans and Protected Areas	• Mongla Port Authority Ordinance, 1976 • Chittagong Port Authority Ordinance, 1976 • Ports Act, 1908 • The Forests Act, 1927 • Environment Conservation Act, 1995 and the Amendments Thereafter • Environment Conservation Rules, 1997 • The Environment Court Act, 2000
Health and Safety	• Fatal Accidents Act, 1855 • Dock Laborers Act, 1934 • Dangerous Cargoes Act, 1953 • Imports and Exports (Control) Act, 1950 • Public Safety Ordinance, 1953 • The Explosives Act, 1884 • Fire prevention and Extinguish Act, 2003
Procurement in Bangladesh	• The Public Procurement Regulations, 2003 and Revisions thereafter
Transport, Handling and Storage of Dangerous Goods	• Environment Conservation Act, 1995 (Amendments thereafter) • Ports Act, 1908 • Petroleum Act, 1934 • Dangerous Cargoes Act, 1953

2.2 National Environmental Legal Provisions in Connection with Setup, Operation & Maintenance

The Environment Conservation Act of 1995 is the key legislation in relation to environment protection in Bangladesh. This Act has been promulgated for environment conservation, standards, development, pollution control, and abatement. It has repealed the Environment Pollution Control Ordinance of 1977. The Act has been subsequently amended in 2000, 2002, 2007 and latest amendments done up to year 2010. The main objectives of the Act are:

- Conservation and improvement of the environment and
- Control and mitigation of pollution of the environment

The main strategies of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried/initiated in the ecologically critical areas
- Regulations in respect of vehicles emitting smoke harmful for the environment
- Environmental clearance
- Regulation of the industries and other development activities' discharge permits
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes
- Promulgation of a standard limit for discharging and emitting waste and
- Formulation and declaration of environmental guidelines

According to the law before setting up any new project/interventions by the Government/ non government agencies/public, the proponents are required to obtain respective clearance from the Department of Environment. Under the Environment Conservation Rules 1997, the project promoter must obtain site clearance from the Director General of Department of Environment. An appeal procedure does exist for those promoters who fail to obtain clearance. The Department of Environment executes the Act under the leadership of the Director General.

Under the Environment Conservation Act, 1995 the first set of rules promulgated is the Environment Conservation Rules, 1997. The Rules have provided categorization of industries/ projects, hence identified types of environmental assessments needed against respective categories of industries/projects. The Environment Conservation Act (Amendment), 2000 provides responsibility for compensation in cases of damage to ecosystems: (1) The polluter pay principle is included herein, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

The Bangladesh Environment Conservation Act (Amendment), 2002 elaborates on: (1) restriction on polluting automobiles, (2) restriction on the sale and production of environmentally harmful items like those that polythene bags, (3) assistance from law enforcement agencies for environmental actions, (4) break up of punitive measures and (5) authority to try environmental cases.

The Environmental Rules are not explicit for various oil and gas exploration interventions. Rather, this is covered under the broader heading of "exploration, extraction and distribution of mineral resources" under the 'Red' category projects.

So far the Rule has been updated three times - February and August 2002 and April 2003.

2.2.1 *Procedure to Obtain Environmental Clearance Certificate*

According to the Section 12 of the Environment Conservation Act 1995 no industrial unit or project will be established or undertaken without obtaining, in the manner prescribed by the Environment Conservation Rules 1997, an Environmental Clearance Certificate from the Director General. Therefore, every development projects/industries which are specified under the Schedule – 1 of the Environment Conservation Rules 1997 require obtaining site and environmental clearance from the Department of Environment. According to the Rule 7 (1) of the Environment Conservation Rules 1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every industrial units or projects, in consideration of their site and impact on the environment and will be classified into the four categories and they are:

Class A:	Green
Class B:	Orange-A
Class C:	Orange-B
Class D:	Red

The projects/ industries are included under these four categories as specified above have been described in Schedule – 1 of the Environment Conservation Rules 1997.The proposed coal based thermal power plants 2 x 660 MW of the Government of Bangladesh falls under the Class-D i.e. the 'Red Category'. For projects under this category, it is mandatory to carry out Environmental Impact Assessment (EIA) including Environmental Management Plan (EMP) and where necessary develop a Resettlement Plan for getting environmental clearance from the Department of Environment. The Rules provide the application procedure for obtaining site and environmental clearance and the application procedure of Red category. According to the Sub-Rule 7(6)(d) of Environment Conservation Rules 1997, the Bangladesh Power Development Board (BPDB) is required to pursue the following steps to obtain the environmental clearance from Department of Environment to install coal based thermal power plants:

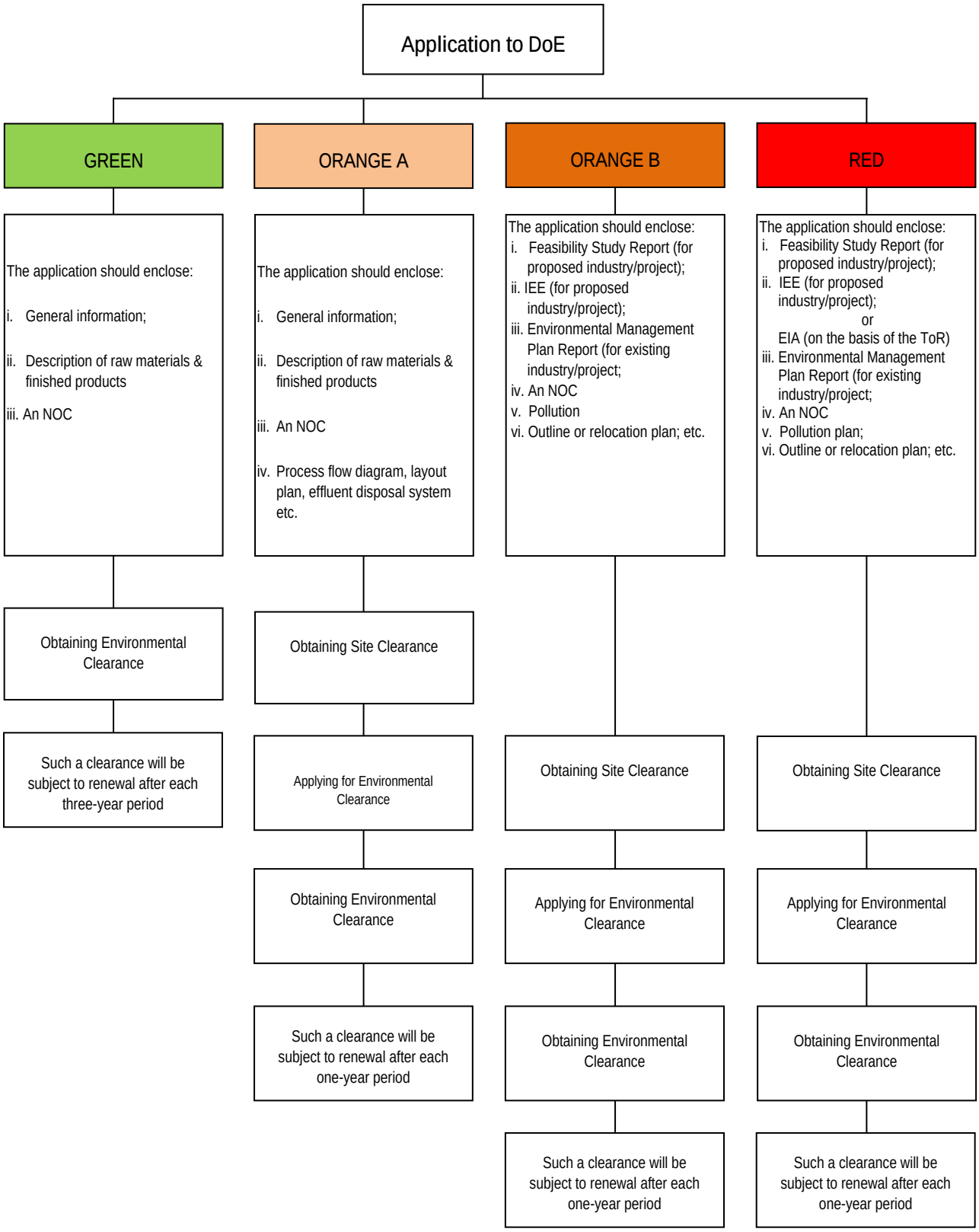


Figure 2.1: Process for obtaining Clearance Certificate from Department of Environment

Steps for obtaining Environmental Clearance Certificates after obtaining site clearance

1	Report on the feasibility of the project
2	EIA report prepared on the basis of terms of reference previously approved by the DoE, along with the Layout Plan (showing location of Effluent Treatment Plant), Process Flow Diagram, design and time schedule of the Effluent Treatment Plant of the unit or project,
3	No objection certificate of the local authority:
4	Emergency plan relating to adverse environmental impact and plan for mitigation of the effect of pollution;
5	Outline of relocation, rehabilitation plan (if applicable);
6	Other necessary information (where applicable);

BPDB obtained the site clearance to the Director General, Department of Environment in FORM 3 specified under the Environment Conservation Rules 1997 accompany with the IEE report. After math, BPDP move to get the environmental clearance certificates according to the procedural of EIA submission. The respective authority after receiving an application in relation to an industrial unit or project of Red Category, the EIA report along with the time schedule and ETP design will decide and reply within sixty working days, be approved or the application shall be rejected mentioning appropriate reasons; (under clause (d) of sub-rule (9))

2.2.2 Protected areas

Under the Environment Conservation Act 1995 and the Forest Act 1927 the territory (10km from the boundary of the Reserve Forest) of the Sundarbans has been declared as protected area and hereby been restricted certain activities in and around the Sundarbans. Under the Forest Act, the Sundarbans is declared as Reserve forest where no commercial activities and damage to forest and wildlife resources will be caused.

"The Government shall take the following factors into consideration while declaring any area as Ecologically Critical Area under sub-section (1) of section 5:-

a) human habitat
b) ancient monument
c) archeological site
d) forest sanctuary
e) national park
f) game reserve
g) wild animals habitat
h) wetland
i) mangrove
j) forest area
k) bio-diversity of the relevant area; and
l) Other relevant factors."

{Environment Conservation Rules 1997 Sub-Rule (1) of Rule 5}:

Under this Section 5 (1) of the Environment Conservation Act 1995, the Ministry of Environment and Forest through an Official Gazette Notification on 30-08-1999 declared 10 km area surrounding the Sundarbans Reserve Forest area as Ecological Critical Area. Upon declaring Ecologically Critical Area, all activities except those permitted by the law are prohibited in the specified area. Setting up industries/ implement project which cause soil, water, air and noise pollution in the specified area are prohibited activity among others. The activities which cause damage/adversely impact on biodiversity, forest resources, wildlife, fisheries and other aquatic resources are also prohibited by the law.

2.2.3 Effluent discharge

The proposed project might emit different types of gaseous pollutants, noise, liquid and solid waste to the surrounding environment. Schedule 2 to 11 of the Rule has been established to regulate uncontrolled emission (Annex I). The specific standards that must be obliged in installing the proposed project are given in Table 2.2

Table 2.2: Standard for different effluent as in Environment Conservation Rules, 1997

Components/Parameter	Standard as in ECR, 1997	Remarks
Standard to be maintained for Air Emission		
SPM (Residential and Rural)	100 µg /Nm^3	
SO_2 (Residential and Rural)	80 µg /Nm^3	No specific regulation is defined in ECR, 1997 for Coal based power plant. Ambient air quality standard, (80 µg/Nm^3)[2] might be applied. Besides, World Bank Standard is 0.2 TPD for each MW for first 5,00 MW and plus 0.10 TPD for each additional MW and the concentration should not to exceed 2,000 µg /Nm^3
Sulfuric acid mist	50 µg/Nm^3	
NO_2 (Residential and Rural)	80 µg /Nm^3	Ambient standard for NO_2 i.e., 80 µg/Nm^3 might be applied for proposed power plant. World Bank sets concentration standards 150 µg/Nm^3 for NO_2 emission from power plant
CO	2000 µg /Nm^3	However, in response to Climate Change issues and Bangladesh position on international platform, we might choose less carbon emitting technology.

[2] The unit is corrected from ECR, 1997. In ECR, it has been written as microgram per cusec meter which is not correct as there is no unit like cusec meter. However, the correction has been made based on EIA report of Meghnaghat Power Station (Mott Ewbank Preece, 1997) accepted by Department of Environment, Bangladesh.

Components/Parameter	Standard as in ECR, 1997	Remarks
		Supercritical emits less Carbon than other existing technology.
Standard for Liquid waste		
Sewerage waste	Schedule 9 of the Rule states the details of the standards for Sewerage waste	The Schedule is attached in Annex I
Cooling water discharge	No specific standard for cooling water. However, Standard for project waste to be discharged in Inland surface water (Schedule 10 of the Rule) might be applied.	Temperature standard defined in the Schedule is 40^0C during Summer and 45^0C during winter should be lower and it must be equal to ambient water temperature considering ecology of the river. EIA suggests temperature should be maximum 2^0 C above the ambient water temperature.
Other liquid waste	As stated in Schedule 9 of the rule	The Schedule is attached in Annex I
Noise as stated in Schedule 4		
Day time noise level	50 dB (A)	Standard for Residential area shall be applied in case of the Rampal site of the project
Night time noise level	40 dB (A)	

Source: Environment Conservation Rule, 1997

The National Water Policy 1999 states that the standards of effluent disposal into common water courses will be set by Water Resource Planning Organization in consultation with DoE. The Power Development Board is required to consider this matter and inform the concerned authority setting standard of the waste water which will be disposed into the nearby water sources.

2.2.4 Stack Height

The Schedule 11: Standards for Gaseous Emission from Industries or Projects, of the Environment Conservation Rules 1997, provides that the lowest height of stack for dispersion of sulfuric acid for 500 MW or above capacity coal based power plant is 275 meter. This standard has been established based on dispersion of SO_2 considering that the stack will emit the pollutants above the inversion layer of the air.

Capacity of the Power Plant	Lowest height of stack
500 Megawatt or above	275 meter

200 to 500 Megawatt	200 meter

Under the Manual of Aerodrome Standard, 2005 of Civil Aviation of Bangladesh, height of any structure within seven nautical miles is restricted up to 500 ft. The proposed site is located near the Khanjahan Ali Airport of Mongla. As the stack of the proposed power plant is located at a distance of seven nautical miles away from the runway centerline and the airport is in site development phase, The Civil Aviation Authority of Bangladesh has given no objection certificate to Power Development Board for the proposed power plant with some condition. The No Objection Certificate obtained from the Civil Aviation Authority of Bangladesh has been attached with the report.

2.2.5 Site location

As per the Rule, no industry shall be constructed within the 10 km extended zone of the Sundarbans. The proposed power plant site is located 4 km away from the 10 km extended zone of ECA. Therefore, the project obliges the Rules for protecting the Sundarbans.

2.3 Compliance under the National Laws

2.3.1 The Forest Act, 1927 & Amendment Act 2000

The proposed location of the coal fired power plant in Khulna is situated around 14 km away from the Sundarbans Reserve Forest. Therefore, it is pertinent to review forest related laws and by-laws of the country to identify possible conflicts among the proposed project interventions and rule of law. The Forest Act, 1927 is the first and omnibus law of the land on forestry. It provides for reserving forests over which the Government has an acquired property right. The proposed interventions of Bangladesh Power Development Board comply with this piece of legislation.

According to the Act the Government (Forest Department) can prohibit certain activities in the declared Reserved Forest area such as any intervention kindles, keeps or carries any fire; trespasses or pastures cattle, or permits cattle to trespass; causes any damage by negligence in felling any tree or cutting or dragging any timber; etc.

"26. Acts prohibited in such forests. -

(1) Any person who, in a reserved forest-

(a) Kindles, keeps or carries any fire except at such seasons as the Forest-Officer may notify in this behalf;

(b) Trespasses or pastures cattle, or permits cattle to trespass;

(c) causes any damage by negligence in felling any tree or cutting or dragging any timber;

(d) quarries stone, burns lime or charcoal, or collects, subjects to any manufacturing process, or removes any forest produce other than timber; or who enters a reserved forest with firearms without prior permission from the Divisional Forest Officer concerned, shall be punishable with imprisonment for a term which may extend to six months and shall also be liable to fine which may extend to two thousand taka, in addition to such compensation for damage done to the forest as the convicting Court may direct to be paid."

The proposed intervention should not carry out any such activities that may cause damage or adversely impact on the natural resources including wildlife of the Sundarbans Reserve Forest.

2.3.2 *The Penal Code, 1860*

The Penal Code of 1860 has some valid provisions related to pollution management, environment protection and protection of health and safety. Chapter XIV of the Penal Code provides offences affective public health, safety, convenience, decency and morals: Section 277: Falling Water or Public Spring or Reservoir; Section 278: Making Atmosphere Noxious to Health; Section 284: Negligent Conduct with Respect to Poisonous Substance; Section 285: Negligent Conduct with Respect to Fire or Combustible Matter; and Section 286: Negligent Conduct with Respect to Explosive Substance.

According to the Section 277, whoever voluntarily corrupts or fouls the water of any public spring or reservoir, to render it less fit for the purpose for which it is ordinarily used will be punished under the law.

According to the Section 278 whoever voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighborhood or passing along a public way will get punishment.

2.3.3 *The Acquisition and Requisition of Immovable Property Ordinance (1982)*

This Ordinance has replaced the Land Acquisition Act of 1894 and the East Bengal (Emergency) Requisition of Property Act of 1948. The Ordinance governs acquisition and requisition by the government of immovable property for any public purpose or in the public interest. It may be noted that contrary to the previous Acts (i.e. Act XIII of 1948); this Ordinance deals only with immovable property.

The Ordinance has well-defined procedures regarding payment of compensation for an acquired piece of land. If, for example, the land is used for rice growing, then an amount equivalent to approximately 1.5 times the market value of a given variety of rice (e.g., paddy) that is currently being (or could be) produced annually is fixed as a yearly lease value. In case of outright purchase (carried out on a 99-year lease), the compensation-value of acquired land varies widely according to the locality, soil fertility, and access to transportation and related infrastructure factors. The current compensation and resettlement provisions are however inadequate both in terms of timing of payments and quantum. The procedures involved are cumbersome and time consuming and often causes hindrance to the smooth execution of the project. Legal provisions covering adequate compensation to the project affected persons, particularly disadvantaged groups such as women & squatters and such other vulnerable groups are yet to be framed.

2.3.4 *The Protection and Conservation of Fish Act 1950*

The Protection and Conservation of Fish 1950 was enacted to provide for the protection and conservation of fish. The law defines 'Fish' as all cartilaginous, bony fishes, prawn, shrimp, amphibians, tortoise, turtles, crustacean animals, mollusks, echinoderms and frogs at all stages in their life history. Under the Act the Protection and Conservation of Fish Rules was adopted in 1985. This is a set of rules in line with the overall objectives of the Act. The Rule 5 of the Rules provides that no person shall destroy or make any attempt to destroy any fish by explosives, gun, bow and arrow in inland waters or within coastal waters. During the

project intervention, it should be noted that if waste effluent is not treated then it may cause significant damage to the local fishery and thus violate the provision of the law.

Rule 6 states that no person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters.

Therefore the proposed intervention of PDB will need to be carried in such a manner that the activities do not cause damage or adversely impact the inland waters or within coastal waters fisheries.

2.3.5 *Civil Aviation Ordinance 1960 & Civil Aviation Rules, 1984*

The Civil Aviation Ordinance 1960 was made to make better provisions for the control of manufacture, possessions, use, operation, sale, import and export of aircraft, the control and regulation of air transport services, and the control and development of aerodromes in the country. It repealed the Aircraft Act, 1934 (XXII of 1934).

Present legal regulatory framework for civil aviation activities in Bangladesh is the Civil Aviation Rules, 1984 and the Air Navigation Orders issued by the Chairman under this rule. All civil aviation activities in Bangladesh are regulated by the Civil Aviation Rules, 1984 which was made and promulgated by the Government in exercise of the powers conferred by sections 4, 5, 7 and 8 of the Civil Aviation Ordinance, 1960 (XXXII of 1960), section 10 of the Aircraft (Removal of Danger to Safety) Ordinance, 1965 (XII of 1965), section 4 of the Telegraph Act, 1885 (XIII of 1885) and in suppression of the Aircraft Rules, 1937 and the Airport Obstruction Clearance Rules, 1981. This set of rules elaborately dealt with personnel (pilot, flight engineer, air traffic controller, aircraft maintenance engineer etc.) licensing, airworthiness requirements, operation of aircraft, rules of the air, air transport services; construction height of the surrounding infrastructure etc. Much of today's operational responsibilities and functions of CAAB are defined and formulated in these Rules.

The proposed location of the Khulna Power Plant project is near the proposed international airport's location. Therefore, the national civil aviation rules and regulations need to be reviewed to avoid any violation of rules of law. The civil aviation law demarcated two zones adjacent to airport runway and provided the specified height of infrastructures in the specified zones.

2.3.6 *Ports Act, 1908*

The Ports Act 1908 was adopted to consolidate the enactments relating to Ports and port charges. The administering authority is the Ministry of Shipping. Subject to this Act, a Conservator is appointed to each port. Now, the Mongla Port's Harbor Master is acting as Conservator of Mongla Port and administers the provisions of the Act for the Port.

Specific environmental management provisions of the Act are given under s.21 (1) which prohibits the discharge of ballast, rubbish and oil into any port or adjacent areas. Under s.31 of the Act, the movement of vessels of 200 tons or more cannot enter, leave or be moved within any port without having a pilot on board. In addition, no vessel of more than 100 tones is to enter, leave or be moved within any port without having a pilot, unless authority to do so has been given in writing. The lawful use of infrastructure such as piers and moorings, and ensuring navigable waters are not obstructed is detailed under s.10, whereas s.21 prohibits interference with buoys, beacons and moorings. Unless permission has been

granted by the Conservator, any action that causes or may cause injury to the bank or shore is prohibited under s.30 (1).

2.3.7 *Mongla Port Authority Ordinance, 1976*

The Mongla Port Authority (MPA) Ordinance 1976, under the Ministry of Shipping, Government People's Republic of Bangladesh established the MPA. The Ordinance provides the MPA with the authority, function and jurisdiction over docks (wharves, warehouses, railways, piers, bridges, and other works) and vessels (including any ship, barge, boat, or raft designed or used for the transport by water of passengers or goods) within the port limits. The MPA also has authority to reclaim or excavate any part of the bank or bed of the river, to construct, maintain and operate dredgers and appliances for clearing, deepening and improving the bed of the river, and to construct, maintain and operate all means and appliances for berthing, loading and discharging vessels. The MPA's authority also extends to improvements made to the land and riverbank of its existing Port at Khulna (Roosevelt Jetty).

Under s.18 of the Act, the MPA may permit any person to make, erect or fix below high water-mark within the Port any dock, pier, erection or mooring. This provision may apply at Akram Point if moorings are established for securing barges or the floating transfer vessel (FTV).

The MPA also has the authority to issue fines for the pollution of water or environment by throwing or allowing into the water, bank or land, any goods, ballast, ashes or any other material that leads to pollution.

2.3.8 *Environment Conservation Act (1995, Amended in 2000 & 2002)*

The Bangladesh Environment Conservation Act of 1995 (ECA '95) is currently the main legislation in relation to environment protection in Bangladesh. This Act is promulgated for environment conservation, environmental standards development and environment pollution control and abatement. It has repealed the Environment Pollution Control Ordinance of 1977.

The main objectives of ECA '95 are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

The main strategies of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried/initiated in the ecologically critical areas;
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental clearance;
- Regulation of the industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines

Before any new project can go ahead, as stipulated under the rules, the project promoter must obtain Environmental Clearance from the Director General. An appeal procedure does

exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment to a maximum of 3 years imprisonment or a maximum fine of Tk. 300,000 or both. The Department of Environment (DOE) executes the Act under the leadership of the Director General (DG).

Environmental Conservation Act (Amendment 2000)

This amendment of the Act focuses on: (1) ascertaining responsibility for compensation in cases of damage to ecosystems, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

Environmental Conservation Act (Amendment 2002)

This amendment of the Act elaborates on: (1) restriction on polluting automobiles, (2) restriction on the sale and production of environmentally harmful items like polythene bags, (3) assistance from law enforcement agencies for environmental actions, (4) break up of punitive measures and (5) authority to try environmental cases.

Environmental Conservation Act (Amendment 2010)

This amendment of the act introduces new rules & restriction on: a) Ensure proper management of hazardous wastes to prevent environmental pollution and Health Risk, b) No remarked water body cannot be filled up/changed; in case of national interest; it can be done after getting clearance from the respective department; and c) Emitter of any activities/incident will be bound to control emission of environmental pollutants that exceeds the existing emission standards.

2.3.9 The Environment Conservation Rules, 1997

These are the first set of rules, promulgated under the Environment Conservation Act of 1995 (so far there have been three amendments to this set of rules - February and August 2002 and April 2003).

The Environment Conservation Rules of 1997 has provided categorization of industries and projects and identified types of environmental assessments needed against respective categories of industries or projects.

Among other things, these rules set (i) the National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc., (ii) the requirement for and procedures to obtain environmental clearance, and (iii) the requirement for IEE and EIA's according to categories of industrial and other development interventions.

2.3.10 The Environment Court Act, 2000

The Environment Court Act, 2000 provides for the establishment of environment courts and matters incidental thereto. This act also provides the jurisdictions of environment court, penalty for violating court's order, trial procedure in special magistrate's court, power of entry and search, procedure for investigation, procedure and power of environment court,

authority of environment court to inspect, appeal procedure and formation of environment appeal court.

2.3.11 *The Fatal Accidents Act, 1855*

An Act to provide compensation to families for loss occasioned by the death of a person caused by actionable wrong. It is mentioned in s.1, whenever the death of a person shall be caused by wrongful act, neglect or default, and the act, neglect or default is such as would (if death had not ensued) have entitled the party injured to maintain an action and recover damages in respect thereof, the party who would have been liable if death had not ensued shall be liable to an action or suit for damages, notwithstanding the death of the person injured, and although the death shall have been caused under such circumstances as amount in law to felony or other crime.

2.3.12 *The Dock Laborers Act, 1934*

An Act to give effect in Bangladesh to the Convention concerning the protection against accidents of workers employed in loading and unloading ships. It is stated in s.5(1), the Government may make regulations providing for the safety of working places on shore and of any regular approaches over a dock, wharf, quay or similar premises which workers have to use for going to or from a working place at which the processes are carried on, and for the lighting and fencing of such places and approaches, prescribing the measures to be taken in order to prevent dangerous methods of working in the stacking, unshackling, stowing and unstaring of cargo, or handling in connection therewith, prescribing the precautions to be observed when the workers have to work where dangerous or noxious goods are, or have bee, stowed or have to deal with or work in proximity to such goods.

It is mentioned in s.9, any person who unless duly authorized, or in case of necessity, removes any fencing, gangway, gear, ladder, life-saving means or appliance, light, mark, stage or other thing required to be provided by or under the regulations made under this Act; or having in case of necessity removed any such fencing, gangway, gear, ladder, life-saving means or appliance, light, mark, stage or other thing, omits to restore it at the end of the period for which its removal was necessary; shall be punishable with fine which may extend to five hundred taka.

2.3.13 *The Dangerous Cargoes Act, 1953*

The Dangerous Cargoes Act, 1953 was enacted to provide provisions related to the safety of ports in respect of the transit, working and storage of dangerous cargoes. Relevant provisions include s.3 (which deals with explosives and fires on vessels), s.6 (safety of vessels imports) and s.9 (enforcement). The concerned authority is the Deputy Conservator of the Port, Board of Trade or the Ministry of Communication and the Chief of Naval Staff.

2.3.14 *The Fire Services Ordinance 1959*

The Fire Services Ordinance 1959 also states that the owner needs to obtain a license under the Ordinance before using premises as a warehouse. In addition, under this Ordinance the Government by order no. HSLG/SVII/1R-1/60/295 dated 3rd June 1960 declared that any stock of coal exceeding four tones shall be considered to be a fire risk.

2.3.15 *The Bangladesh Petroleum Act, 1974*

The Bangladesh Petroleum Act is enabling legislation that allows the Government of Bangladesh to enter into all aspects of petroleum exploration, development, exploitation, production, processing, refining and marketing. In addition, the Government is authorized to enter into Petroleum Agreement(s) with any person(s) for the purpose of petroleum operations. The duties of such person(s) are:

- To ensure that petroleum operation is carried out in a proper and workman like manner and in accordance with good oil field practice.
- To carry out petroleum operation in any area in a manner that does not interfere with navigation, fishing and conservation of resources.
- To consider the factors connected with the ecology and environment.

Clause 6(2) of the Act sets out certain details related to environment and safety:

"In particular, and without prejudice to the generality of the foregoing provision, a person engaged in any petroleum operations shall, in carrying out such operations in any area:

- Control the flow and prevent the waste or escape in the area, of petroleum or water;
- Prevent the escape in that area of any mixture of water or drilling fluid with petroleum or any other matter;
- Prevent damage to petroleum-bearing strata in any area, whether adjacent to that area or not; and
- Keep separate any petroleum pool discovered in the area."

Apart from the above the law provides the following obligations:

a) prescribing places where petroleum may be imported and prohibiting its import elsewhere;
regulating the import of petroleum;

b) prescribing the periods within which licenses for the import of [class I] petroleum shall be applied for, and providing for the disposal, by confiscation or otherwise, of any [class I] petroleum in respect of which a license has not been applied for within the prescribed period or has been refused and which has not been exported;

c) regulating the transport of petroleum;

d) specifying the nature and condition of all receptacles and pipe-lines in which petroleum may be transported;

e) regulating the places at which and prescribing the conditions subject to which petroleum may be stored;

f) specifying the nature, situation and condition of all receptacles in which petroleum may be stored;

g) prescribing the form and conditions of licenses for the import of dangerous petroleum, and for the transport or storage of any petroleum, the manner in which applications for such licenses shall be made, the authorities which may grant such

licenses and the fees which may be charged for such licenses; determining in any class of cases whether a license for the transport of petroleum shall be obtained by the consignor. consignee or carrier;

h) providing for the granting of combined licenses for the import, transport 18[, storage and distribution] of petroleum, or for any two of such purposes;

i. prescribing the proportion in which any specified poisonous substance may be added to petroleum, and prohibiting the import, transport or storage of petroleum in which the proportion of any specified poisonous substance exceeds the prescribed proportion;

ii. regulating the distribution of petroleum;

iii. prescribing the conditions for the appointment of, and the granting of the licenses to, agents, dealers and stockiest;

iv. prescribing the form and conditions of agreement between and agent, dealer or stockiest and an oil marketing company;

v. providing for cancellation or restoration of licenses of an agent or a dealer and of agreement between an oil marketing company and an agent, dealer or stockiest; and

vi. Generally, providing for any matter which in its opinion, in expedient for proper control over the import, transport, storage and distribution of petroleum."

2.3.16 The Explosives Act, 1884

The Government may for any part of Bangladesh, make rules consistent with this Act to regulate or prohibit, except under and in accordance with the conditions of a license granted as provided by those rules, the manufacture, possession, use, sale, transport and importation of explosives or any specified class of explosives.

Any person manufacturing, possessing, using, selling, transporting or importing an explosive in contravention of a notification issued shall be punishable with imprisonment for a term which may extend to ten years and shall not be less than two years and also with a fine which may extend to fifty thousand Taka, in default of which with a further imprisonment for a term which may extend to one year, and in the case of importation by water or land, the owner and master of the vessel or carriage in which the explosive is imported shall, in the absence of reasonable excuse, each be punishable with imprisonment for a term which may extend to ten years and shall not be less than two years and also with a fine with a further imprisonment for a term which may extend to one year.

2.3.17 Wildlife Conservation (protection and safety) Act 2012

The government in 1973 framed a law for conservation of the forests. Since the independence, no effective measure had been taken for conservation of the wildlife. The existence of a number of animals are now under severe threat as no adequate measures were taken to protect wildlife in the pre-independence period. Bangladesh have expressed deep concern about the existing wildlife and a new wildlife law passed in parliament. The act has been formulated for the conservation and safety of wildlife to manage the protected areas. The act depicts 10 new types of protected

areas. The bill with many other provisions proposed stern action for violation of the law. It proposed one-year imprisonment and Taka 50,000 fine for such a violation. The law also proposed at least two years and highest seven years imprisonment and minimum Taka one lakh and maximum Taka 10 lakh fine for killing a tiger or elephant.

2.4 Policy Guidance

Under the study a number of sectoral national policies have been reviewed to identify the guiding principles which are relevant to the coal based thermal power plant installation, operation and maintenance activities. The sectoral policies will include energy, environment, water, forest, transport, import; fisheries etc.

2.4.1 National Environment Policy

The National Environment Policy of 1992 sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. The Policy provides the broader framework of sustainable development in the country. It also stated all major undertakings, which will have a bearing on the environment; (including setting up of an industrial establishment) must undertake an IEE and EIA before they initiate the project.

The Policy delineates DoE, as the approving agency for all such IEE and EIA's to be undertaken in the country. The policy guidelines of fifteen sectors are stated in the Policy. Under the 'energy and fuel sector' (section 3.4), the use of environmentally sound and less harmful fuel has been encouraged in Section 3.4.1. Section 3.4.5 provides, 'Conservation of country's fossil fuel reserve and renewable sources of energy'. And section 3.4.6 provides that EIA should be conducted before implementation of projects for extraction of fuel and mineral resources.

Under the Environmental Action Plan Section of the Policy and sub-section 'Fuel and Energy' provides that:

- Section 4.2 "In the rural areas the use of gas, coal, kerosene and petrol as fuel will be expanded in the rural areas, so that fuel wood, agricultural residues and cow dung are conserved. This will help the use of agricultural residues, and cow dung etc. as manure"
- Section 4.7 "Appropriate measures will be taken to ensure that extraction, distribution and use of natural resources such as oil, gas, coal, peat etc. do not adversely affect air, water, land, the hydrological balance and the ecosystem".
- Section 3: 'Forest, wildlife and biodiversity' directs the followings:
    - Conserve wildlife and biodiversity, strengthen related research and help dissemination and exchange of knowledge in these areas; and
    - Conserve and develop wetlands and protection of migratory birds.

2.4.2 Draft Coal Policy

The Draft Coal Policy (version 1) was published on 1st December 2005 by the Energy and Mineral Resources Division of Ministry of the Power, Energy and Mineral Resources. After that, it was revised several times. The latest one is the Bangladesh Draft Coal Policy, 2010.

The latest Draft Coal Policy (2010) outlines gas shortage, power generation, coal development, investment for coal sector, import coal, environment etc. in Bangladesh. Therefore, this policy will become useful data in relating the domestic coal supply. This policy states that coal will be used for power generation instead of gas as an alternative fuel to maintain national energy stability.

2.4.3 *Power System Master Plan, 2010*

The main objective of this study is to formulate a Master Plan for the attainment of stable power supply in the People's Republic of Bangladesh up to year 2030 in consideration of the diversification of fuel resources, including an optimum power development plan, power system plan, and identification of the potential power plant sites based on the fuel diversification study. Therefore, this study includes a comprehensive power development master plan where the study of the fundamental conditions of the development (demand forecast, procurement of primary energy resources, optimum power development plan, future optimum power supply structure including the positioning of gas-fired power plants, and so on) are added.

The power sector was heavily dependent on gas. Even two/three years back almost 90% of the electricity used to be generated from the natural gas of the country and rest by hydro electricity and coal. The power sector master plan 2010 has stressed on diversification of the fuel such as natural gas, coal, furnace oil, diesel etc as well as renewable energy sources.

In this Master Plan, the target composition of power supply as of 2030 is set at 50% for domestic and imported coal, 25% for domestic and imported (in the form of LNG) natural gas and 25% for other sources such as oil, nuclear power and renewable energy.

2.4.4 *National Environment Management Action Plan 1995*

The National Environment Management Action Plan (NEMAP) is a wide ranging and multi-faceted plan, which builds on and extends the statements set out in the National Environment Policy (NEP). NEMAP was developed to address issues and management requirements for a period between 1995 to 2005 and set out the framework within which the recommendations of the National Conservation Strategy (NCS) are to be implemented.

NEMAP has the following broad objectives:

- Identification of key environmental issues affecting Bangladesh;
- Identification of actions necessary to halt or reduce the rate of environmental degradation;
- Improvement of the natural and built environment;
- Conservation of habitats and biodiversity;
- Promotion of sustainable development; and
- Improvement in the quality of life of the people

One of the key issues in NEMAP regarding the energy sector is “energy conservation awareness is generally low throughout the country”. NEMAP did not recognize mineral resources as an important sector and there is no separate discussion on this.

2.4.5 *The National Forest Policy (1994)*

The National Forestry Policy of 1994 is the revised version of the National Forest Policy of 1977 in the light of the National Forestry Master Plan. The major targets of the Policy are to

conserve the existing forest areas; bring about 20% of the country's land area under the afforestation program, and increase the reserve forestland by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

The need of amendments of the existing forestry sector related laws and adoption of new laws for sect oral activities have been recognized as important conditions for achieving the policy goals and objectives. The Forest Policy also recognizes the importance of fulfilling the responsibilities and commitments under international multilateral environmental agreements

2.4.6 The National Energy Policy (1995)

The National Energy Policy provides for utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy sources and environmentally sounds sustainable energy development programs. The Policy highlights the importance of protecting the environment by requiring an EIA for any new energy development project, introduction of economically viable and environment friendly technology.

One (Section 1.2) of the seven objectives addresses the environment and states, "(vi*) to ensure environmentally sound sustainable energy development programs causing minimum damage to the environment*".

The seven specific policy recommendations are listed under Chapter 1.9. Of those, the following three are relevant to the present project:

- EIA should be made mandatory and should constitute an integral part of any new energy development project;
- Use of economically viable environment friendly technology is to be promoted; and
- Public awareness is to be promoted regarding environmental conservation

2.4.7 The National Water Policy (1999)

The National Water Policy of 1999 was adopted to ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.

The Policy states that excessive water salinity in the southwest region is a major deterrent to industrial growth. In addition, pollution of both surface and groundwater around various industrial centers of the country by untreated effluent discharge into water bodies is a critical water management issue. The Policy suggests that the following matters should be considered:

a. Zoning regulations will be established for location of new industries in consideration of fresh and safe water availability and effluent discharge possibilities;

b. Effluent disposal will be monitored by relevant Government agencies to prevent water pollution;

c. Standards of effluent disposal into common watercourses will be set by WARPO in consultation with DOE;

d. Industrial polluters will be required under law to pay for the cleanup of water- body polluted by them.

2.4.8 World Bank's Safeguards (Relevant Policies)

The Bank requires environmental assessment (EA) of projects proposed for Bank support to ensure that they are environmentally sound and sustainable, and thus to improve decision making. EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, sitting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. EA takes into account the natural environment (air, water and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples and physical cultural resources); and trans-boundary and global environmental aspects.

The Bank classifies the proposed project into three major categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

Category A: The proposed project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.

Category B: The proposed project's potential adverse environmental impacts on human population or environmentally important areas-including wetlands, forests, grasslands, or other natural habitats- are less adverse than those of Category A projects. These impacts are site specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than Category A projects.

Category C: The proposed project is likely to have minimal or no adverse environmental impacts.

Analysis of the relevant policies is summarized in Table 2.3.

Table 2.3: Summary of the relevant polices

Title and Scope	Relevant Provisions to the Project Activities	Obligations of Power Development Board	Requirement of Power Development Board
Agricultural Policy, 1999			
Agricultural Policy, 1999	Preserve and develop land productivity	Power Development Board Should: take appropriate measures to prevent loss of land fertility in and around project site during the project implementation period. If not then compensate the loss.	Extension Department, Soil Resource Development Institute
Agricultural Policy, 1999	Section 2.1 Objective; Preserve existing biodiversity of different crops	Power Development Board Should take appropriate measures to prevent loss of any indigenous crop variety of the project site *Viz.* preserve the indigenous crop verity. If not then compensate the loss.	MoA, Bangladesh Rice Research Institute (BRRI), BARC
Agricultural Policy, 1999	Section 12.1 Land Use; Appropriate measures will be taken in the light of the Land Use Policy, to stop the trend of shifting agricultural land into to other due to its use for non-agricultural purposes.	Power Development Board must follow the appropriate land acquisition procedure as per the GOB	MoA, MoFL
Environment Policy 1992			
Environment Policy, 1992	Section 3.2.1 Industry; Adoption of corrective measures by polluting industries in phases	Power Development Board must comply with the government regulation.	MoEF, MoFL, MoPEMR, DoE and other relevant government agencies
Environment Policy 1992	Section 3.2.4 Industry; Encourage development of environmentally sound and appropriate technology and initiatives on research and extension in the fields of industry. Balance such initiatives with the best use of labor and provision of proper wages.	Power Development Board should use economically viable and environmental friendly technology Provide analysis of alternatives in the EIA report	MoEF, MoFL, DoE

Title and Scope	Relevant Provisions to the Project Activities	Obligations of Power Development Board	Requirement of Power Development Board
Environment Policy 1992	Section 3.3.1 Health; Prevent activities, which are harmful to public health in all spheres, including development	Power Development Board should take all appropriate measures to prevent risky activities that may affect the public.	MoEF, LGED, DPHE, Local Administration
Environment Policy 1992	Section 3.3.5 Health; Ensure healthy workplace for workers	Power Development Board should take all appropriate measures to ensure healthy workplace for the workers	DoE, DPHE
Environment Policy 1992	Section 3.4.1 Energy and Fuel Reduce and discourage the use of those fuels which pollute the environment and increase the use of environmentally sound and less harmful fuels	Power Development Board must: Use the fuels in their machinery and vehicles that reduce pollution in the environment	MoEF, DoE, MoPEMR, Local Government Institutes
Environment Policy 1992	Section 3.4.2 Energy and Fuel reduce the use of fuel wood, agricultural residues etc. to meet energy need and increase the use of alternative energy sources	Power Development Board should use materials other than fuel wood and agricultural residue	MoPEMR
Environment Policy 1992	Section 3.4.5 Energy and Fuel Conserve country's fossil fuel reserves and renewable sources of energy	Power Development Board should: Consider the provision for long term aspects	MoPEMR
Environment Policy 1992	Section 3.4.6 Energy and Fuel; Conduct EIA before implementing the projects for extraction of fuel and mineral resources	Power Development Board should conduct EIA	MoEF
Environment Policy 1992	Section 3.5.1 Water development; Ensure environmentally sound utilization of all water resources	Power Development Board should: Ensure conservation of freshwater resources	MoEF
Environment Policy 1992	Section 3.5.5 Water development Keep the rivers, canals, ponds, lakes, *haors, baors* and all other water bodies and water resources free from pollution	Power Development Board should: Make sure that the nearby water bodies and resources are not polluted due to project activities.	MoEF

Title and Scope	Relevant Provisions to the Project Activities	Obligations of Power Development Board	Requirement of Power Development Board
Environment Policy 1992	Section 3.6.2 Prevent land erosion, preserve and increase soil fertility, and expand activities for conservation and environmentally sound management of newly accreted land	Power Development Board should take appropriate measures to prevent land erosion in the project site.	MoEF, MoFL
Environment Policy 1992	Section 3.7.2 Forest; Include tree plantation programme in all relevant development activities	Power Development Board should: Carry out afforestation in and around the project site	MoEF, FD
Environment Policy 1992	Section 3.7.3 Forest; Stop shrinkage and depletion of forest land and forest resources	Power Development Board should: Take appropriate measures minimize the deforestation around the site	MOEF, FD
Environment Policy 1992	Section 3.7.5 Forest Conserve wildlife and biodiversity	Power Development Board should: Take appropriate measures to prevent loss of the biodiversity and undertake compensatory measures in case of inevitable damage if any	MoEF, FD
Environment Policy 1992	Section 3.7.6 Forest; Conserve and develop wetlands and protect migratory birds	Power Development Board must: avoid activities which cause huge damage to wetlands and destroy the any fish sanctuary or species habitat of conservation significance	MoEF, MoWR, FD
Environment Policy 1992	Section 3.8.2 Fisheries; Prevent activities that diminish the wetlands natural habits of fish	Power Development Board should: Take appropriate measure, so that the nearby fish habitats are not threatened due to project activities, viz. do not discharge untreated waste water into the river	WET, EIA Report
Environment Policy 1992	Section 3.11.2 Transport and Communication; Ensure that vehicles and people using roads, rails, air and inland waterways do not pollute the environment and take steps to protect health of the workers running these transports	Power Development Board should: Use the vehicles (which is going to be used during the operation of the project) which cause less pollution to the environment. Take necessary measures to protect health of the workers running transports	MoEF, MoC, Roads and Highway Department, Railway Authority, Inland Water Transport Authority

Title and Scope	Relevant Provisions to the Project Activities	Obligations of Power Development Board	Requirement of Power Development Board
Environment Policy 1992	Section 3.11.3 Transport and Communication; Control activities in inland ports and dockyards which cause pollution of water and the local environment	Power Development Board should: Need to consider this provision while importing and transporting the coals	MoEF, MoC, Roads and Highway Department, Port Authority, Inland Water transport Authority
Environment Policy 1992	Section 3.12.1 Integrate environmental consideration into all housing and urban planning activities and research	Power Development Board should: While setting up the (proposed) Proposed location town, consider the integrated environmental aspects	MoEF
Energy Policy 1996			
Energy Policy 1996	Section 1.2 Objective (iv); Ensure sustainable operation of the energy utilities	Power Development Board should: Ensure that the project activities does not hamper the sustainable of operations of energy utilities in the Proposed location	MoPEMR, Power Development Board, Rural Electrification Board
Energy Policy 1996	Section 1.2 Objective (v); Rational use of total energy sources	Power Development Board should: Ensure the coal are used rationally	MoPEMR Hydrocarbon Unit
Energy Policy 1996	Section 1.2 Objective (vi); Ensure environmentally sound sustainable energy development program causing minimum damage to the environment	Power Development Board must: Consider this provision while implementing the project viz. ensure minimum damages caused to the environment	MoPEMR
Energy Policy 1996	Sectio1. 9 Environmental Conservation Issues will be considered for all type of fuels and in each and every step of fuel cycle; namely, exploration, appraisal, extraction, conversion, transportation and consumption.	Power Development Board Should: Need to consider this provision during their project cycle.	MoPEMR
Energy Policy 1996	Section 7.3 Technology Assessment, Necessary arrangements are to be made to select appropriate technologies i.e. conversion, efficiency, transferability, adaptability, environmental effects, cost should be considered while selecting technologies	Power Development Board should: Consider these (mentioned) factors while selecting the technologies.	MoPEMR

Title and Scope	Relevant Provisions to the Project Activities	Obligations of Power Development Board	Requirement of Power Development Board
Energy Policy 1996	Promote use of economically viable environment friendly technology are to be promoted	Power Development Board should: Use economically viable and environmental friendly technology	MoPEMR
Energy Policy 1996	Discourage use of fuel wood	Power Development Board should: Use materials other than fuel wood	MoPEMR
Energy Policy 1996	Section 1.9 (g) Encourage the use of lead free petrol	Power Development Board should: Use lead free petrol	MoPEMR
Land Use Policy 2010			
Land Use Policy 2010	Section 2 (e) Objective Ensure the land use in harmony with the natural environment.	Power Development Board should: Follow the Government's land use plan	MoFL and DoE
Land Use Policy 2010	Section 2 (i) Objective; Conserve the natural forest	Power Development Board must: Compensate for destroying the natural forest, viz. plantation on the other nearby areas, reforestation, and plantation on the annulled forest area.	MoFL, Forest Department
Land Use Policy 2010	Section 2 (i) Objective; Prevent river bank erosion	Power Development Board should: Prevent activities that may cause river bank erosion	MoFL and MoWR
Land Use Policy 2010	Section 2 (h) Objective; Prevent the land pollution	Power Development Board should: Take appropriate measures to prevent/ reduce the land pollution	MoFL and DoE
Land Use Policy 2010	Section 3.4 Land Use; Maintaining a balanced ecosystem	Power Development Board should: Proper authorization to utilizing the area (project site) from the concerned authority, via, seek authorization from the Forest Department for utilizing the forest land	MoFL, MoWR, Forest Department and others
The Forest Policy 1994			
Forest Policy 1994	Conserve the natural forest (protected, reserved and unclassified state forest)	Power Development Board should: Take appropriate measures to mitigate adverse impact (due to project activities) on the forest of the proposed location area	MoEF, FD
Forest Policy 1994	Restoration of natural forest to preserve biodiversity and wildlife	Power Development Board should: Carry out afforestation and reforestation of forests cleared during the project activity	MoEF, FD
Forest Policy 1994	Without proper authorization, forest land cannot be used for non forest purpose.	Power Development Board should: Seek for permission from the Forest Department for using the forest area for non forest purpose	MoEF, FD

Title and Scope	Relevant Provisions to the Project Activities	Obligations of Power Development Board	Requirement of Power Development Board
The Tourism Policy 1992			
Tourism Policy 1992	Section 5 (3): Development, preservation and maintenance of tourism resources of the country	Power Development Board need: To look into the matter so that any tourism resource of the Sundarbans are not affected due to the project activities	MoCAT
Tourism Policy 1992	Section 7: Restoration and maintenance of archaeological and historical sites	Power Development Board must: Not destroy any archaeological and historical sites of the with the proposed location of the Power Plant	MoCAT
Tourism Policy 1992	Section 8: Conservation of wildlife	Power Development Board need to consider this provision	MoEF
The Fisheries Policy 1998			
Fisheries Policy 1998	Section 9.10; Protect natural water bodies and marine biodiversity.	Power Development Board must: Consider this provision and take appropriate measure to reduce adverse impact on the water bodies	MoFL, Fisheries Department
Fisheries Policy 1998	9.10.2 Control activities which may have adverse effect on the fish resources	Power Development Board must: Control the activities which may have adverse impact on the fish resources	MoFL, Fisheries Department
Fisheries Policy 1998	9.10.6 Implement laws to prevent discharge of untreated waste into water bodies.	Power Development Board must comply with these laws	MoFL, Fisheries Department
The Water Policy 1999			
Water Policy 1999	Section 4.8 Water and Industry; a) Zoning regulation will be established for location of new industries in consideration of fresh and safe water availability and effluent discharge possibilities.	Power Development Board must: Follow the zoning regulation of the Government	MoFL, MoWR
Water Policy 1999	b) Effluent disposal will be monitored by relevant Government agencies to prevent water pollution	Power Development Board must: Allow the monitoring authority to monitor their effluent discharge	MoWR
Water Policy 1999	c) Standards of effluent disposal into common watercourses will set by WARPO in consultation with DOE	Power Development Board need to comply with the polluter pay principle under the national legislation	DoE/MoWR

Title and Scope	Relevant Provisions to the Project Activities	Obligations of Power Development Board	Requirement of Power Development Board
Water Policy 1999	d) Industrial polluters will be required under law to pay for the cleanup of water body polluted by then.	Power Development Board need to comply with the polluter pay principle under the national legislation	DoE/MoWR
Water Policy 1999	Section 4.12 Water and Environment; d) Protect against degradation and resuscitate natural water bodies such as lakes, ponds, heels, khals, tanks, etc. affected by man-made intervention or other causes.	Power Development Board should: Consider this provision while implementing the project	MoWR
Water Policy 1999	i) Enforce the 'polluter pay' principle in the development of regulatory guidelines for all regulatory actions designed to protect public health and the environment	Power Development Board need to follow the regulatory guidelines.	DoE
The Industrial Policy 1999			
Industrial Policy 1999	Objective (p); To take appropriate measures for preventing	Power Development Board need to consider the provision during implementation of the project activities	DoE, MoPEMR
The Housing Policy 1999			
Housing Policy 1999	Section 4.7; Initiate planning to produce more forest products used to build infrastructures and attention be given to environmental management	Power Development Board should: Carry out afforestation and Reforestation activities to restore degraded lands	MoHPW/MoHFW
Housing Policy 1999	Section 4.9; While implementing any new housing project, need to consider the local building modes, upholding and conservation of the cultural heritage	Power Development Board should: Consider the provision while implementing the proposed township under the project activities	MoHFW/MoC
Housing Policy 1999	Section 5.1.3 Land; Ensure that the minimum land acquired for any development project/programme	Power Development Board should: Adopt the principle during land acquisition	MoHPW Power Development Board
Biodiversity Strategy and Action Plan (BSAP)			

Title and Scope	Relevant Provisions to the Project Activities	Obligations of Power Development Board	Requirement of Power Development Board
BSAP	Strategy 2: Conserve ecosystems, species and genetic pool of the country to ensure that the present and future well-being of the country and its people are secure	Power Development Board should: ▪ Create an inventory of all the species of flora and fauna in the area. ▪ Conduct EIA and SIA reports.	MoEF/ DoE
BSAP	Strategy 3: Restore ecosystems and rehabilitate endangered species	Power Development Board should: ▪ Construct ETP to restrict amount of pollution ▪ Create buffer zones in and around the project site ▪ Carry on afforestation and reforestation ▪ activities on abandoned site	MoEF/ DoE
BSAP	Strategy 10: Ensure wise use of wetland resources environment pollution and maintaining the ecological balance	Power Development Board should: Consider the provision while implementing the project.	MoWR/ MoEF

The Constitution of the People's Republic of Bangladesh considered the issue of environmental protection and agreed through its 15th amendment. The high-level committee on Constitutional Amendment included the following article in 'Part II: Fundamental Principles of State Policy 'and was passed accordingly: "18A. Protection and improvement of environment and biodiversity: The State shall endeavor to protect and improve the environment and to safeguard the natural resources, biodiversity, wetlands, forests and wild life for the present and future citizens."

2.5 International Maritime Conventions, Protocols and Agreements applicable for coal transportation

Bangladesh is signatory of the International Maritime Organization (IMO). Therefore, all activities relating to shipment of coal through the Port shall have to be done strictly in compliance with the standards set by the IMO, particularly the conventions, protocols and agreements.

The following Conventions/ Protocols of IMO have been agreed by the GoB-

1. IMO Convention 48
2. IMO amendments 91
3. IMO amendments 93
4. SOLAS Convention 74
5. SOLAS Protocol 88
6. LOAD LINES Convention 66
7. LOAD LINES Protocol 88
8. TONNAGE Convention 69
9. COLREG Convention 72
10. STCW Convention 78
11. SAR Convention 79
12. STP Agreement 71
13. STP Protocol 73
14. IMSO Convention 76
15. INMARSAT OA 76
16. FACILITATION Convention 65
17. MARPOL 73/78 (Annex I/II)
18. MARPOL 73/78 (Annex III)
19. MARPOL 73/78 (Annex IV)
20. MARPOL 73/78 (Annex V)
21. MARPOL Protocol 97 (Annex VI)
22. INTERVENTION Convention 69
23. SUA Convention 88
24. SUA Protocol 88
25. OPRC Convention 90

Some of the Conventions/Protocols acceded by GoB are highlighted below-

Table 2.4: International maritime conventions, protocols and agreements of different issues

Issues	International Maritime Conventions, Protocols and Agreements	Remarks
International Maritime	IMO Convention, 1948	The Convention establishing the IMO was adopted in 1948 but the Organization started life as the Inter-Governmental Maritime Consultative Organization (IMCO) until it was changed to the IMO in 1982. The Aims of the IMO include a range of objectives:

Issues	International Maritime Conventions, Protocols and Agreements	Remarks
		- To provide machinery for co-operation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade, and to encourage the general adoption of the highest practicable standards in matters concerning maritime safety and efficiency of navigation; - To provide for the consideration by the Organization of any matters concerning shipping that may be referred to it by any organ or specialized agency of the United Nations; - To provide for the exchange of information among Governments on matters under consideration by the Organization. There have been a series of amendments to the Convention which are 1975 amendments, 1977 amendments, 1991 amendments. This Convention came into force in Bangladesh on May 27, 1976. The amendment 1993 acceded on November 7, 2002.
Maritime safety	SOLAS Convention, 1974	The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The 1974 version includes the tacit acceptance procedure - which provides that an amendment shall enter into force on a specified date unless, before that date, objections to the amendment are received from an agreed number of Parties. The Convention came into force on May 25, 1980 and acceded by GoB on February 6, 1982. The 1988 Protocol of SOLAS 1974 was acceded by Bangladesh on November 4, 2002.
Measurement of ships	Load Lines Convention, 1966	It has long been recognized that limitations on the draught to which a ship may be loaded make a significant contribution to her safety. These limits are given in the form of freeboards, which constitute, besides external weather tight and watertight integrity, the main objective of the Convention. The Convention acceded by GoB on August 10, 1978. The Protocol of the Load Line Convention acceded by GoB on November 4, 2002.
Preventing collisions at	Convention on International	The 1972 Convention was designed to update and replace the Collision Regulations of 1960 which were

Issues	International Maritime Conventions, Protocols and Agreements	Remarks
sea	Regulations for Preventing Collisions at Sea (COLREG), 1972	adopted at the same time as the 1960 SOLAS Convention. One of the most important innovations in the 1972 COLREGs was the recognition given to traffic separation schemes - Rule 10 gives guidance in determining safe speed, the risk of collision and the conduct of vessels operating in or near traffic separation schemes. The Convention was acceded by Bangladesh on May 10, 1978.
International Maritime Satellite System	Convention on International Maritime Satellite Organization (INMARSAT), 1976	IMO recognized the potential for satellite communications to assist in distress situations at sea soon after the launch of the world's first telecommunications satellite, Telstar, in 1962. In February 1966, IMO's Maritime Safety Committee (MSC) decided to study the operational requirements for a satellite communications system devoted to maritime purposes. In 1973, IMO decided to convene a conference with the object of establishing a new maritime communications system based on satellite technology. The Convention came into force by GoB on July 16, 1979.
Prevention of Pollution from Ships	International Convention for the Prevention of Pollution from Ships (MARPOL)	The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and also includes the Protocol of 1997 (Annex VI). It has been updated by amendments through the years. MARPOL 73/78 (Annex-I, II, III, IV, V and VI) was acceded by GoB on November 4, 2002.
	Convention on Facilitation of International Maritime Traffic (FACILITATION), London, 1965	The Convention's main objectives are to prevent unnecessary delays in maritime traffic, to aid co-operation between Governments, and to secure the highest practicable degree of uniformity in formalities and other procedures. In particular, the Convention reduces the number of declarations which can be required by public authorities. The Convention came into force in Bangladesh on October 28, 2000.
Safety of maritime navigation	Convention for The Suppression of Unlawful Acts of Violence	The main purpose of the convention is to ensure that appropriate action is taken against persons committing unlawful acts against ships. These include: • the seizure of ships by force;

Issues	International Maritime Conventions, Protocols and Agreements	Remarks
	Against the Safety of Maritime Navigation (SUA convention), 1988	• acts of violence against persons on board ships; and • the placing of devices on board a ship which are likely to destroy or damage it. The convention obliges Contracting Governments either to extradite or prosecute alleged offenders. The Convention came into force in Bangladesh on September 7, 2005.

In addition to the aforementioned conventions, Government of Bangladesh will sign the following conventions very soon;

1. STCW- 2010
2. Bunker Convention
3. Anti-fouling Convention
4. Hong Kong Convention for Ship Recycling
5. Ballast Water Management Convention

2.6 International Legal Obligations

Bangladesh is signatory to a number of Multilateral Environmental Agreements (MEAs) and also some bilateral instruments. Some of them are very important in the context of environmental protection. The legal obligations and provisions of MEAs related to the proposed project interventions will be reviewed; (***Convention on Biological Diversity; Convention on Wetlands of International Importance Especially as Waterfowl Habitat; United Nations Convention on the Law of the Sea; Convention concerning the Protection of the World Cultural and Natural Heritage)***

Bangladesh has already had accessed to, ratified or signed a number of important MEAs related to environment protection and conservation of natural resources which shall have to be complied with during implementation of the project. The pertinent ones of these are highlighted below:

2.6.1 Rio Declaration

The 1992 United Nations Conference on Environment and Development (UNCED) adopted the global action program for sustainable development called 'Rio Declaration' and 'Agenda 21'.

Principle 4 of the Rio Declaration, 1992, to which Bangladesh is a signatory along with a total of 178 countries, states, "In order to achieve sustainable development, environmental protection should constitute an integral part of the development process and cannot be considered in isolation from it".

2.6.2 *Convention on Biological Diversity (1992)*

The Convention on Biological Diversity, Rio de Janeiro, 1992 was adopted on 5 June 1992 and entered into force on 29 December, 1993. Bangladesh ratified the Convention on 20 March, 1994.

The Contracting Parties of the Convention have committed to:

- Introducing appropriate procedures requiring environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biodiversity, with a view to avoiding or minimizing such effects, and where appropriate allow for public participation in such procedures; and
- Introducing appropriate arrangements to ensure that environmental consequences of its programs and policies, that are likely to have significant adverse impacts on biodiversity, are duly taken into account.

Obligation has been placed on State parties to provide for environmental impact assessments of projects that are likely to have significant adverse effects on biological diversity (art. 4).

2.6.3 *Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar (1971)*

This convention is also known as the Ramsar Convention. It was adopted 2 February, 1971 and entered into force on 21 December, 1975. Bangladesh has ratified the Convention 20 April, 2002. This provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are 127 Parties with 1085 wetland sites designated as Wetlands of International Importance'.

This is an intergovernmental treaty, which provides the framework for international co-operation for the conservation of wetlands habitats. Obligations for Contracting Parties include the designation of wetlands to the "List of Wetlands of International Importance', the provision of wetland considerations within their national land use planning, and the creation of Natural Reserves. Parts of Sundarbans Reserved Forest (Southwest of Bangladesh) are one of the Ramsar Site.

2.6.4 *United Nations Convention on the Law of the Sea, Montego Bay, (1982)*

This Convention was adopted on 10 December 1982 at Montego Bay, Jamaica. Bangladesh has ratified this Convention.

Main objectives of the convention are:

• To set up a comprehensive new legal regime for the sea and oceans, as far as environmental provisions are concerned, to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment; and

• To establish basic environmental protection principals and rules on global and regional co-operation, technical assistance, monitoring, and environmental assessment, and adoption and enforcement of international rules and standards and national legislation with respect to alt sources of marine pollution.

2.6.5 *UNESCO World Heritage Convention*

Convention concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972: This convection has been ratified by 175 states. This defines and conserves the world's heritage by drawing up a list of natural and cultural sites whose outstanding values should be preserved for all humanity. Of the 730 total sites, there are currently 144 natural, 23 mixed and 563 cultural sites that have been inscribed on the World Heritage List (distributed in 125 State parties). These are the 'Jewels in the Crown' of conservation.

The Sundarbans is declared as the World Heritage Site. Therefore the provisions of this convention regarding protection of World Heritage Site are very much relevant for the proposed intervention.

The proposed project intervention should be carried out in such a manner that the above mentioned provisions of the multilateral environmental agreements are not violated and may not cause adverse impact on the natural resources.

2.6.6 *Development Agency's Health and Safety Guidelines*

Under the study health and safety guidelines of few development agencies has been reviewed. This included ADB's Social Safeguard Policy and the World Bank's Environmental Process.

2.6.7 *Social Safeguard Policy of ADB and World Bank*

ADB has had environment assessment requirements for more than 20 years and own safeguard policy framework which is currently taken to consist of three operational policies, namely the Environment Policy (2002), the Policy on Indigenous Peoples (1998), and the Policy on Involuntary Resettlement (1995), together with their respective operations manual sections and guidelines. In 1989 the World Bank adopted Operational Directive (OD) 4.00, "Annex A: Environmental Assessment". EA became standard procedure for Bank financed investment project. In 1991 the directive was as OD 4.01, which has subsequently been changed to operational policy OP 4.01 in January 1999 and the operational policy statement has been updated in March, 2007. EA is designed to be a flexible process that part of project preparation allows environmental issues to be addressed in a timely and cost-effective way during project preparation and implementation.

ADB's safeguard policies are central to achieving sustained development impact and poverty reduction. The objective of these policies is to avoid, minimize or mitigate adverse environmental impacts, social costs to third parties or marginalization of vulnerable groups that may result from development projects. Safeguard policies prescribe; "do no harm" requirements that must be met for all ADB projects. Regarding the resettlement plan of a project ADB provides that 'A satisfactory resettlement plan must include all eleven essential elements'. The safeguard policies are at the front line of ADB's accountability mechanism and compliance review process, since these policies, if properly implemented, help ensure that third parties do not incur material damages, either directly or through environmental media, and thus have no basis for complaint.

All three safeguard policies involve a structured process of impact assessment, planning and mitigation to address the adverse effects of projects and programs throughout the project cycle. The safeguard policies require that: (i) impacts are identified and assessed early in

the project cycle; (ii) adverse impacts are avoided, minimized, or mitigated; and (iii) affected people are consulted.

In July 2009, ADB's Board of Directors approved the new Safeguard Policy Statement (SPS) governing the environmental and social safeguards of ADB's operations. The SPS aims to avoid, minimize, or mitigate harmful environmental impacts, social costs, and to help borrowers/clients strengthen their safeguard systems. The SPS builds upon ADB's previous safeguard policies on the environment, involuntary resettlement, and Indigenous Peoples, and brings them into one consolidated policy framework with enhanced consistency and coherence, and that more comprehensively addresses environmental and social impacts and risks. The SPS also provides a platform for participation by affected people and other stakeholders in project design and implementation.

2.6.8 Compliance with World Bank Environmental Assessment (EA) Process

The primary responsibility for the Environmental Assessment process lies with the borrower. The Bank's role is to advise borrower throughout the process, to confirm that practice and quality are consistent with Environmental Assessment requirements and to ensure that the process feeds effectively into project preparation and implementation.

The 2001 Environment Strategy for the World Bank emphasizes the importance of integrating–or mainstreaming–environment into country development programs, sector strategies, and investments and underpinning sustainable development. WB introduced environmental policies and procedures to integrate good environmental management into our operations, and we have also developed environmental assistance programs to help client countries integrate environmental issues into their development process, to address their pressing environmental challenges.

In addition to efforts identified in the 2001 Strategy, the Bank has adopted a set of operational policies and procedures that deal with the Bank's core development objectives and goals, the instruments for pursuing them, and specific requirements for Bank financed operations.

World Bank seeks to ensure that -supported infrastructure and other development projects take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society. The policy strictly limits the circumstances under which any Bank-supported project can damage natural habitats (land and water areas where most of the native plant and animal species are still present).

Specifically, the policy prohibits Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are either:

- legally protected,
- officially proposed for protection, or
- Unprotected but of known high conservation value.

In other (non-critical) natural habitats, Bank supported projects can cause significant loss or degradation only when

i. there are no feasible alternatives to achieve the project's substantial overall net benefits; and

ii. Acceptable mitigation measures, such as compensatory protected areas, are included within the project.

(Operational Policy 4.04)

The Bank's current forests policy aims to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty, and encourage economic development.

Combating deforestation and promoting sustainable forest conservation and management have been high on the international agenda for two decades. However, little has been achieved so far and the world's forests and forest dependent people continue to experience unacceptably high rates of forest loss and degradation. The Bank is therefore currently finalizing a revised approach to forestry issues, in recognition of the fact that forests play an increasingly important role in poverty alleviation, economic development, and for providing local as well as global environmental services.

Success in establishing sustainable forest conservation and management practices depends not only on changing the behavior of all critical stakeholders, but also on a wide range of partnerships to accomplish what no country, government agency, donor, or interest group can do alone.

The new proposed forest strategy suggests three equally important and interdependent pillars to guide future Bank involvement with forests:

- Harnessing the potential of forests to reduce poverty,
- Integrating forests in sustainable economic development, and
- Protecting vital local and global environmental services and forest values.

(**Operational Policy/Bank Procedure 4.36**)

Chapter 3: Approach and Methodology

3.1 Introduction

The EIA of the proposed 1320 MW coal based thermal power plant to be constructed at the location of Khulna (Rampal, Bagerhat) has been conducted following the EIA Guidelines for Industries, prepared by the DoE in 1997 in accordance with the requirement of the Environment Conservation Rules, 1997 under the Environment Conservation Act 1995. The ToR approved by DoE has been duly followed during carrying out EIA. EIA process involves identification of the key impacts on natural and social environment and evaluation of the significant impacts along with recommendation of initiative measures as well as listing of unresolved environmental issues. The EIA includes collection of baseline information, setting of boundaries, impact assessment, suggestion of mitigation measures and alternative sites providing an environmental management plan. Flow diagram of the process followed in conducting the Environmental Impact Assessment (EIA) study of the project is presented in Figure 3.1.

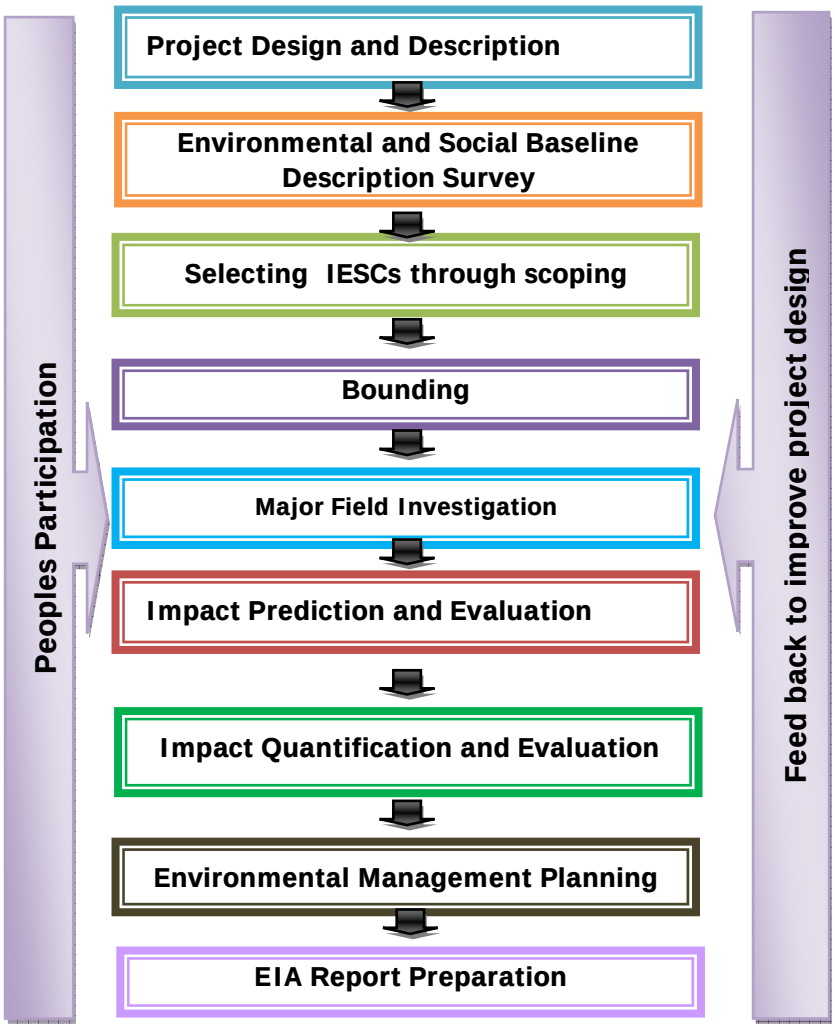


Figure 3.1: Process followed in the EIA study

Preliminary step of an EIA is the collection of primary and secondary data. Reviews of available literature from various sources, informal interviews and site visits are the steps to collect baseline information for the project area. Setting of boundaries is an important step and the elements are used for the scoping are geographical boundary, time horizon for alternative actions, affected groups, etc. The scoping covers all the phases of project implementation.

There are a number of methods present to conduct impact assessment for EIA study. In this study, Ad-hoc, Checklist and Matrix methods have been used to identify impacts of the proposed power plant to be constructed at Sapmari in Rampal, Bagerhat. Mitigation measures of the identified significant impacts are suggested and a preliminary Environmental Management Plan (EMP) has been proposed for the EIA study. The unresolved critical issues and resolution of issues are discussed in the EMP.

The EIA report of the coal fired thermal power plant at Sapmari, Rampal, Bagerhat has been prepared based on the findings from the IEE report, field observation and consultation with local people. This study was initiated with collection of environmental and socio-economic data from secondary sources. The primary data and public opinions have been collected from the project site and the study area. However, most of the data, which have been used for outlining baseline condition, have been collected from secondary sources. Remotely sensed satellite images have been procured, processed, ground truthed and interpreted for enrichment of EIA study of coal fired power plant.

The baseline has covered a detail description of the ***physical environment, water resources, land resources, agriculture, fisheries, eco-systems*** and ***socio-economic*** condition including identification of problems in respect of the resources.

Field visits were carried out in the project site as well as in the total study area. The main objectives of these visits were observation, assessment and professional justification. These have been conducted to identify the Important Environmental and Social Components (IECs/ISCs) through a scoping process including scoping sessions with the stakeholders. The visits have also been aimed for public disclosures and consultation as suggested in the EIA guidelines of DoE. Important parameters such as soil criteria, surface and ground water quality, noise, air quality etc. of the baseline situations have been generated from long term data collected from different organizations like: Soil Resources Development Institute (SRDI), Bangladesh Water Development Board (BWDB), Bangladesh Inland Water Transport Authority (BIWTA), Department of Public Health and Engineering (DPHE), Upazila Offices of different agencies and Department of Environment (DoE). Most of the social and economic data have been generated from BBS censuses. Moreover, CEGIS has its own database for different resource sectors, which also helped in the EIA study.

Data from secondary as well as primary sources on physical environment, water resources, land resources, agriculture, fisheries, eco-systems and socio-economic condition have been collected for assessing environmental and social impact of the proposed project and establishing an environmental management plan. Resource based parameters or criteria on which data have been defined including the sources of data and the methodology of data collection are presented in the following sections:

3.2 Assumptions

The study has been carried out considering some assumptions on project information and design

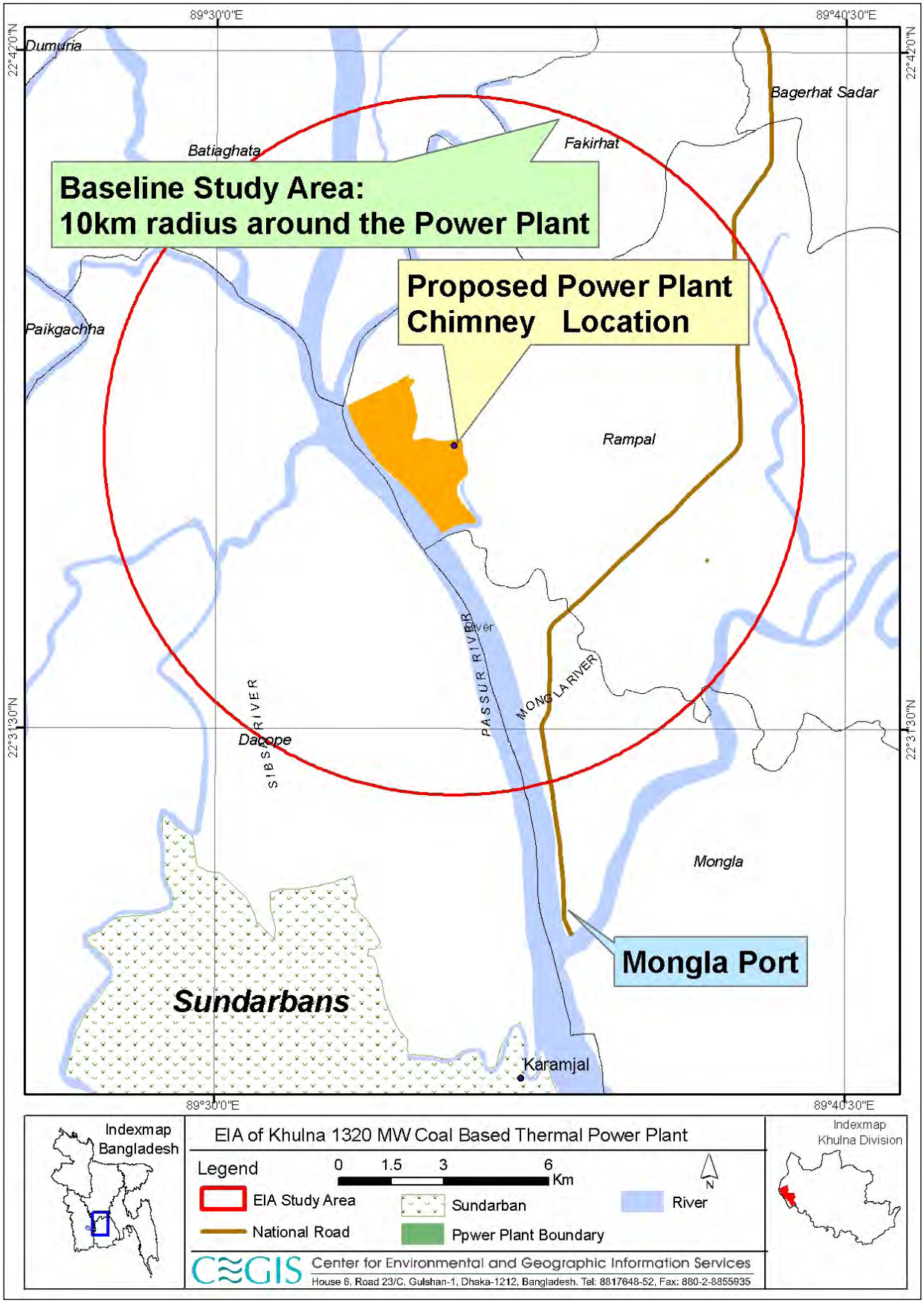
1. The dredging activities required for site establishment and improvement of the channel will be carried out under different projects which are to be executed by the relevant authority as per the norms of the ECR 1997. Under the scope of this study issues related with dredging are only briefly discussed.
2. The Bagha-Kaigar Daskati Road will be used for access road. LGED will renovate the road. If necessary, relevant studies shall be carried by LGED.
3. Initially, 420 acre of land will be developed for establishment of the site with sand to be dredged from Passur River and later the rest of the land of 1,834 acre will be filled by ash to be generated from coal burning. Bangladesh Water Development Board will carry out necessary study for executing the work.

3.3 Study area boundary

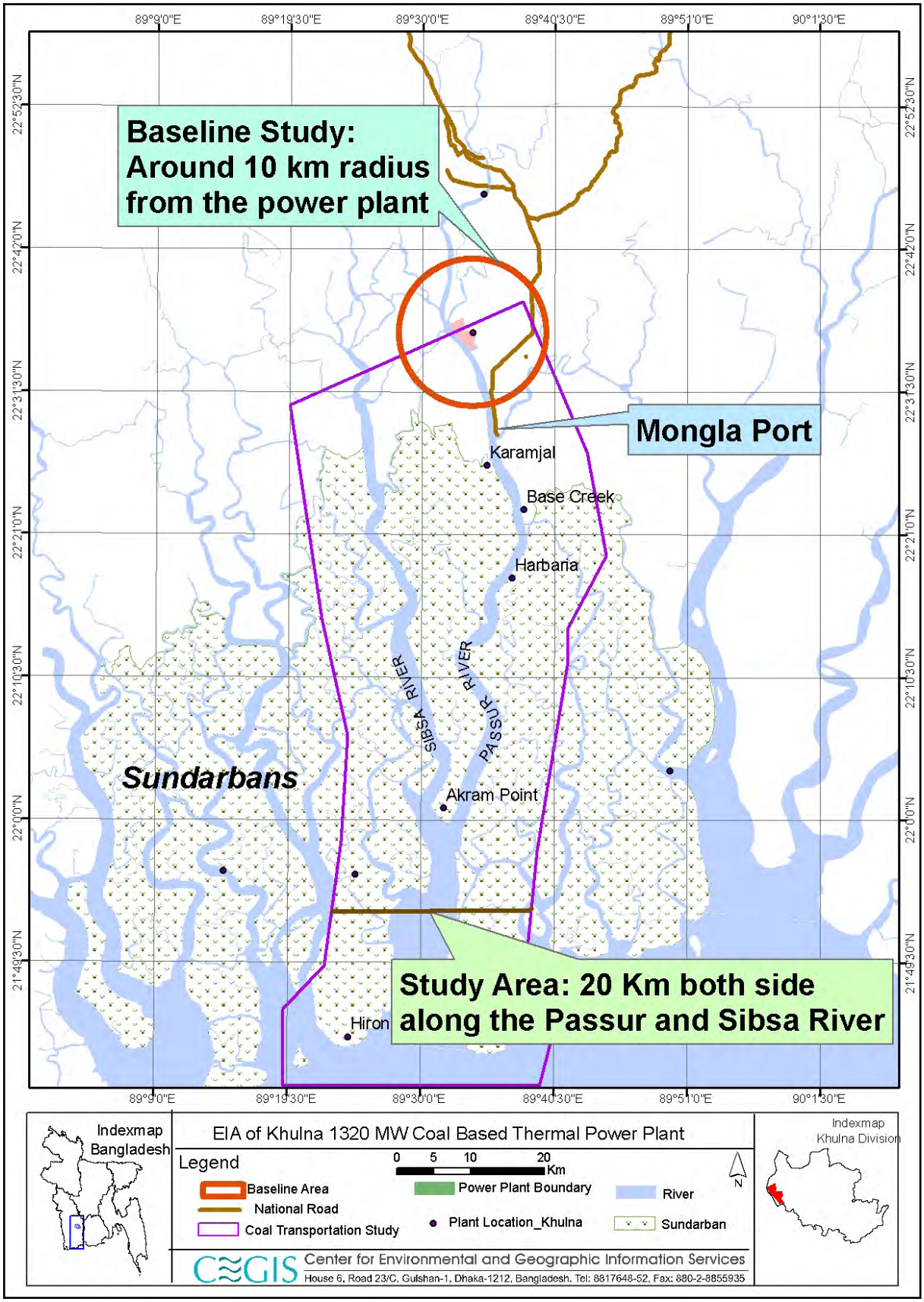
The study area boundary has been re-delineated in EIA study based on the findings of the IEE study, and air pollutants and thermal plume dispersion scenarios. For establishing Environmental Baseline condition, about 10 km radius around the plant location and the area of Sundarbans Reserve Forest have been considered (Map3.1). For Impact assessment, as vast area from the plant location has been considered (Map 3.1) depending on wind direction, water flow and sensitivity. Besides, an area of a 20km strip of land from the both sides of the Passur and Sibsha River from Mongla Port Fair Way Buoy to North end of the project has been considered for assessing impact of coal transportation (Map 3.2). The impact zone has been considered based on the experience of Barapukuria coal based thermal power plant, nature of the proposed project and the ToR approved by DoE.

3.4 Study period

Initially, the study period provided for EIA was six months. Later, comprehending the importance of the environmental issues and scope of the EIA, the study period has been extended to 1.5 year. The major field investigations were carried out during August 2010 to August 2011. The Draft Final EIA report was submitted to DoE on September, 2011. A discussion meeting was held on 26 February, 2012 at DoE Dhaka office. On the basis of comments from different government and non-government organizations, the said report has been revised.



Map 3.1: Boundary of the study area for impact assessment



Map 3.2: Baseline condition impact assessment for coal transportation route

3.5 Physical Environment Assessment

The issues of ***physical environment*** have been investigated through professional observation of the multi-disciplinary team members backed up by feedback from the local people during field visits. The base of the physical environmental assessment was data from secondary sources, high resolution recent satellite images (Quick Bird-2 and IRS ID Pan) and field observation. In general, the physical environmental data collection and survey was carried out by a composite method of investigation including observation, remote sensing image analysis and public consultation. Every analysis was done with world standardized tools and the result presented with Geographical Information Services interface.

The ***geological and seismic issues*** have been taken care through secondary information and field observations. The general geological features and the seismicity of the project and its surrounding areas were collected from available secondary literature and Geological Survey of Bangladesh. The lithology of the project area was collected from NWRD of WARPO.

Meteorological data such as rainfall, evapo-transpiration, temperature, sunshine hours, humidity, wind speed and wind direction have been collected and analyzed for assessing local climate that are directly related to water resources of the study area and the project area. Meteorological data for selected stations have been collected from the National Water Resources Database (NWRD) of WARPO, which contains long series of temporal data showing daily values for meteorological stations maintained by the Bangladesh Meteorological Department (BMD). Air quality and noise level data were collected from Department of Environment, Khulna.

3.6 Topographical survey and development of Digital Elevation Model

A detail topographical survey (25m x 25m grid) was carried out for indentifying land use, area, land type, land elevation, and other topographical features. Topographic information from recent DEM was used for planning of thermal power project study. In addition, total station survey was carried out to obtain detail topographical information. Topographical features were identified and mapped, analyzing latest satellite image of the area and topographical survey. Based on the topographical survey and topographical maps prepared by BIWTA and Geological Survey of Bangladesh, the average land level and levels of specific locations were generated for further planning purposes.

3.7 Soil Survey

Soil investigation method was treated as indicative approach toward smooth execution of the work within the time frame and financial involvement. Overall methodology for works was divided into two major phases. First were field works and later on laboratory works. The field works include exploratory boring drilling, standard penetration test and extraction of soil sample. On the other hand, laboratory works include proper evaluation of selected physico-chemical parameters of soil sample of the project site.

3.8 Air quality assessment

Air quality monitoring data were collected from 11 points located at down wind direction of the plant area within the study area. Air samples for assessing SOX, NOx, SPM concentration were collected at three cement industries (approximately 8 to 10 km south of the plant location), Sarankhola Upazila (approximately 43 km southeast of the plant location), Khulna City area (approximately 23 km northeast of the plant location). Map 3.3 depicts detail locations of the air quality monitoring points from where air samples were collected by experts of DoE.

3.9 Water Resources

Most of the water resources data have been collected from secondary sources. The Passur and other river systems of the study area have been identified for hydrological and morphological data collection. Hydrological stations on the Passur river system, defined by BWDB and Mongla stations have been selected for historical and current data collection and analysis. Specific fields of interest have been selected for collecting data on special hydrological and morphological events such as salinity, drainage congestion, water logging, tidal fluctuation, erosion – sedimentation etc.

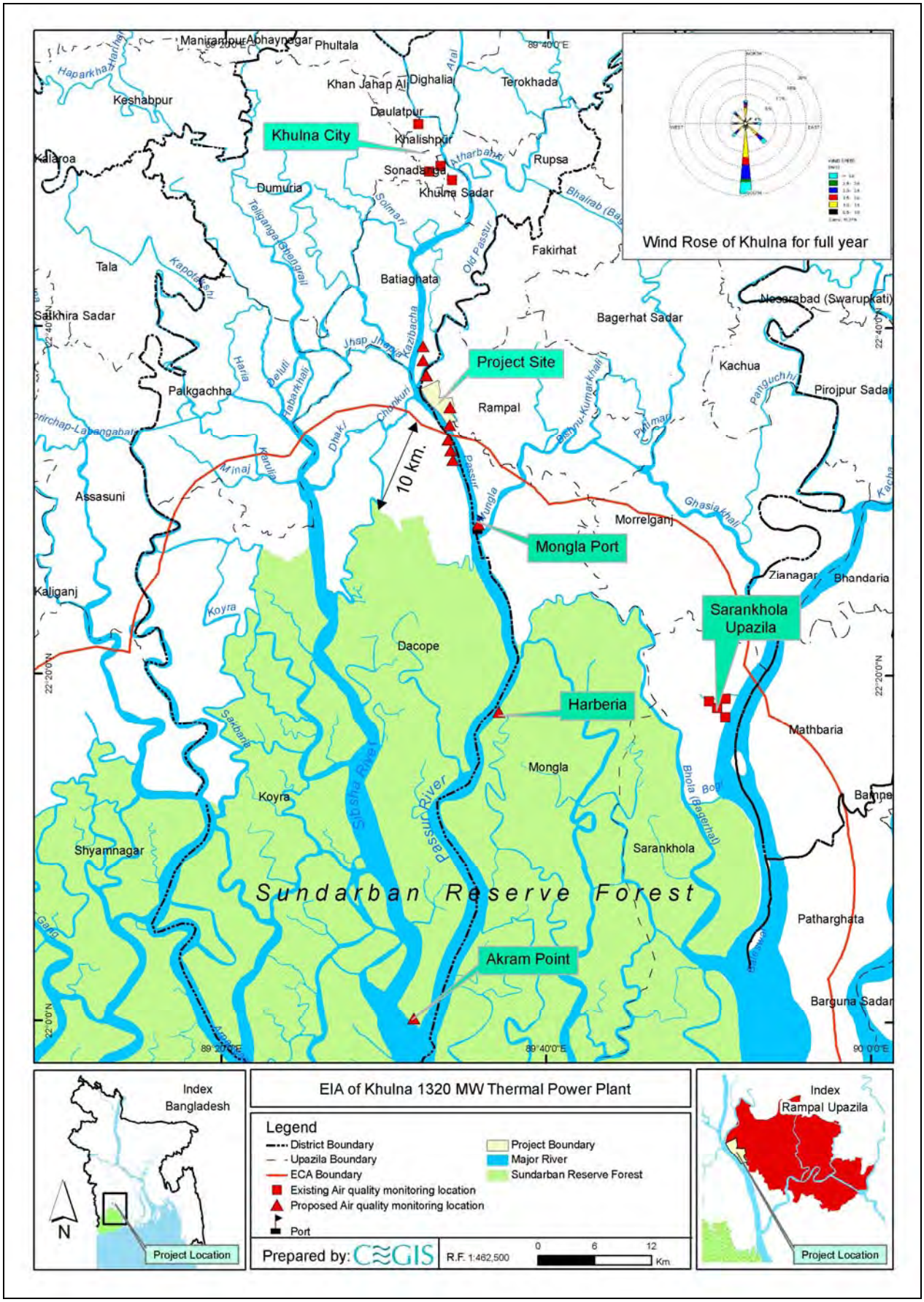
Water resources data under four broad heading namely ***river hydrology***, ***river morphology***, ***ground water hydrology***, ***ground and surface water quality and use*** have been collected from secondary sources and primary observation using the methodology presented in the following table.

Table 3.1: Data source and methodology for water resources assessment

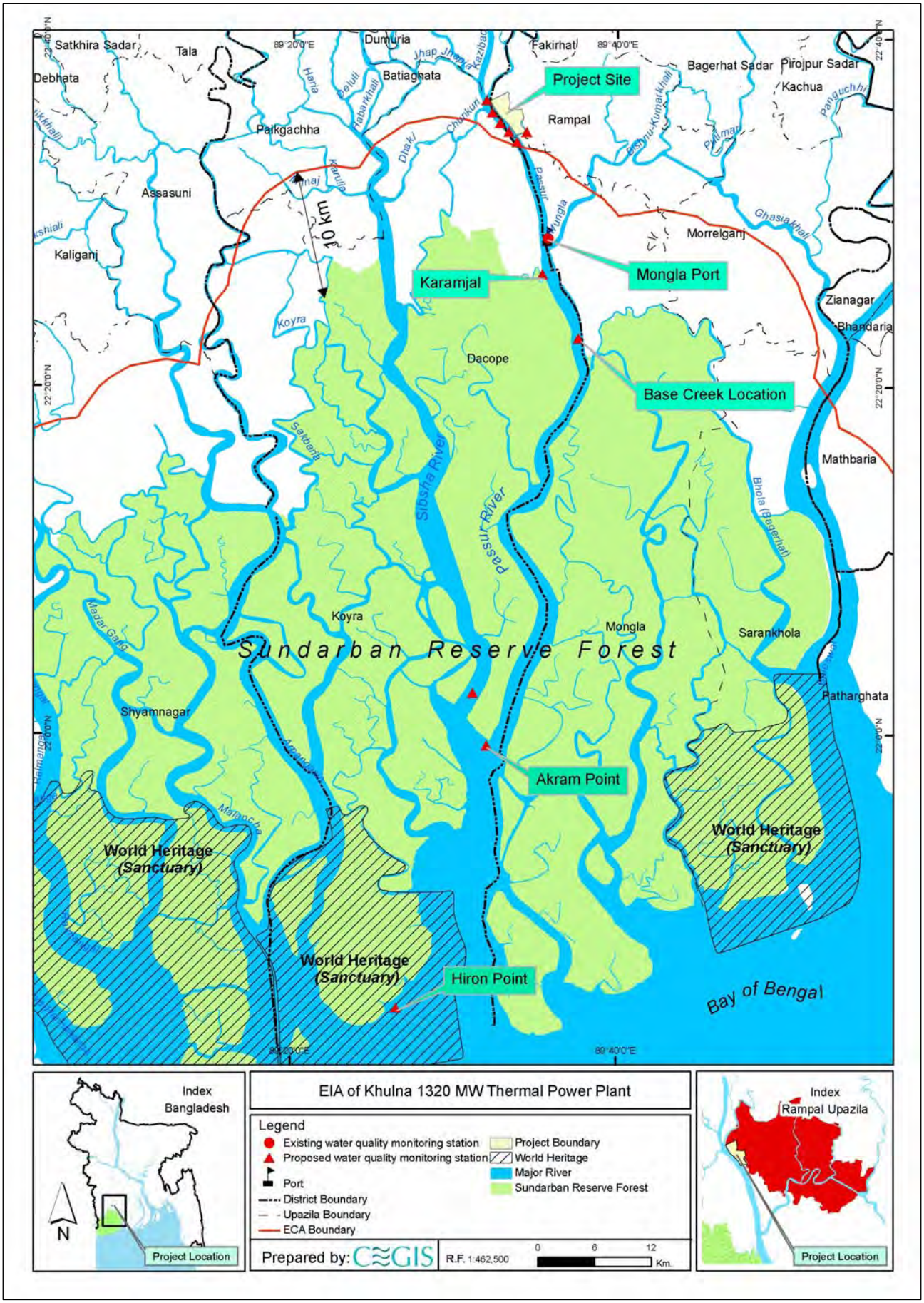
Parameter	Data Sources	Methodology
River hydrology		
Dry and wet season water level in the Passur	BWDB	Mean monthly water level in Mongla station were collected from BWDB database.
Tidal Flooding	BWDB/ Field observation	Tidal level data have been collected from BIWTA and Mongla Port Authority.
Drainage system	CEGIS/field observation	Primary data gathered through image analysis and physical observations have been used.
River morphology		
Sedimentation	CEGIS	Data generated through satellite image analysis and physical observations have been used.
Erosion	CEGIS	Historical data have been collected from CEGIS reports and current situation have been defined from image study and physical observations

Parameter	Data Sources	Methodology
Navigation	BIWTA, Bangladesh NAVY and Mongla port authority	Depth and length data of navigation route within the study area have been collected from source organizations
Plan form change	CEGIS	Data have been derived from satellite image analysis.
Ground water hydrology		
Water table	DPHE	Data have been collected from source organization at different locations of the entire study and project area.
Surface and ground water quality and use		
Surface and ground water quality. (*Salinity level and Arsenic concentration*)	BWDB, DOE and DPHE	Salinity level has been analyzed based on salinity data from WARPO. Other surface water quality data have been collected from yearly reports of DOE
Surface and ground water use	BBS, BWDB and DPHE	Rate of water use in different sectors have been calculated from the data of information in BWDB and BBS

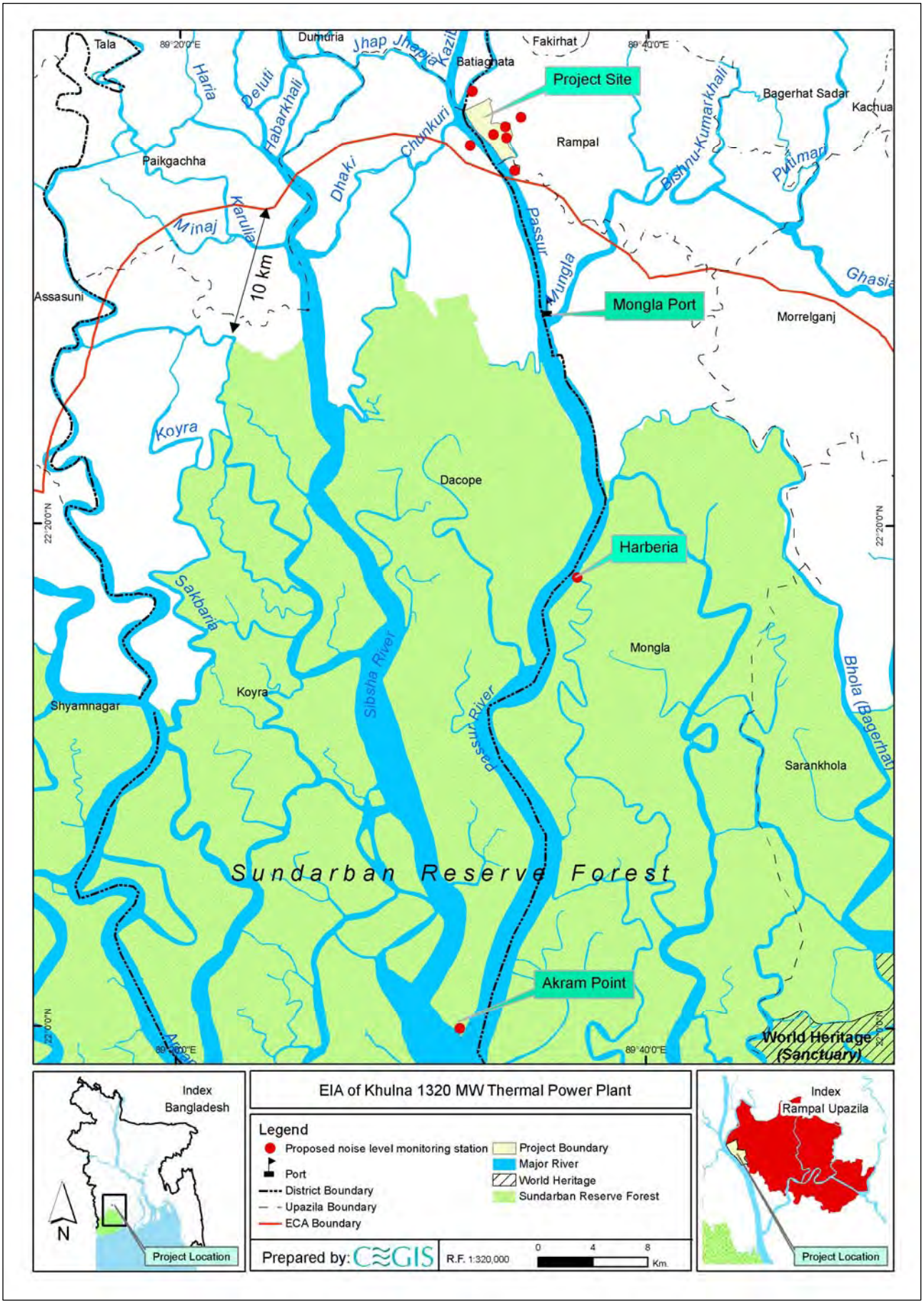
Water samples of the Passur River were collected from six different locations within the study area. Map 3.4 depicts location of water quality monitoring points considered for this EIA. Groundwater samples were collected from 13 boreholes installed within the project area (Map 6.12).



Map 3.3: Locations of air quality / monitoring points



Map 3.4: Locations of water quality Measuring / monitoring points



Map 3.5: Locations of noise level / monitoring points

3.10 Land Resources

The Agro-ecological Region of the proposed project area has been identified using secondary sources (FAO/UNDP). The land type, soil texture, drainage characteristics, surface water recession and soil nutrient status have also been collected from secondary sources (Soil Resource and Development Institute, SRDI). The secondary data of these parameters have been verified at field level through physical observations as well as in consultation with the local people and officials of the Department of Agriculture Extension (DAE) during field visit.

High resolution satellite images were acquired to derive current land use/land cover maps of the project area. Methodology of present land use/land cover mapping from satellite image is shown in Figure 3.2.

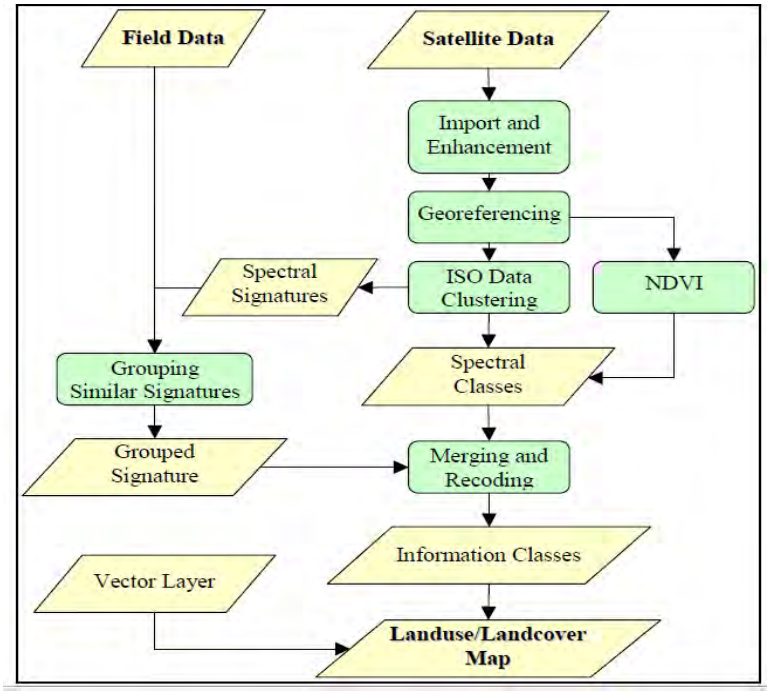


Figure 3.2: Methodology of land use/land cover map preparation from satellite image

Table 3.2: Satellite Images used for Land use/land cover map preparation

Site Name	Image Type	Spatial Resolution	Acquisition Dates
Rampal, Khulna	QuickBird-2	0.6m X 0.6m	12th February 2010
	IRS ID Pan	6m X 6m	8th March 2003

After procuring the images, all of them were geo-referenced into the Bangladesh Transverse Mercator projection by Ground Control Point (GCP) coordinates. The GCPs were collected from the study areas using the Differential Global Positioning System (DGPS). Both visual and digital interpretation techniques were used to derive the land use/land cover information from these images. Field surveys were conducted to collect ground truth data for the information on current land use/land cover, which are used for interpreting digital classification. Finally, land use/ land cover maps were produced by digital classification with the help of ground truth data.

3.11 Agricultural Resources

Agricultural resources include existing cropping patterns, crop variety, crop calendar, crop yield, crop damage and agricultural input used. Agriculture data have been collected from primary sources through extensive field survey by developing questionnaire and in consultation with local people and concerned agricultural officials. Agricultural resources data were also collected from secondary sources from Upazila Agriculture Extension office (DAE). Crop production was determined using the formula: Total crop production **=** damaged free area **×** normal yield **+** damaged area × damaged yield. The crop damage (production loss) has been calculated using the formula: Crop production loss = Total cropped area ×normal yield-(damaged area ×damaged yield+ damaged free area × normal yield). The crop damage data have been collected from the fields for last three years. Existing programme and future development plan of agriculture in the study area were collected in consultation with the officials of DAE and local people of the study area.

3.12 Livestock Resources

Present status of livestock (Cow/Bullock, Buffalo, Goat and Sheep) and poultry (Duck and Chicken) in the study area have been evaluated during the field level survey in consultation with the local people through questionnaire. Discussions were also made with the local Upazila Livestock Officials about existing development programme and future development plan in the study area.

3.13 Fisheries

The sequential approaches for fisheries components study under EIA process were as follows:

Selection of sampling sites

The following 15 sampling sites were selected for collection of fisheries and aquaculture data.

Table 3.3: Sample location for the fisheries resources assessment

Sl. No	Name of the site	Site location	Observing habitat
1	Kalikaprasad	Study area	Shrimp *gher*, Pond
2	Rajnagar	Study area	Shrimp *gher*, Pond
3	Basherhula	Study area	Shrimp *gher*, Pond
4	Kapasdanga	Study area	Shrimp gher, Pond+Khal
5	Sapmari-Katakhali	Project area	Shrimp *gher*, Pond
6	Kaighar Daskati	Study area +Project area	Shrimp *gher*, Pond
7	Bagha-Kaighar-daskati (Khal)	Study area +Project area	*Khal*
8	Khalekhar Ber	Study area	Shrimp gher, Pond, *Khal*
9	Belai	Study area	Shrimp gher, Pond, *Khal*
10	Ichamati River	Study area	River

Sl. No	Name of the site	Site location	Observing habitat
11	Maidaha River	Study area	River
12	Passur River	Study area	River
13	Chunkuri River	Study area	River
14	Chukuri Village	Study area	Pond
15	Bajua	Study area	Pond

Note: Gher means shrimp aquaculture farm land

Fisheries data were collected from primary and secondary sources from the fishermen community, fisher households, local key informants and the Upazila Fisheries Office comprised primary data and data collected from the Department of Fisheries (DoF), District Fisheries Office, Upazila Fisheries Offices and relevant literature reviews comprised secondary data.

Primary data collection

Prior to data collection, the prevailing fish habitats were classified into two broad categories, such as capture and culture fish habitats. Capture fish habitats included rivers, estuaries and *khals*, *beels*, floodplains and the mangrove, whereas culture fish habitats included culture fish ponds, shrimp/ prawn *ghers*, crab fattening habitats, etc. The habitat-based macro level fish data collection methods are elaborated below.



Plate 3.1: Field team identifying fisheries habitats Passur river and Kaigardaskati



Plate 3.2: Fisheries specialist conducting Catch Assessment Survey in Maidara river

Capture fisheries

Catch Assessment Survey (CAS)

Gear-specific fish catch data were collected using Catch Assessment Survey (CAS) log sheets.

Species diversity and composition

Habitat wide varieties of fish species were identified and their composition in catch was estimated during the CAS. The species diversity information as well as composition was facilitated through a survey of adjacent fish markets.

Indicator fish species identification

Indicator fish species were identified in terms of rare and locally unavailable species by interviewing professional fisherman and key informants.

Fish migration survey

Data collection on the migration of fish species along with their life stages were collected by questioning fulltime fisherman engaged in fishing. Moreover, fishermen perceptions were noted down with regard to the potential implications of fish migration if the power plant is installed.

Hatchling migration survey

Information on hatchling migration was collected from hatchling and PL collectors at the local rivers and tributaries. The information included the period of hatchling migration, species composition and trends of hatchling migration. Fishermen's perceptions on possible implication to hatchling migration due to the power plant were also determined.

Habitat identification for fish conservation

Potential habitats for fish conservation like fish sanctuaries, *katha*, ECA etc. were identified by interviewing fisherman and key informants.

Culture fisheries

Fish ponds and shrimp and prawn farms were surveyed to collect data and information by using developed questionnaire. Fish culture pattern, species composition, production status and other relevant information on fish ponds and shrimp/prawn *ghers* were collected from the respective managers/owners through random sampling.

Secondary data collection

Secondary data were collected from the Department of Fisheries (DoF), District Fisheries Office (DFO), Upazila Fisheries Office (UFO) and from various literatures/studies.

Data analysis & output

Fish Habitat calculation / Assessment and Fish production

Fish production for individual habitats of capture and culture fisheries were estimated using both primary and secondary data. For estimating production, classified habitat area was determined using FRSS databases and CEGIS calculation.

Habitat quality assessment

For assessing habitat potential, fish species diversity was determined for the rivers and tributaries to make assumptions on the post plant installation habitat condition.

Threats for fisheries

Attempts were made to identify potential threats for fisheries due to installation of the power plant along with mitigation measures by discussing with fisheries and water resources experts.

3.14 Ecosystems

The high-resolution satellite images of the proposed site were studied to identify any ecologically significant area and different habitats existing within the project site. Based on information from the aerial maps and available project site map, field survey was undertaken to list the available habitat types and flora and fauna known to inhabit the area. The surveys included transects within the study area covering all major habitat types. Usually teams comprising of experts from different fields of specialization conducted the transect walks. Apart from the transect walks river habitat were surveyed on boats.



Plate 3.3: Field team conducting transect along Passur river



Plate 3.4: Field team conducting transect walk in Chunkuri

Transects were made along the roads where possible. On the contrary four cross-country transects were also made from east to west up to the left bank of the Passur river. Similarly to cover the study area the river was crossed on a boat and three transects from west to east up to the right bank of the Passur was conducted. The left bank was more stable than the right bank owing to the presence of the mangroves. Lot of sand accumulation was observed including a shoal on the right bank.

Published information related to the ecological characteristics of the area was collected from various publications. The bird list was prepared using mid-winter survey information in the coastal areas conducted by CARINAM and Bangladesh Bird Club (BBC) and "Bangladesher Pakhi" (Khan, 2010). Verification of the occurrence of plants was made using "Bangladesher gach gachra" (Dey 2006).

3.15 Socio-economic condition

Socio-economic assessment for the EIA study of the proposed 1320MW Coal Based Thermal Power Plant project in Bagerhat district has been designed with a view of having an intrinsic notion about the socio-economic condition of the study area from the local people's perspective and their consultation about this project.

For investigating problems and their solution, the study team focused on describing, understanding and interpreting social phenomena and processes related to the study area. It is normally quite difficult to predict and explain social phenomena very precisely. Therefore, the study team depended on different methodological approaches for capturing, understanding and interpreting the socio-economic information. Both qualitative and quantitative approaches were used for collecting socio-economic information of the study area.

Study area

The study area for socio economic assessment covers 10 km radius of the project area to explore impact of the project. It, therefore, includes both inside and outside project area, i.e. the outside impacted area. The study area include two districts namely Khulna and

Bagerhat, four Upazila namely Dacope (Khulna), Batiaghata (Khulna), Rampal (Bagerhat) and Mongla (Bagerhat), 10 unions and 29 Mauza. Twenty five percent of the Mauzas were selected for smooth completion of the study within the short duration of the study period. As such seven sample Mauzas were selected based on their locations, population density and number of settlements. Out of seven Mauzas, Sapmari Katakhali is located in the project area while the rest (Rajnagar, Bara Durgapur, Kaigar Daskati, Chunkuri, Kapasdanga, and Baserhula) are within of the study area. Table 3.4 shows the location of the sample Mauzas. It needs mentioning here that Labanchara in Batiaghata upazila was selected as an alternative site for examining its feasibility as the location for the project. The necessary information was collected on the basis of every indicator mentioned in the Inception Report.

Table 3.4: Location of the sample Mauzas

Upazila	Union	Mauza	Population (2011)	Household (2011)	Population Density (population per sq km)
Rampal	Upazila Total		203917.5	46344.9	607.9
	Rajnagar Union	Union Total	15111.3	3434.4	500.6
		Sapmari Katakhali	696.8	158.4	93.9
		Rajnagar	2159.1	490.7	1343.9
		Bara Durgapur	2375.0	539.8	375.0
		Baserhula	741.4	168.5	240.1
		Kaigar Daskati	734.5	166.9	187.7
	Gaurambha Union	Union Total	24703.9	5614.5	740.1
		Kapasdanga	2080.3	472.8	1129.8
Dacope	Upazila Total		179911.6	40889.0	181.4
	Bajua	Union Total	17157.3	3899.4	561.2
		Chunkuri	8279.9	1881.8	454.0

Note:

- *The project area covers only Sapmari Katakhali Mauza*
- *The population size for 2011 was estimated from the average annual national growth rate 1.34 (mentioned in the Preliminary Report of Population Census 2011).*
- *The number of households was estimated on the basis of the average national household size (4.4)*

Source: BBS 2001 & BBS 2011

Technique of data collection

Different techniques were used to gather relevant information on existing socio-economic condition of the study area. Quantitative and qualitative data were collected from secondary and primary sources. Quantitative data was collected through exploitation of the techniques of literature review and Rapid Rural Appraisal (RRA), where qualitative data was through informal interview and public consultation session.

Table 3.5: Variables and associated data collection techniques

Variables	Techniques	Tools
Demographic information	Literature review	Check list, note pad
Quality of life	RRA	Check list, note pad, camera, map
Social overhead capital	RRA, informal interview	Check list, note pad, camera, and map
Safety net & poverty reduction measures	RRA, informal interview	Check list, note pad, camera, and map
People's perception	Public Consultation	Check list, note pad, camera, and map

Sources of data collection

In this EIA study, data were collected from different sources. But all these sources can be grouped into two categories:

Primary sources

The data were collected from the six Mauzas of Rampal and Dacope Upazila through RRA, public consultation, and informal interviews.

Secondary sources

To prepare the baseline situation of the study area, information about some important socio-economic parameters were collected from the census and survey reports of Bangladesh Bureau of Statistics (BBS).

Time allocation for fieldwork

The time allocated for field data collection was five days during the preliminary field survey. A number of times has been surveyed to the study area during detail study as well as updating the report. The information was collected from the local people and relevant government offices (Deputy Commissioner and Civil Surgeon/Rampal Upazila Health Complex). Different professional groups of people like fishermen, teacher, political leaders, village polices, and health officers participated in the RRA and public consultation sessions. These sessions were held in different public gathering places, such as, rural shops, schools, and working places.

Details of the data collection techniques

Rapid Rural Appraisal (RRA)

RRA is an approach for shared learning between local people and outsiders to enable development practitioners, government officials and local people to plan together for appropriate intervention. In this study RRA was used to grasp details about the socio-economic situation of the study area. The local people informed the study team about the anticipated problems related to the project. The method was important to know the present

situation and identify future impact (positive and/or negative) of the project on the socio-economic condition of the study area.

Informal Interview

Informal interviews don't have any guidelines, questionnaire and check lists. In this study informal interview was characterized by greater flexibility. The main reason for this type of interview was to get people to open up and let them express themselves in their own terms, and at their own pace. Such kind of informal sittings with the informants helped in establishing a kind of intimacy, in turn helped to come to the discussion on the perception and reactions about the project.

Public Consultation

Public consultation is a session of discussion by the local people for conducting any development work. This discussion includes people's perception, recommendations, suggestions etc. The consultation sessions, in this study, were started with the short description of the power plant project and project impact zone. The objectives, proposed sites and the possible impacts of the project and the connectivity links of the study area with the project were also explained. The participants of consultations belong to different occupational groups, for example, farmer, fisher, day labor, school teacher etc. Moreover, to grasp the women's perception consultation sessions were also facilitated among a group of women to know the existing occupational status, future possibilities for employment due to the implementation of this project. The detailed methodology is given in the Stakeholder Consultation Chapter). Generally, public consultation is a formal participatory approach in which local people and development experts interact actively but, in this study, the study team facilitated public consultation sessions informally. The main idea was to grasp grassroots' voice without any political biasness. Thus, ten numbers of such types of public consultation sessions were conducted to know the perceptions and recommendations of local people about the Power Plant Project. The local people of the study area expressed their demands in these meetings. They identified both positive and negative impacts of the project on their existing socio-economic life.

Stakeholder consultation and Disclosure

Throughout the reconnaissance survey and field investigations, stakeholder consultations were conducted at three different tiers of stakeholders: Government Department, Local Government Institution, and local people. The main purpose of the consultation was to inform them about the proposed project and CEGIS activities in this context. It was tried to gain the stakeholders' perception about the project activities and their suggestion in conducting EIA.

Data Analysis

The study involved a numbers of levels of analysis. Some are simple and informal while others required some statistical sophistication. The data collected from public consultations, RRAs and informal interviews were analyzed through the electronic software "Microsoft Office". The sum and the percentage of total values were used to specify the percentage of households containing different values on different variables. This analysis explains the socio-economic situation of every household out of 100 households. For report writing the

numerical data were processed through Microsoft word software and to prepare baseline database and numerical data calculation Microsoft excel software was used. The Microsoft excel software was also used to convert the data into different charts, e.g. pie chart. The main reason behind this graphical presentation is to capture the whole socio-economic situation at a glance from the graphs.

3.16 Impact Assessment and Evaluation

3.16.1 Assessment and evaluation

At IEE stage, attempts were made to identify all potential impacts of the proposed power plant both on environmental and social components. Impacts having potential to be resulted during pre-construction, construction and post-construction stages were identified separately. All the potential impacts have further been evaluated, and detailed in EIA stage following the ToR approved by DoE. Both quantitative and qualitative tools have been used to assess the impacts. The impact evaluation has been made following the operational guideline of the World Bank, EIA guideline of the DoE and standard practice of impact evaluation. Each impact has been evaluated examining the following criteria:

- Nature of the impact – direct or indirect
- Spatial extent of the impact- local or widespread
- Temporal extent – long term or short term
- Reversibility
- Likelihood, and
- Significance

Evaluations were made following expert judgment in Delphi approach. Several round table discussion meeting with the team members were made to finalize the evaluation. A qualitative scale defined by word scenario was prepared for each criterion for evaluation. Based on the qualitative scale, judgments were made about the nature, spatial extent, temporal extend, reversibility, likelihood and significance of each impact. The evaluation was finalized following iteration method through round table discussion and expert opinion. Chapter 9 details out the Evaluation Matrix and Word Scenarios of the qualitative scale of evaluation.

The results were shared with experts of BPDB, DoE and other relevant agencies attended in two different meetings on Draft EIA Report at Ministry of Power, Energy and Mineral Resources and Department of Environment. Finally, the evaluations have been rechecked and updated considering the valuable and expert comments of the participants.

3.16.2 Air pollutant dispersion modeling

Maximum ground level concentration of SO_2 and NOx has been calculated using SCREEN 3.0.0 model. The model is fully approved by the United States Environmental Protection Agency (USEPA) for calculation of maximum short-term concentrations of non-reactive pollutants emitted from a single source. Short-term concentration represents peak one-hour and 24-hour maximum concentration (ground level concentration). The SCREEN 3.0.0 model set up has been prepared including buoyancy-induced dispersion (BID), subroutines to estimate shoreline fumigation due to presence of river and sea, rural dispersion, and simple terrain. SCREEN 3.0.0 is an optimized version of the USEPA reference Industrial Source

Complex model (ISC). Maximum concentrations are calculated based on a screening set of 54 meteorological conditions for distances downwind of the source.

3.16.3 Identification of control measures for minimizing CO_2, SO_2, NO_2, etc emission

The specific measures for controlling CO_2, SO_2, NO_2 emissions have been suggested and detailed in the EMP. The measures will be identified based on expert judgment, literature review consultation with BPDB professionals and DoE Experts.

3.17 Risk and hazard analysis

Hazard and associated risk with the construction and implementation of proposed power plant have been identified using risk matrix. The associated occupational hazard, emission of pollutants (SO_2, NO_2, SPM), fire hazards etc. have been identified and their detailed analysis has been given in chapter 11. The procedure of occupational health and safety measures has been guided by ADB's Social Safeguard Policy and the World Bank's Environmental Process.

3.18 Environmental management and monitoring plan

The EMP as outlined in the IEE has been detailed out in EIA following the ToR approved by the DoE. The detail of water quality management plan, air quality management plan, noise level management plan, land and soil management plan, biodiversity management plan and socio-economic management plan, etc have been discussed and estimated management cost in Chapters 12. Moreover, hazard and risk management plan including occupational health and safety measures have been specified in the chapter 12 following the standard practices. The monitoring procedure, monitoring location, responsible authorities and monitoring schedule has been detail out in chapter 13. The EMP has been formulated in a manner so that the implementing agency can easily follow it.

3.19 Resettlement and compensation

According to the Population Census and field expedition, it is estimated that, approximately 150 households are now living at Sapmari Katakhali Mauza. Due to the project implementation these households will be displaced. The study team assessed the resettlement and compensation modes through the consultation with multi-level stakeholders. In these consultation sessions, these households expressed their opinions regarding the resettlement and compensation approaches. They discussed different alternative strategies and those are described in Chapter 12 and 15 in detail.

Chapter 4: Evaluation of Alternatives Site Selection

4.1 Introduction

The project proponent has already obtained the Location/Site Clearance Certificate from DoE on 23May, 2011. Earlier, as per requirement of the ECR 1997, BPDB identified two candidate sites- Labanchara, Khulna and Sapmari Katakhali, Bagerhat (Map 4.1) for the proposed Khulna 1320 MW Coal Based Power Plant. An alternative evaluation was carried out at IEE stage through multi-criteria considering ECR 1997 recommended criteria for site selection and reported in the IEE report for obtaining feedback of the IEE reviewers and Site Clearance Certificate from DoE. Accordingly, DoE issued the Location/Site Clearance Certificate.

At this stage of EIA, the evaluation of the alternative sites was reconciled with the comments obtained from experts of DoE, IUCN, BPDB and other participants of the meeting on draft EIA. An alternative site is located in Batiaghata Upazila of Khulna District that covers 500 acres of lands within Labanchora and Putimari Mauza of Batiaghata union (Plate 4.1). The other alternative site is in Rampal of Bagerhat district that cover 1,834 acres of land within Sapmari Katakhali and Kaigar Daskati Mauza of Rajnagar Union (Plate 4.2). The detail approach and methods of alternative site evaluation are described in the following section.



Plate 4.1: Panoramic view of the alternative site in Labanchara, Batiaghata, Khulna



Plate 4.2: Panoramic view of the alternative site in Sapmari, Rampal, Bagerhat

4.2 Approach and methodology

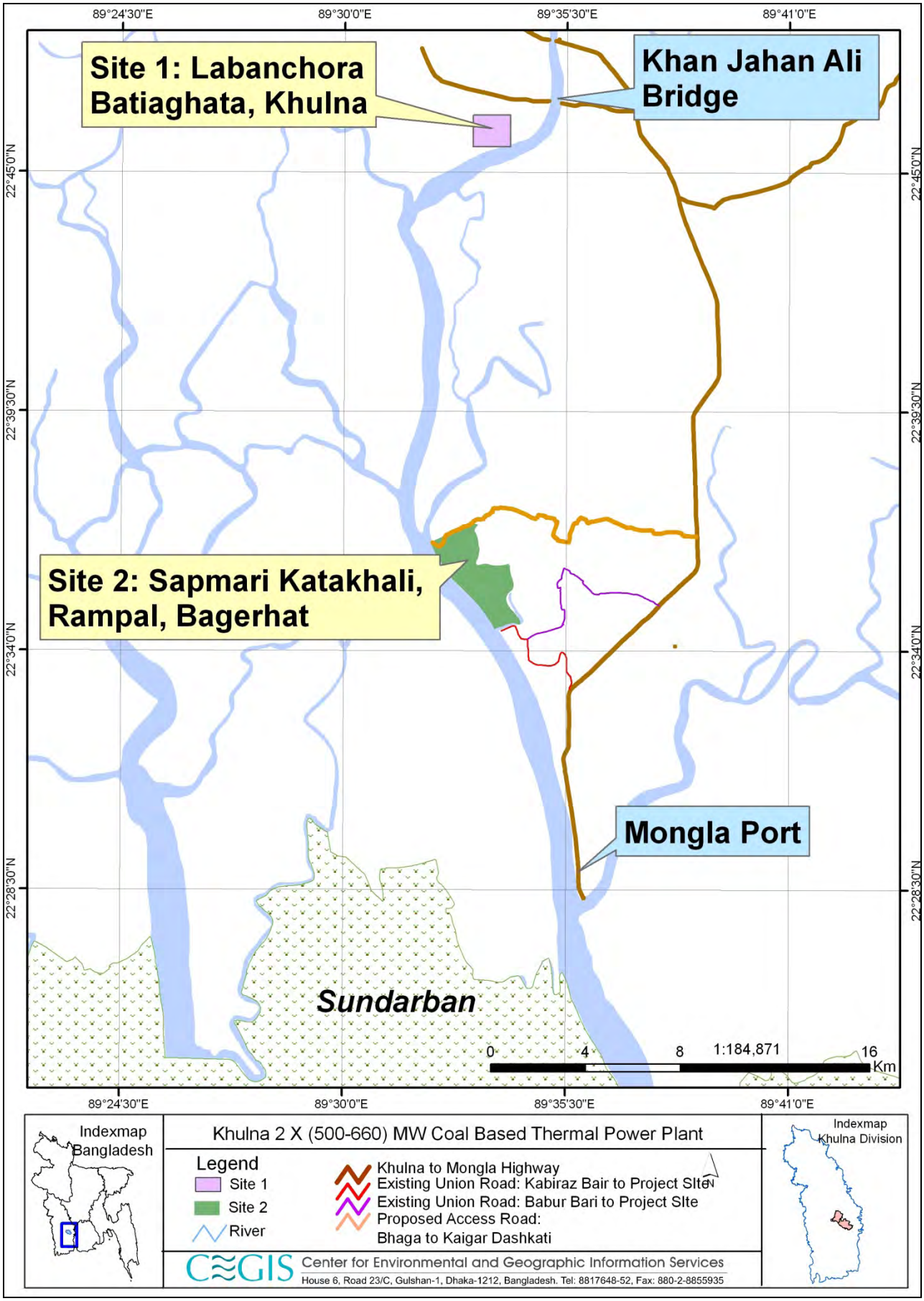
The comparison between two alternative sites were made in a systematic approach of evaluation based on a set of criteria and considering only the direct impact due to land occupation of the proposed power plant. A preliminary criterion framework was developed based on DoE's guideline of EIA, the suggestion of ToR approved by DoE, international practices and expert opinion. This framework was refined and verified in field during reconnaissance field visit through public consultation in an approach of Rapid Rural Appraisal (RRA) and Key Informants Interview. Eventually, the matrix was set consisting of 13 criteria and 33 indicators incorporating the expert opinion of BPDB professionals. The table 4.1 shows the criterion framework with its indicators set.

Table 4.1: Criterion framework of alternative site evaluation

Criteria	Indicators
Minimum disturbance to society	Number of settlements to be rehabilitated
	Population density in surrounding area
	Occurrence of archeological site
	Sensitive cultural heritage
	Occurrence of city at downwind direction
Minimum disruption to water resources	Obstruction to drainage system
	Occurrence of local boat landing station
Minimum use of agricultural/fisheries land	Total cropped area in ha (Cropping Intensity x cultivable area)
	Fisheries habitat (natural and Aquaculture)
	Fish landing sites/centers
Minimum Ecosystem destruction	Occurrence of sensitive ecosystem
	Habitat of sensitive species
	Distance from Sundarbans
Minimum disturbance to ecotourism	Occurrence of Ecotourism spot
	No. of tourist/year
	Distance from World Heritage Site
Minimum/avoiding hilly area	Extent of hilly area within project boundary
Use of maximum *Khas* land	Amount of *Khas* land
Coal transportation and supply	Navigability (Draught)
	River Sedimentation
Construction facilitation	Available route of construction material transportation
	Availability of sand for land filling
	Availability of local labor
Site suitability	Land price
	Land elevation
	Historical Maximum Surge Height
	Land filling
	Extent of erosion
Communication	Road communication
	Railway communication

Criteria	Indicators
	Waterway communication
Equity	Equitable distribution of benefits
Public opinion	In favor or against with reasons

A checklist was developed for making the framework operational in field. The multidisciplinary professionals filled in the checklist in field and later the evaluation was made through discussion session with all the team members and using their expert judgments. Eventually the final evaluation was made through debriefing session with the BPDB professionals.



Map 4.1: Location of two alternative sites for the proposed power plant

4.3 Alternative sites evaluation

Both the sites were examined through the alternative site selection framework and checklist. The comparison and evaluation of the alternative sites are presented in Table 4.2.

Table 4.2: Alternatives evaluation for site selection

Criteria	Indicator	Site 1: Labanchara	Site 2: Sapmari Katakhali
Minimum disturbance to society	Number of settlements to be rehabilitated	400-450 Households	150 Households
	Population density	High (647 per sq km)	Very low (121 per sq km) Sapmari Katakhali: 94 Kaigardashkati: 188 Baserhula : 240 Baro-durgapur: 375
	Occurrence of archeological site	No	No
	Sensitive cultural heritage	1 Mosque, 1 Shrine	1 Madrasa
	Occurrence of city at downwind direction	Khulna city is at only 2km northeast. Most of the time of a year, prevailing wind flows from southwest to northeast direction that means emissions from the power plant will easily be transported to the city by the prevailing wind	Khulna City is at 23 km Northeast direction. Hence, emission from power plant will hardly reach the city and will barely have any effects on community
Minimum disruption to water resources	Obstruction to drainage system	Potential to obstruct local surface runoff	Insignificant obstruction to the drainage systems
	Occurrence of local boat landing station	No	No
Minimum use of agricultural/fisheries land	Total cropped area in ha (cropping intensity x cultivable area)	Net cultivable land is high due to high crop intensity 3055 ha (2.25 x 1358)	Net cultivable land is low due to low crop intensity 866 ha (1 x 866)
	Fisheries habitat (natural and aquaculture)	1. No use of open water fish habitat 2. Some acres of shrimp/ prawn *gher* are present in the proposed acquisition plan 3. There are some freshwater fish ponds in the proposed project boundary	1. No use of open water fish habitat except some creeks that have been occupied by the shrimp farming. 2. Most of the land to be acquired are occupied by shrimp farming 3. No fresh water fish pond exists within the project boundary

Criteria	Indicator	Site 1: Labanchara	Site 2: Sapmari Katakhali
	Fish landing sites/centers	No	No government developed fish landing centers but some local facilities for landing exist
Minimum Ecosystem destruction	Occurrence of sensitive ecosystem	No	No
	Habitat of sensitive species	No	No
	Location and distance from Sundarbans	33 km (satisfies ECR 1997) South-west Only during winter (November to February) wind prevails from North west to south east. Hence, emission from the power plants will not reach to Sundarbans	14 km (satisfies ECR 1997) south west. Only during winter (November to February) wind prevails from North west to south east and rest of the year it flows toward northwest. Hence, Sundarbans is located at safe site and at safe distance from the proposed site. Emissions from the power plants will hardly reach to Sundarbans and will have barely impacts on Sundarbans Ecosystem.
Minimum disturbance to ecotourism	Occurrence of ecotourism spot	No	No
	No. of tourist/year	N/A	N/A
	Distance from world heritage site	103km	70 km
Minimum/avoiding hilly area	Extent of hilly area within project boundary	No	No
Use of maximum *Khas* land	Amount of *Khas* land	Less than 5%	5-10%
Coal transportation and supply	Maximum Allowable Drought	2-3m	Up to Mongla port Jetty: 6 to 6.5 m Mongla port to project location: 6.5 to 7.5m
	River Sedimentation	Around the Project area	At Right Bank of Passur near project location and at the North-western edge of the project boundary
Construction facilitation	Available route of construction material transportation	Available	Available
	Availability of sand for land filling	Available	Available
	Availability of local labor	Available	Available

Criteria	Indicator	Site 1: Labanchara	Site 2: Sapmari Katakhali
Site suitability	Land price	25,000-30,000/decimal	8,000-10,000/decimal
	Average land elevation	7m PWD	2m PWD
	Historical Maximum Surge Height	10m PWD (during SIDR as per perception of the local people)	5m PWD (during AILA as per perception of the local people)
	Land filling (average)	3m+ land filling will be required	(Mongla port Jetty's top level: +4.118 m PWD and Basement of Administration Building: +5.642m (PWD) 3.642 (deducting 2m plinth height) m land filling will be required to achieve basement of Mongla Port Administration building which will also be above the max. surge height
	Extent of erosion	Minor	Minor
Communication	Road communication	1. 6 km pavement road Khanjahan Ali Bridge to Batiaghata Upazila across the site	1. Three connecting roads (Brick Soaling and Earthen) from Dhaka-Mongla high way to the Project location 2. A proposed road of 40 ft width from Dhaka-Mongla highway (Bhaga point) of Kaigardaskatthi
	Railway communication	No	Proposed railway network (from Khulna to Mongla)
	Waterway communication	Kaji Bacha River	4. Passur River 5. Maidara River 6. Regular Boat communication with Chalna and nearby other Villages
Equity	Equitable distribution of benefits	Respondents are hopeful about getting benefits	Local people are optimistic about the future development but dubious about the equitable compensation to be paid

4.4 Concluding remarks on selected site

Distance from the Sundarbans satisfies ECR 1997 (no pollution causing activity within 10 km from the boundary of the Sundarbans reserve Forest) in case of both sites. Rampal site is 14 km northeast from the Ecological Critical Area of Sundarbans. The Rampal site is located in a position from where emissions may not reach to the Sundarbans (located southwest of the

project area) as the prevailing wind flows from Southwest to Northeast during March to November and from Northwest to Southeast during rest of the year. The wind direction, being from south to north for most of the year, is an important argument in favor of choosing the Rampal site- since emission flow southward (in the direction of ECA) will be very minor and will not be a significant negative factor. On the other hand, the Labanchara site is closer to Khulna city. Khulna city is located northeast of the Labanchara site. As such, in case of Labanchara, there is a possibility of emission flow toward the Khulna city, as in maximum time of a year, prevailing wind flows from southwest to northeast direction (March to November). With the Labanchara, there is a significant risk of health hazard due to air pollution. Besides, dense urban settlements cause trapping of air pollutants that further results fumigation of air pollutants and formation of acid rain.

Labanchara site is relatively more populated. Around 450 households need to be resettled for land acquisition. Besides, the there is a dense settlement beyond the boundary of the project area. On the other hand, population density of Sapmari site is low. Only 150 households (mostly temporary settlement of labors working in shrimp aquaculture pond) need to be resettled. Moreover, there is no dense settlement within 1km radius of the project boundary that means the site is located at a safe distance from the community.

Another major issue is the sustainability of coal supply to the power plant. The driven factor of sustainability of a power plant is the reliable and uninterrupted fuel supply. Transportation of imported coal is easier in case of Rampal site due to navigability of river, short distances from anchorage position of mother vessel and minimum dredging requirement. With Labanchara site, river navigability does not allow plying of purpose built coal barge (8,000 - 10,000 DWT) suitable to meet daily coal requirement. Improvement of the channel from the position of the mother vessel (Akram Point) to Labanchara through dredging might not be feasible and cost effective. Moreover, long inland water route for coal transportation (up to Labanchara) possesses more risk of environmental damage.

Backwater effect of Passur River is stronger at Rampal location than Labanchara, which provides advantages of withdrawing water for plant purpose without affecting the natural flow of the river.

Considering all the aforementioned facts it might be concluded that the Sapmari Katakhali site of Rampal is more feasible than Labanchara site for the proposed power plant that ensures sustainable coal supply and occupies minimum destruction and disruption of settlements, minimum destruction to agricultural land, physical resources, and biological environment including Sundarbans.

Chapter 5: Project Description

5.1 Project Proponent

The Bangladesh Power Development Board (BPDB) is the proponent of this proposed 1,320 MW (2 x 660 MW) coal based thermal power plant. The Board functions under the aegis of Power Division of the Ministry of Power, Energy and Mineral Resources. Since its establishment in 1972, the BPDB has been planning, constructing and operating power generation and transmission facilities throughout Bangladesh and distributing in the urban areas except metropolitan city of Dhaka and its adjoining area.

Despite the creation of Ashuganj Power Station Company Ltd. (APSCL), Electricity Generation Company of Bangladesh (EGCB), North West Power Generation Company Ltd. (NWPGCL) and West Zone Power Distribution Company Ltd. (WZPDCL), Power Grid Company of Bangladesh (PGCB) as company under BPDB, the BPDB still maintains the major part in power generation and distribution. In compliance with the revised Power System Master Plan (PSMP), 2010, with the aim of providing quality and reliable electricity to people for desired economic and social development the proposed power plant has been planned to construct within the shortest possible time.

5.2 Project Concept

The proposed project is a coal based thermal power plant with gross capacity of 1320 MW (two units of 660MW each) with provision for further extension of another 1320MW in future. The plant will be a super critical pulverized coal fired boiler type plant with material resistant to corrosion due to induction of saline water. The water required for steam generation and cooling will be abstracted from the nearby Passur River. The specified quality of coal as mentioned in section 4.16 shall be maintained in sourcing and importing the required amount of coal. The coal will be imported through Mongla Port facilities (except Jetty facilities). The plant will be designed in such a way, which will ensure minimum environmental pollution and maintain all standards of World Bank, ADB and especially MoEF, Bangladesh (ECA 1995, ECR 1997, etc).

5.3 Purpose of the Plant-intent

It is the intention of the Bangladesh Power Development Board to install two identical coal based thermal power generating units for a total capacity of 1320 MW with a provision for additional two units of 660 MW each in future at Rampal, Bagerhat in the name of Bangladesh-India Friendship Power Company, in order to meet the future power demand. The plant shall be coal fired and equipped with re-heater and all auxiliary and ancillary systems. The project will be implemented by internationally reputed & experienced contractor through open bidding & the contractor shall cover all works for the engineering, procurement, construction and commissioning of the whole plant on a turnkey basis. In order to transmit the generated electrical power to 400 KV grid network a step up substation shall be included. The boilers shall be a supercritical open-air installed for firing with coal.

The steam turbine condensers shall be closed cycle water-cooled. The condenser shall be with divided water box construction. It shall be horizontal, surface type with integral air cooling section. In order to cool the condenser cooling water, cooling towers shall be constructed.

Highest reliability and availability, convenience of operation and maintenance, neat and orderly arrangement, are of utmost importance. The functional requirements of the various systems and the pleasing physical appearance of the completed Plant shall also be taken into account.

Due care shall be undertaken concerning the environmental impact out of the Plant and sufficient protective measures shall be incorporated in the design of the Plant for environmental protection especially on air pollution, water pollution and noise. The environment protection measures shall be undertaken in accordance with the Environment Protection Guidelines of UNDP, ADB, World Bank and Environmental Protection and Emission Control Standards of Bangladesh.

In all instances, the listing of items of the plant shall be understood as general, and shall include upon completion, even if not specifically mentioned, other necessary components and appurtenances required for proper, continuous and reliable commercial operation of the complete installation, including any and all auxiliary and ancillary systems.

5.4 Project Location

The proposed project is located in Rampal Upazila of Bagerhat District (Map 4.1). With geospatial reference, the project site lies between $22^{O}37'0"$N to $22^{O}34'30"$N and $89^{O}32'0"$E to $89^{O}34'5"$E. The administrative boundary comprises of Sapmari Katakhali and Kaigar Daskati Mauzas of Rajnagar Union under Rampal Upazila (Map 4.2). With reference to the nearest important features, the proposed site is geographically located at 14 km northeast of Mongla port and 14 km northwest of the Sundarbans (Map 1.2), hence it is placed clearly outside the Ecological Critical Area of Sundarbans[3] that covers further 10 Km from the boundary of the reserve forest.

5.4.1 Topographical information

The land elevation of the area varies from (–) 2.19 m (SOB) to (+) 3.4 m (SOB). The mean elevation (area average method) is 0.8752 m (SOB). Frequency distribution shows that maximum area (35.32%) falls under 0.75m to 1.0 m (SOB) elevation class. Figure 5.1 shows distribution of area under different elevation class.

[3] The entire Sundarbans and its adjoining areas of 10 Km buffer outside the forest boundary has been declared as Ecological Critical Area through a notification issued under ECR, 1997 on 1999.

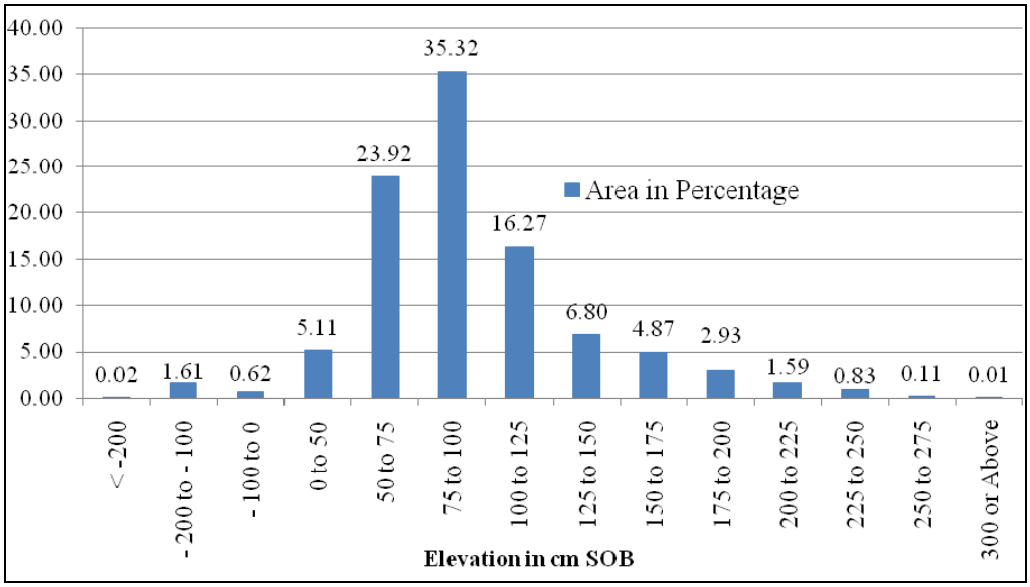


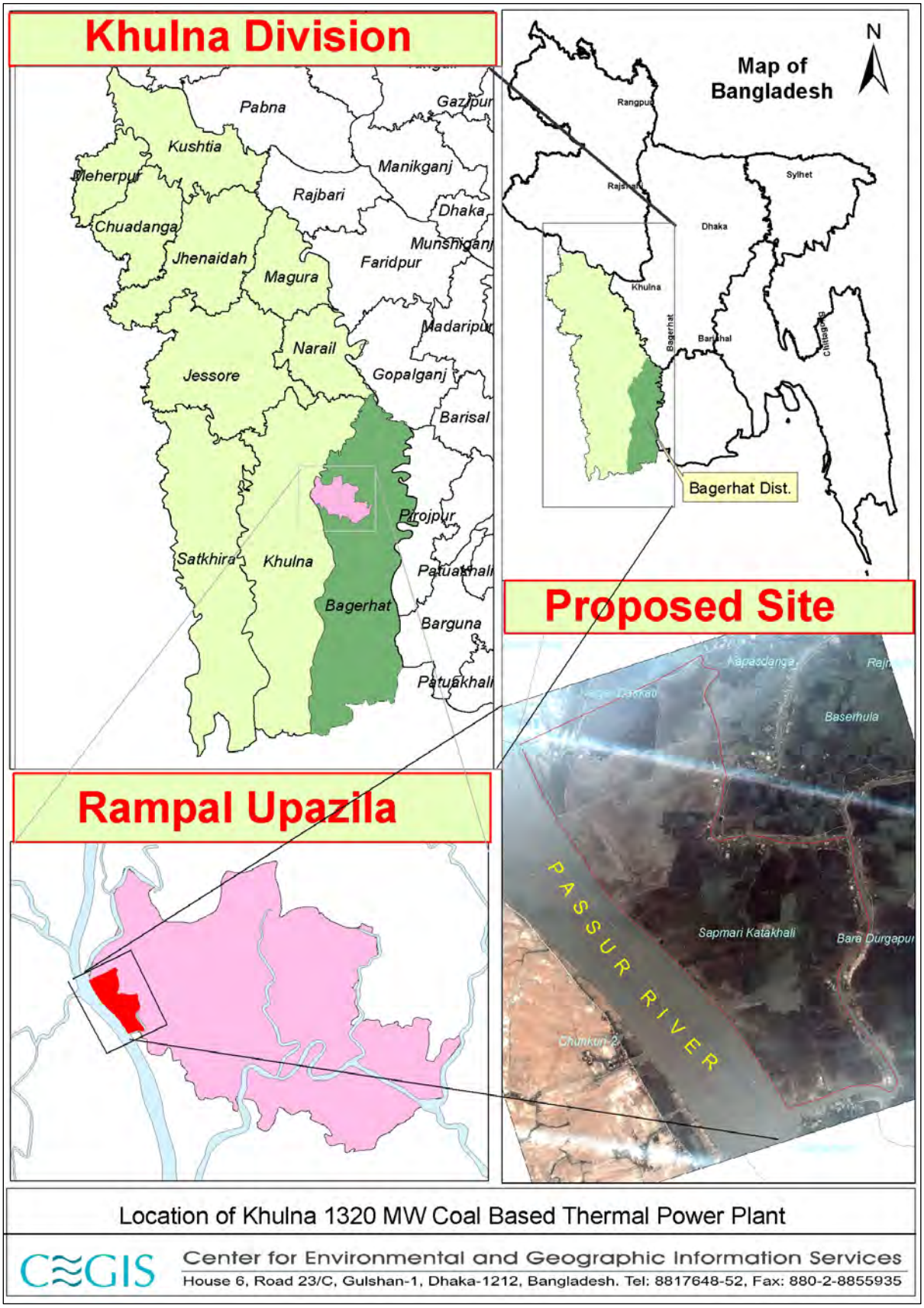
Figure 5.1: Area distribution under different elevation class

The figure shows that around 2% area lies below the mean sea level (0 m, SOB) and around 2.5% area shows elevation above (+) 2 m (SOB). As per local community perception, the site has experienced the maximum surge height during cyclone Aila. It was found that historical maximum surge (during cyclone Aila) reached up to elevation of 4.47m SOB (as per perception of the local people.

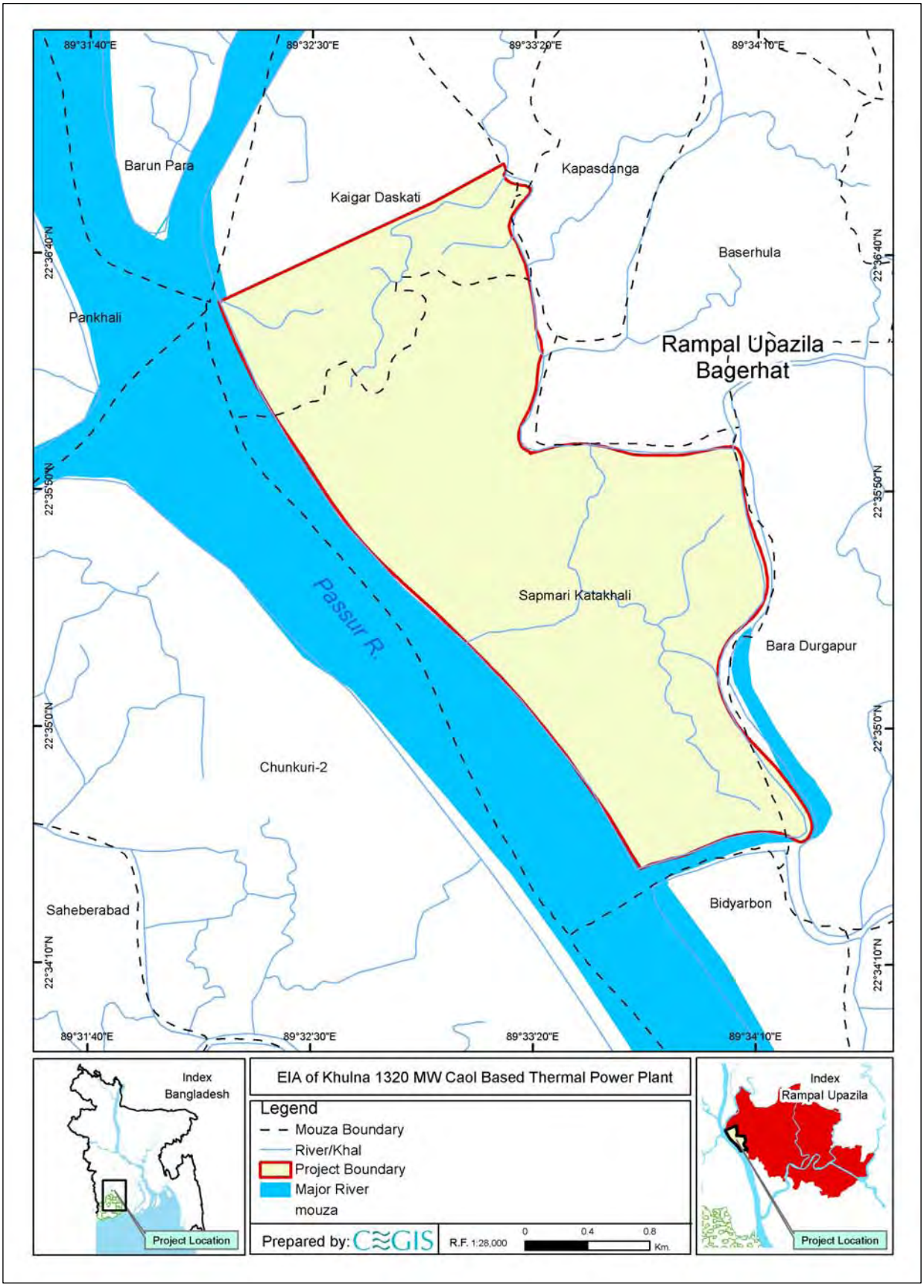
Presently the area is dominated by agricultural practice (shrimp aquaculture cum rice field). The entire area is protected from tidal inundation by raised levee made by the local shrimp farmers. Existing, tidal creeks are occupied by shrimp farming and tidal flow is controlled for shrimp farming activities.

5.4.2 Access way

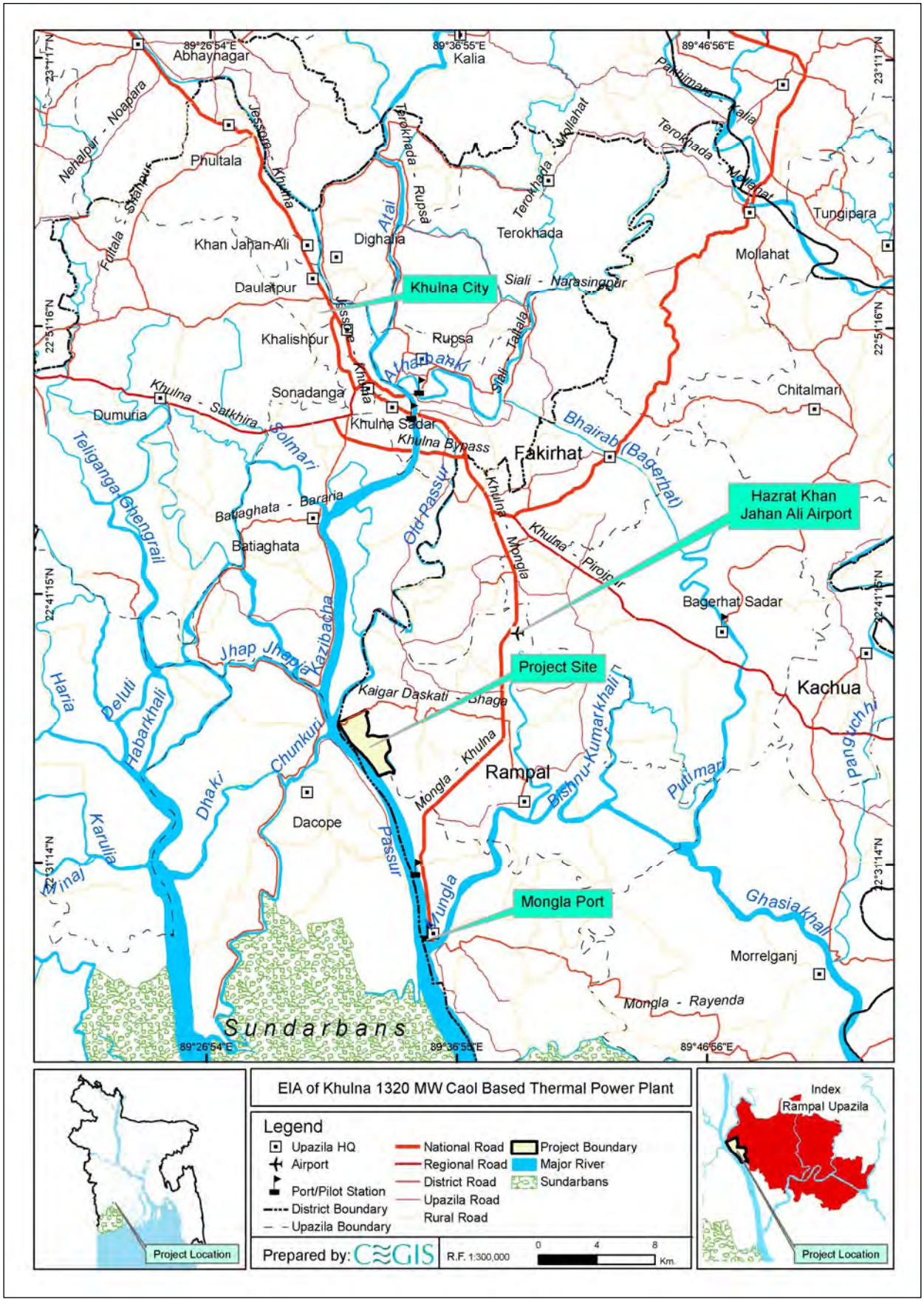
Bhaga-Kaigar Daskati rural road and the Passur River are the most modest way of access to the project location. Through road communication; the project site is connected with Dhaka Mongla national high way by several numbers of brick soaling and earthen roads (Map 5.3). However, the project also includes construction of a two lane road of 12 m width from Dhaka-Mongla Highway to project site. LGED has been entrusted for constructing a new road from Babur Bari to Project site road that will be considered as the access road of the proposed project (Map 5.4). The design and construction materials have been detailing in feasibility report. About 40 acre of land will be required to construct this road. This access road can be constructed escaping the household areas of the inhabitants satisfactorily. The project might also get benefits from the installation of the proposed railway line from Khulna to Mongla. Apart from the land communication, navigation through Passur River will be an important way of transportation for construction materials and the primary fuel of the power plant-coal.



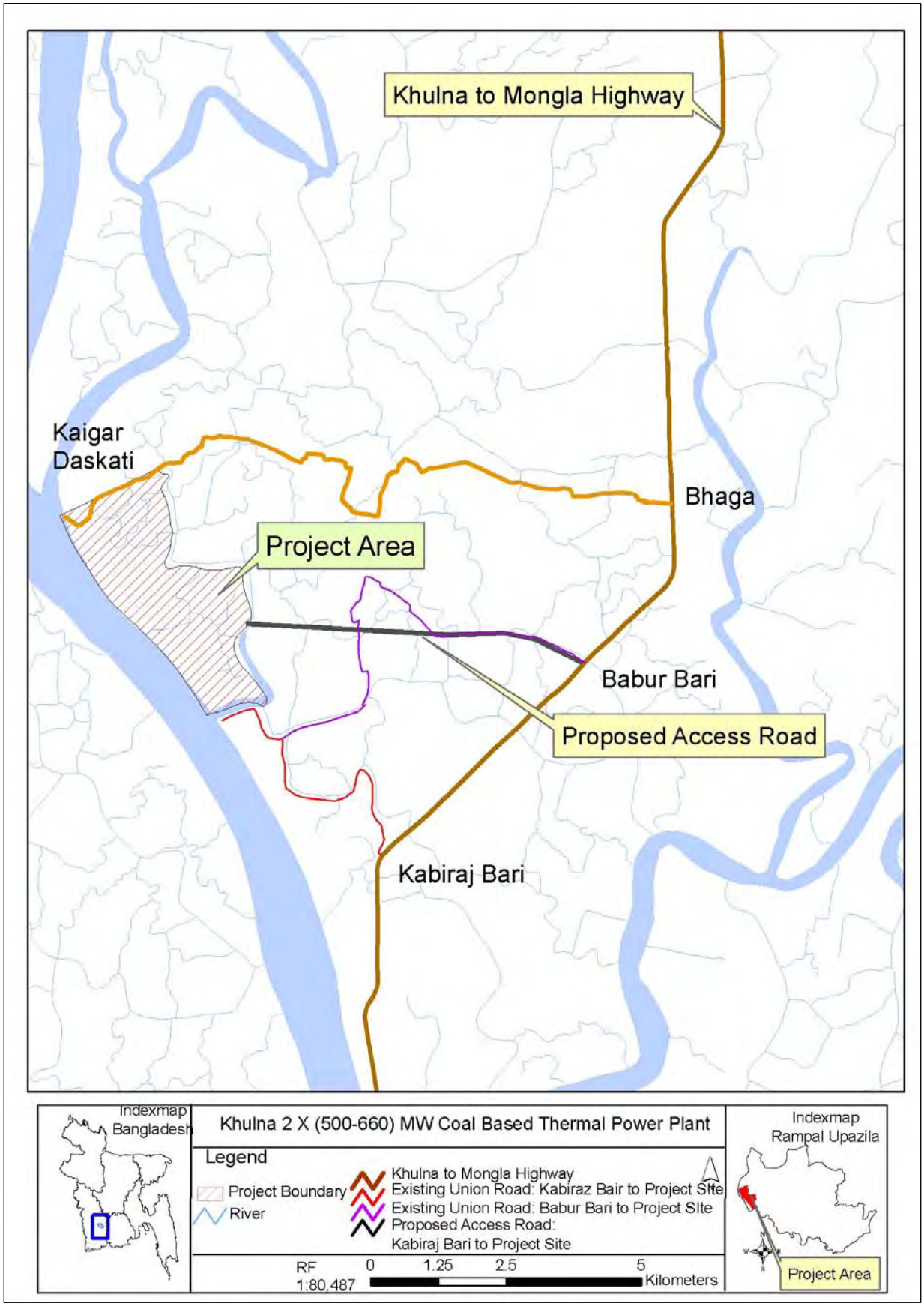
Map 5.1: Administrative location of the project area



Map 5.2: Mauza Maps of the proposed project site



Map 5.3: Road and rail communication to access the project area



Map 5.4: Access road of the proposed power plant

5.4.3 *Site development*

The total project will be developed on a raised platform, having 5 m (SOB) RL considering historical maximum Cyclonic surge height (+4.47 m SOB as per perception of local people) and basement of Administration building of Mongla Port Authority (+4.18 m SOB) while the existing land elevation of the area varies from (-) 2.19 m (SOB) to (+) 3.4 m (SOB). The topographical information considered for site establishment is presented in the Figure 5.2 below. The Figure shows surge height of the Aila, plinth level of Mongla Port Authority's administrative building, RL of the proposed plant formation level with cumulative area under different elevation.

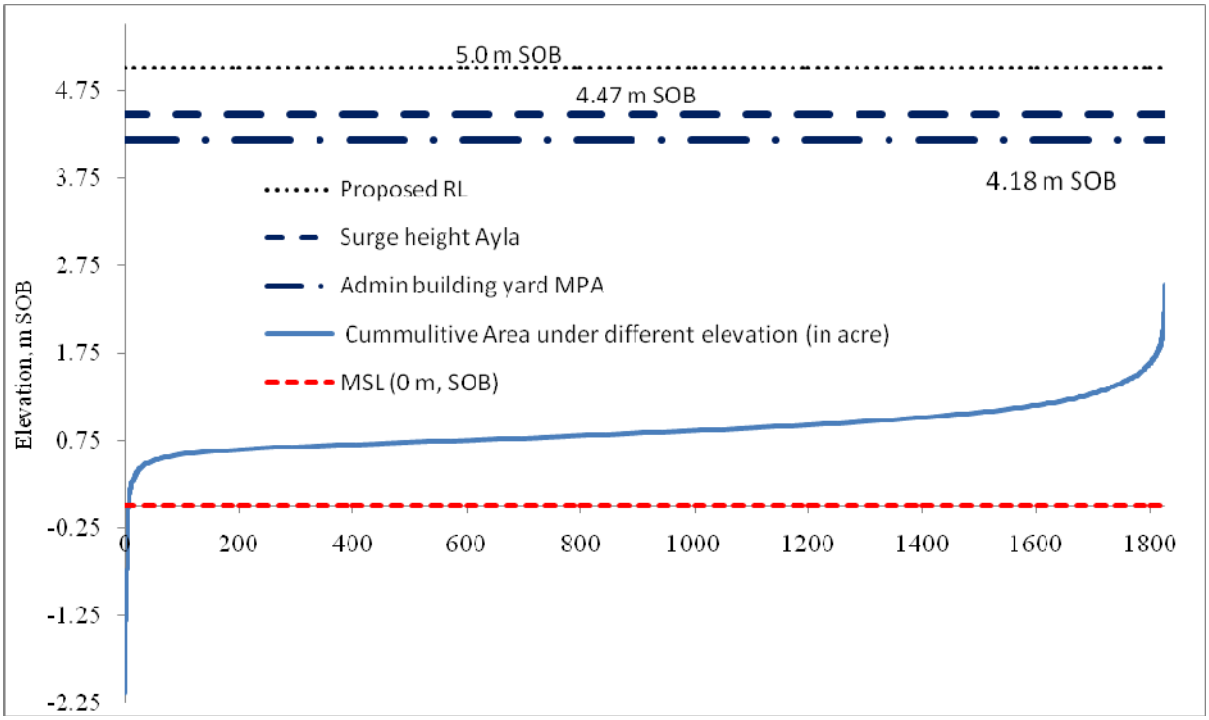
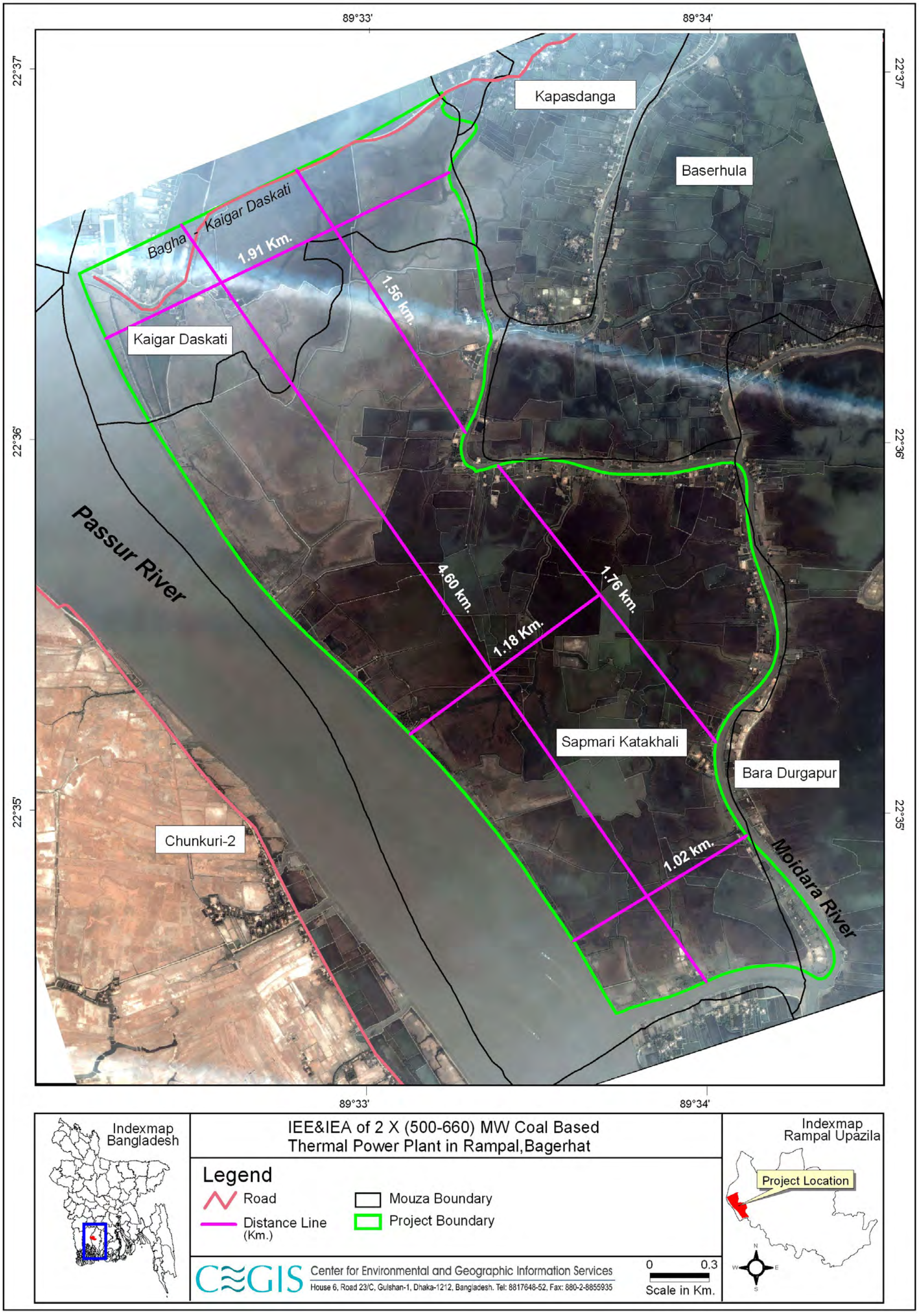


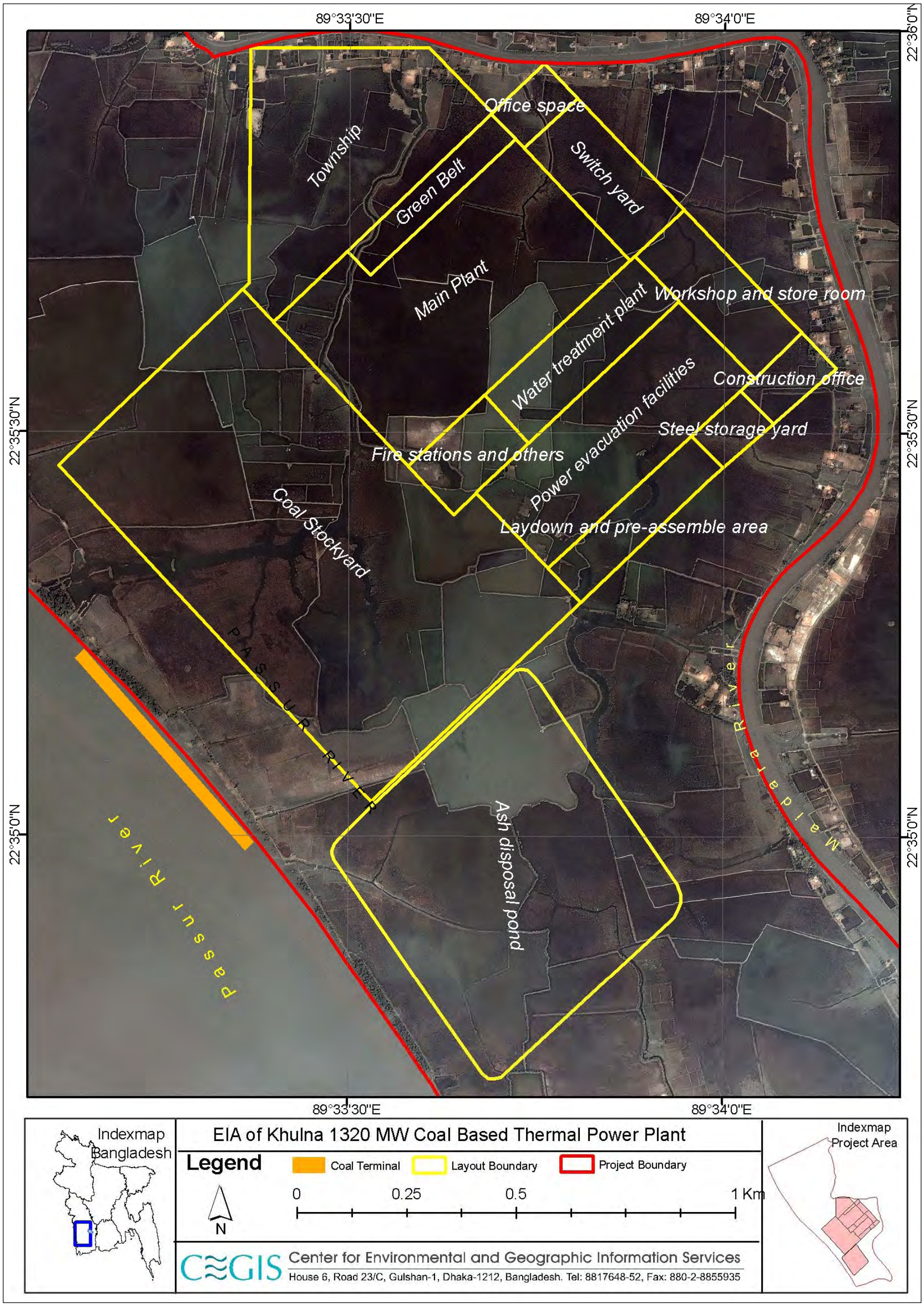
Figure 5.2: Area-elevation curve with MSL and proposed RL of the plant formation level

The detailed area needs to develop for site establishment showing in the Map 5.5. Initially, about 420 acres of land will be developed in which 350 acres will be used for plant and 70 acres for township. The total earth requirement for land development would be approximately 80 lac m^3. This volume of earth material will be extracted from different sources depending on the environmental sustainability and economic efficiency. Bangladesh Water Development Board, BIWTA will play an important role during the development of land site of the power plant project. The rest of the land will be filled up by ash to be generated from coal burning for power generation. Map 5.5a, 5.5b and 5.5c show the length, width, plant layout and other information of the project site. If required, a separate environmental study would be carried out related to sources of filling materials and mode of transportation

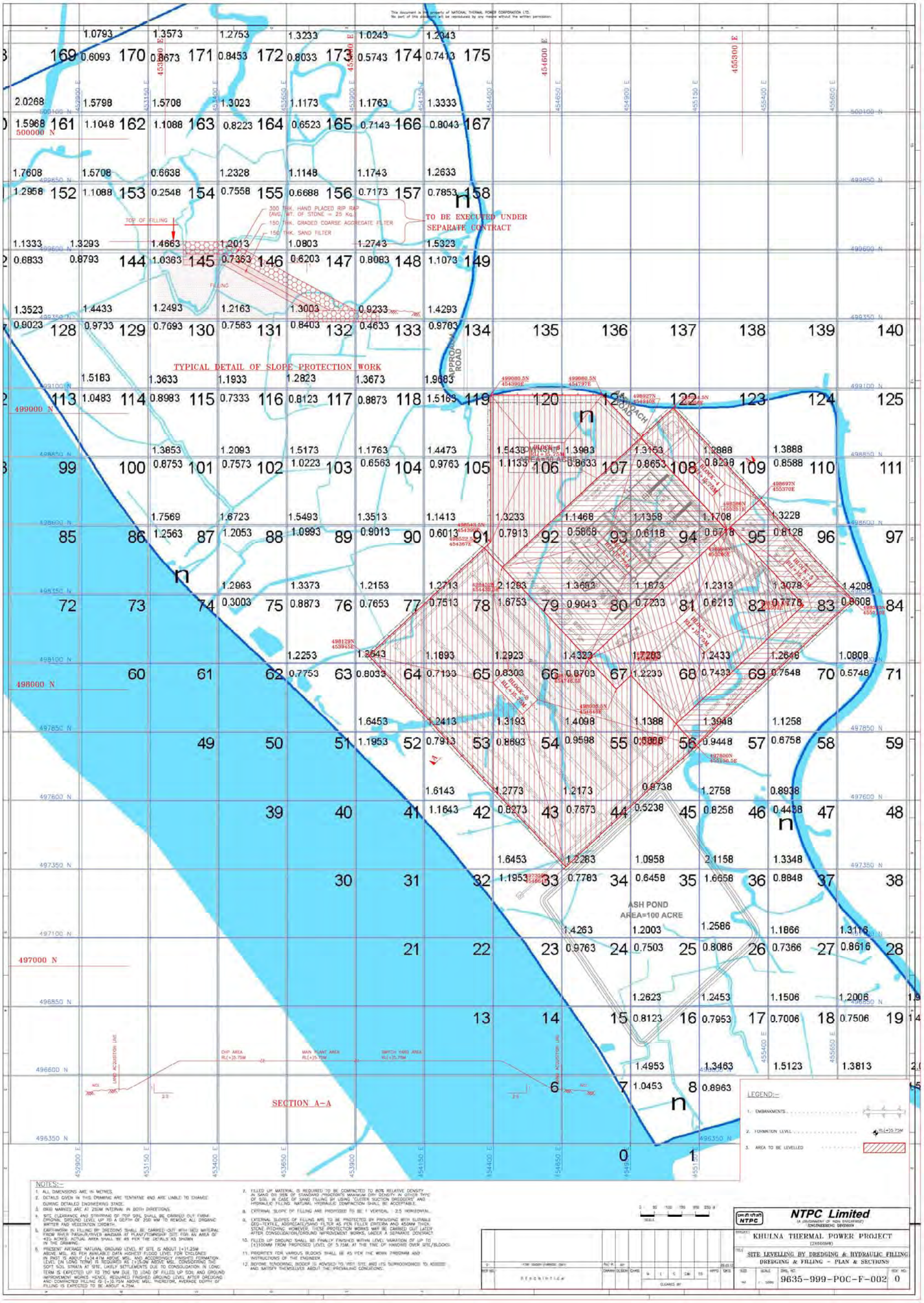
During site establishment, all the canals and water bodies occurring outside the plant boundary (boundary of the 420 acre area where the plant shall be installed) but within the project area (1,834 acre) shall be kept as it is.



Map 5.5a: Project site measurements



Map 5.5b: General Layout of the plant as per Feasibility Study Report



Map 5.5c: General layout of the site development

5.5 Project layout

A general layout plan designed by the feasibility study team is given in the Map 4.5b and in Annex-IV. The detail layout plan showing all structures, road network, drainage network, different pollution abatement measures, and water, waste water and effluent treatment facilities shall be developed by the EPC contractor before construction. The EPC contractor shall be appointed after receiving the Environmental Clearance Certificate from the DoE. BPDB shall submit the final layout plan to DoE for their review and comments. Considerations of available land, landscape, ground features, elevation, and environmental and social concerns recommended by EIA study have been taken into account in developing the layout.

For its first phase, the plan is prepared in minimum area so as to reduce the quantity of filling by dredging. Gas Insulation Switchgear has been planned for switchyard orientation as a requirement for power evacuation. Permanent facilities like workshop, permanent stores, etc. are located close to the main plant. The ash slurry/ash water pump house is kept towards the chimney and Flue Gas Desulfurization (FGD) space is kept beyond the chimney. The intake/discharge ducts have been routed in the corridor between transformer yard and switchyard and location of CWPH is chosen, so as to minimize the length of CW ducts. Considering the soil condition induced Draft Cooling Towers are proposed and located considering the safe distance from the Main Plant and Switchyard. The water treatment plant and the DM water facilities are located close to the main plant. The coal is assumed to come from the nearest port and direct coal conveyor is assumed from the port to the plant.

Adequate space has been kept in the layout plan for lay-down and pre-assembling activities of open stores, contractor's offices and stores etc. Construction offices and storage sheds area located close to the main approach road to the plant. Administrative building is proposed to be located outside the plant boundary near the main approach road. The following major components have been included in the layout plan:

A: Industrial (plant area)

1. Main power plant (boiler, turbine, Generator, Workshop Store, etc)
2. Electrostatic Precipitator, Flue Gas Desulfurization (FGD) as required, and Chimney
3. Induced Draft Cooling Tower
4. Greenbelt and open space
5. Open air sub-station and network control room
6. Water treatment, sewerage treatment plant and sewerage channel
7. Coal terminal including jetty & coal conveyer belt
8. Ash handling control room, ash silo, ash disposal area
9. Coal shade (open & covered)
10. Embankment along the river side, internal road, *khal*, footpath, park, lake, school, hospital, mosque, lay-down area, area for safety length of structure to structure

B: Township

11. Residential buildings, school, mosque, play ground, community hall, rest house, dormitory, health center, club, etc.
12. Administrative building, auditorium and parking area including cafeteria & social building

5.6 Project Overview

Basically, the project consists of a coal fired thermal power plant with two units of 660MW each and induced draft cooling tower stations of wet type, circulating cooling water station including proper intake piping and discharge channel, and stacks of 275 m each. The Power Plant will be designed in such a way so that the construction of another additional unit of 1320 MW can be made possible. A typical diagram of a coal based thermal power plant is shown in Figure 5.3.

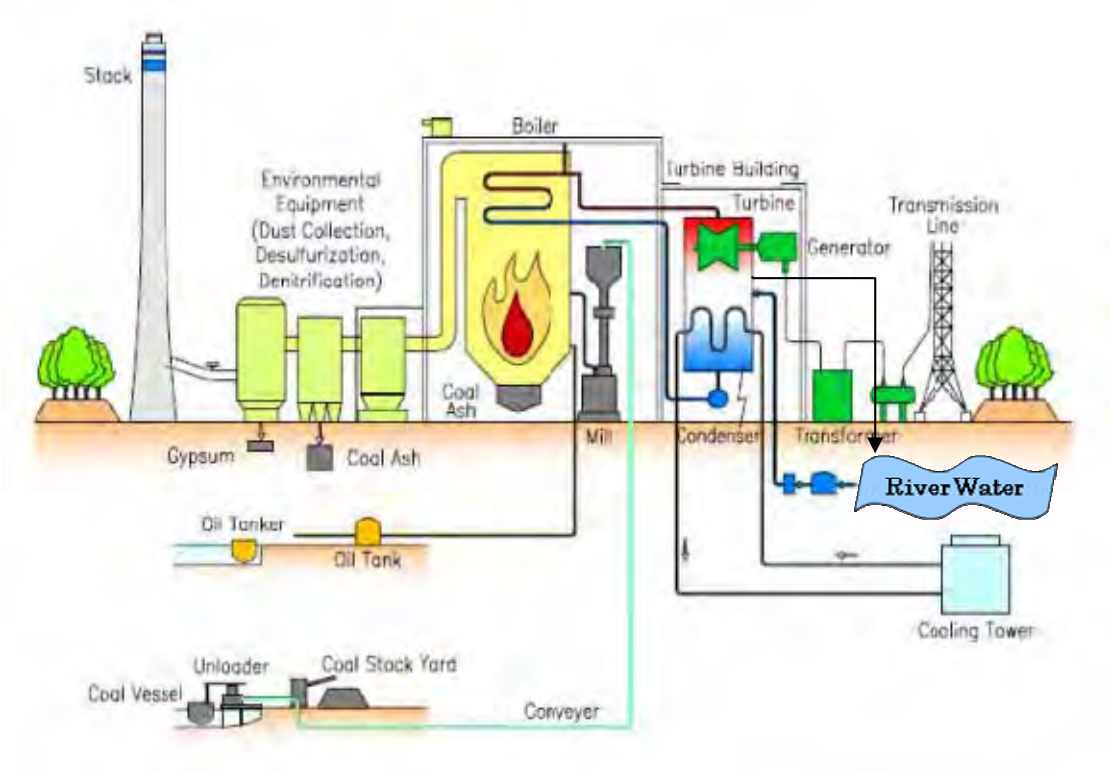


Figure 5.3: Typical diagram of coal fired thermal power plant

The main project facilities comprise of a power house and auxiliary facilities that include a switch yard, raw water reservoir, water pre-treatment system, demineralization plant, desalinization plant (Surface Water Reverse Osmosis), circulating cooling water pump house, coal handling system (Conveyor belt and stockpiles), ash handling and disposal system, effluent treatment plant and residential township for project staff. Other project facilities that will be constructed by BPDB include embankment along the river, 12 m wide two lane approach road, 6.75m wide single lane access roads, 3.5 km wide patrol roads and water supply pipeline from the nearest river to the project site. In addition, space for FGD has been kept for provision of future use if required.

The proposed 2x660 MW (net power output) supercritical bituminous pulverized coal (PC) plant will be constructed at a Greenfield site. This plant is designed to meet Best Available Control Technology (BACT) emission limits. The plant is a single-train design. The combination process, heat and mass balance diagram for the supercritical PC plant case is shown in Figure 5.3.

The step up voltage level has been considered as 400 KV as the capacity of the project has been considered as 1320 MW. The 400 KV power transmission lines for evacuation of power from the Project will be built by PGCB, Bangladesh.

The primary fuel will be bituminous coal with a Gross Calorific Value (GCV) of 5800 to 6100 Kcal/kg. The capacity factor (CF) for the plant is 85 percent without sparing of major train components. A summary of plant performance data for the supercritical Pulverized Coal (PC) plant is presented in Table 5.1 below:

Table 5.1: Basic plant information of the proposed coal based thermal power plant (feasibility Study Report)

Component	Design condition
Plant type	Supercritical PC
Carbon capture	Nil
Net power output	1320 MW
Primary fuel (type)	Bituminous and Sub-bituminous Coal having GCV of 6000Kcal/Kg (after mixing) and low Sulfur content (0.6%)
Coal flow	12,920 T/Day (at 100% plant load factor)
Annual coal requirement	4.72 MT/year (considering 100% load factor)
Ash production	15%
Temperature of flue gas at stack	$125^{O}C$
Flue Gas Flow	$4.47x10^{6}$ Nm^3/hr
Flue Gas Desulfurization (FGD)	To maintain concentration of Sulfur in ambient air below the MoEF standard (80 µg/Nm^3 and 30 µg/Nm^3 for Sundarbans world Heritage)
Maximum emission of SOx	819g/s
Maximum emission of NOx	490g/s (less than 750 µg/Nm^3)
Particulate matter	100 µg/Nm^3
Stack height	275 m
Water Intake (Make up water)	9,150 m^3/hr (*e.g.* 2.5 m^3/s) (less than 0.5% of lowest flow condition in Passur River)
Water discharge after treatment	5,150 m^3/hr
Water consumed	4,000 m^3/hr

The detail design including general layout plan, equipment layout plans, main plant cross section, and project implementation schedule has been attached in Appendix IV.

5.7 Land Requirement and Acquisition

The land requirement has been revised for avoiding dense settlement. In revised form, the proposed project setup will require approximately an area of 1,834 acres of land for construction and other ancillary works; including structural, residential & fuel storage purpose with consideration of future extension of 1320 MW (Table 5.2).

Table 5.2: Land requirements for the proposed project considering full scope capacity

Sl. No.	Description of Structure	Covered area (Acre)
1.	Main Power plant (Boiler, Turbine, Generator, Workshop, Store etc)	600
2.	Conveyor belt and emergency coal storage area	200
3.	Water Treatment, sewerage treatment plant and sewerage channel	110
4.	Ash handling control room, ash silo, ash disposal area (dense phase system/pond)	380
5.	Sub-station and network control room	10
6.	Embankment in sea side, internal road, *khal*, footpath, park, lake, school, hospital, mosque, lay-down area, area for safety length of structure to structure	254
7.	Residential buildings, school, mosque, play ground, community hall, rest house, dormitory, health center, club, etc	100
8.	Administrative building, parking area	10
9.	Ship landing facilities/Jetty	170
10.	Coal yard	475
	Total land	**2,309**
	Revised land requirement to minimize environmental and socio-economic disruption	**1,834**

Source: Feasibility Study report, BPDB

This land will be acquired from public under the provision of the Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance II of 1982). BPDB has submitted the land acquisition proposal. The first proposal of 1,834 acres was submitted to Bagerhat DC and approval from the Ministry of Land has been obtained. All the necessary process has been completed. DC, Bagerhat has handed over said land to BPDB on 02 January, 2012.

5.8 Project activities

Pre construction phase

a) Selection of candidate sites
b) Environmental and feasibility study
c) Selection of site
d) Land acquisition & site establishment

Construction phase

a) Civil construction and technological installation work
b) Post erection check & pre commissioning test
c) Monitoring of mitigation measures for Environmental impact of the plant
d) Commissioning test
e) Reliability test run
f) Commercial operation of the plant
g) Overall project management

Post construction

a) Commercial operation of the plant
b) Monitoring of EMP
c) Proper O & M of the plant for efficient running

5.9 Work Plan of Project Implementation

The commissioning and Commercial Operation Date (COD) of the first 660 MW unit of the proposed thermal power plant will be 48 months from the investment approval and second unit after an interval of 6 months thereafter. A detail work plan of implementation (Implementation Schedule) is provided in Annex IV.

5.10 Costing and Funding

According to the feasibility study of the project, the estimated investment cost of the project may be Tk. 11,888.016 crore (excluding financing cost), where civil works will cost Tk 3,5333.216 crores, and mechanical work's and Electrical work's cost will be Tk 7,866.35 crores. Among these, around Tk. 19,50.7 crore would be for installing pollution abatement measures and environmental monitoring. The cost also includes Contingency and Environmental Management Plan. As per the JV Agreement signed 29 January 2012 between BPDB and NTPC, India, it is contemplated that the proposed project will be installed under joint venture of BPDB and NTPC, India. BPDB and NTPC, India (50:50) will invest 30% of the total cost and the rest 70% will be obtained through loans from external sources.

5.11 Fuel Requirement

The main fuel to be used for generating electricity will be coal. Based on estimation of Feasibility Study, the daily coal requirement for generation of 1320 MW power by operating two units of 660 MW each shall be 12,920 tons considering 100% plant load factor. It stands requirements of 4.72 million tons annually. However, this is the maximum requirement as the plant load factor might not be over 90% under general condition. Besides, light diesel fuel oil will also be used for boiler start up, flame stabilization and low-load operation. Annual light diesel fuel oil consumption is estimated to be 20,000 m^3.

5.12 Water Requirement and Source

A circulatory water system has been planned for the plant. Initially, the power plant will intake 144,000 cubic meter water which will be circulated in a closed cycle during operation period. It is estimated that 9,150 m^3/hr water will be required for meeting different demand of water including makeup of circulating water systems (cooling, boiler, etc) service water, domestic water, water for ash management, etc. This water will be collected from Passur River. Saline water will be used for cooling and ash management in ash sump. The project adopts Reverse Osmosis Process for desalinization of saline water to meet the fresh water requirement.

After use (consumptive and non-consumptive) of intake water, 5,150 m^3 per hour will be discharged after treatment through central effluent treatment and monitoring sump. It is estimated that the plant will consume 4,000 cubic meter water per hour that is less than 0.5% of the net lowest flow condition. This 5,150 cubic meter per hour water will be discharged to Passur River maintaining standard of the Environment Conservation Rules, 1997.

5.13 Resources and Utility Demand

The proposed project shall provide employment opportunity for unskilled, semi-skilled and skilled categories. Employment potential shall increase with the start of construction activities. During operation phase there will also be employment opportunities, mainly in service sector.

Electricity demand during construction phase shall be met up by West Zone Power Distribution Company Ltd (WZPDCL). A 33 KV line shall be installed by WZPDCL.

5.14 Process Description of Individual Project Components

5.14.1 Power Generation

The power plant consists of two 660 MW units. Both units will have steam-based, pulverized coal-fired boiler units of supercritical type, steam turbines and generators. Each boiler unit will comprise a boiler proper, regenerating type air heater, and 2 forced draft (FD) fans and 2 induced draft (ID) fans. The boilers will have steam flow of 2,120 T/hr at super-heater outlet with temperature of 568˚C and steam pressure of about 256kg/cm^2, and stream flow of 1,708.2 T/hr at re-heater outlet with steam of 596˚C temperature. In addition to coal,

light diesel fuel oil will be used for start-up as well as flame stabilization and during low-load operation. The main plant consists of three interconnected structures: (i) boiler structures, (ii) turbine building, and (iii) an integrated control and electrical building. Figure 5.4 illustrates the process flow of the Project.

5.14.2 Steam Generator and Auxiliaries

The steam generators shall be once through, water tube, direct pulverized coal fired, top supported, balanced draft furnace, single reheat, radiant, dry bottom type, suitable for outdoor installation. The gas pass arrangement shall be single pass (Tower type) of two pass type. Boiler design shall be suitable for variable pressure operation from 30% to 100% BMCR with and without 5% throttle margin. The steam generator shall be designed for low NOx formation by adopting the appropriate burners. Furnace shall be sized for burning high ash coal and low flue gas velocities to minimize erosion. The main parameters at 100% BMCR will be in Table 5.3.

Table 5.3: Boiler parameter

Sl no	Parameter	Measures
1	Steam flow at main super-heater outlet	2120 T/hr
2	Pressure at super-heater outlet	256 kg/cm^2
3	Temperature at super-heater outlet	568^{0}C
4	Steam flow to re-heater	1708.2 T/hr
5	Steam temperature at re-heater outlet	596^{0}C
6	Feed water temperature at economizer inlet	293.7^{0}C

5.14.3 Fuel Oil Burning System

Start-up, warm up and low load (up to 30%) carrying shall be done by heavy furnace oil/HPS/LSHS. Boiler will be so designed that oil firing for flame stabilization will not be required beyond 30% MCR. For coal firing the entire operation of purging, insertion, air and fuel sequencing removal and blow off shall be automatic. LDO system shall be sized for 7.5% BMCR capacity of two (2) boilers.

5.14.4 Coal Burning System

The coal burning system will comprise of coal mills of vertical spindle type which include (a) bowl mills, (b) roller mills (c) balls & race mills or any approved equivalent. The number and capacities of the mills shall be so selected that it can fire the worst and design coals at BMCR/TMCR. Coal from raw coal bunkers will be fed into the mills by belt driven gravimetric coal feeders suitable for handling moist coal. There will be two axial P.A fans for transporting the pulverized coal from mills to burners.

5.14.5 Soot Blowing System

Fully automatic, sequentially controlled, microprocessor based steam soot blowing system, complete with provision for individual operation of any soot blower pair, operation and

facility to bypass any soot blower, will be provided. The system will have short retractable rotary wall blowers for the furnace and long retractable rotary blowers for the super-heater, re-heater and economizer.

5.14.6 Electrostatic Precipitator

A high efficient electrostatic precipitator (ESP) having efficiency to limit outlet particulate emission to 100 µg/Nm^3 will be installed. The ESP will collect fly ash and other air borne particulate matter from flue gas. Each steam generating unit will be provided with an electrostatic precipitator (ESP) with parallel gas paths. Each path will consist of a number of fields in a series for collection of fly ash. The ESPs will have a dust collection efficiency of not less than 99.9% while firing coal with the highest ash content (34%). The ESP will be provided with gas tight dampers at inlets and outlets of each stream, so as to allow maintenance to be carried out safely on the faulty stream, while the working ESP will be provided with microprocessor based programmable type rapper control system and ESP management system to ensure safe and optimum operation of ESP. There will also be a heating arrangement in dust collector hopper to prevent ash stitching to the slope sides and sown pipes.

5.14.7 Flue Gas Desulfurization System

Provision of space for Flue Gas Desulfurization system (FGD) has been kept in the plant area. If coal having more than 0.6% is imported, FGD will be installed and operated to meet the ground level SO_2 concentration standard of MoEF. As such, provision of the installation of FGD has been kept in the layout of the plant.

5.14.8 Auxiliary Boiler

To meet the auxiliary steam requirement for cold start of the unit, a start up of the unit, a start up auxiliary boiler of 60 T/Hr. capacity,19 kg/cm^2 (gauge) pressure and 250°C temperature shall be provided. Auxiliary boiler shall be suitable to generate rated parameter with LDO. Auxiliary boiler shall be connected to auxiliary PRDS system suitably.

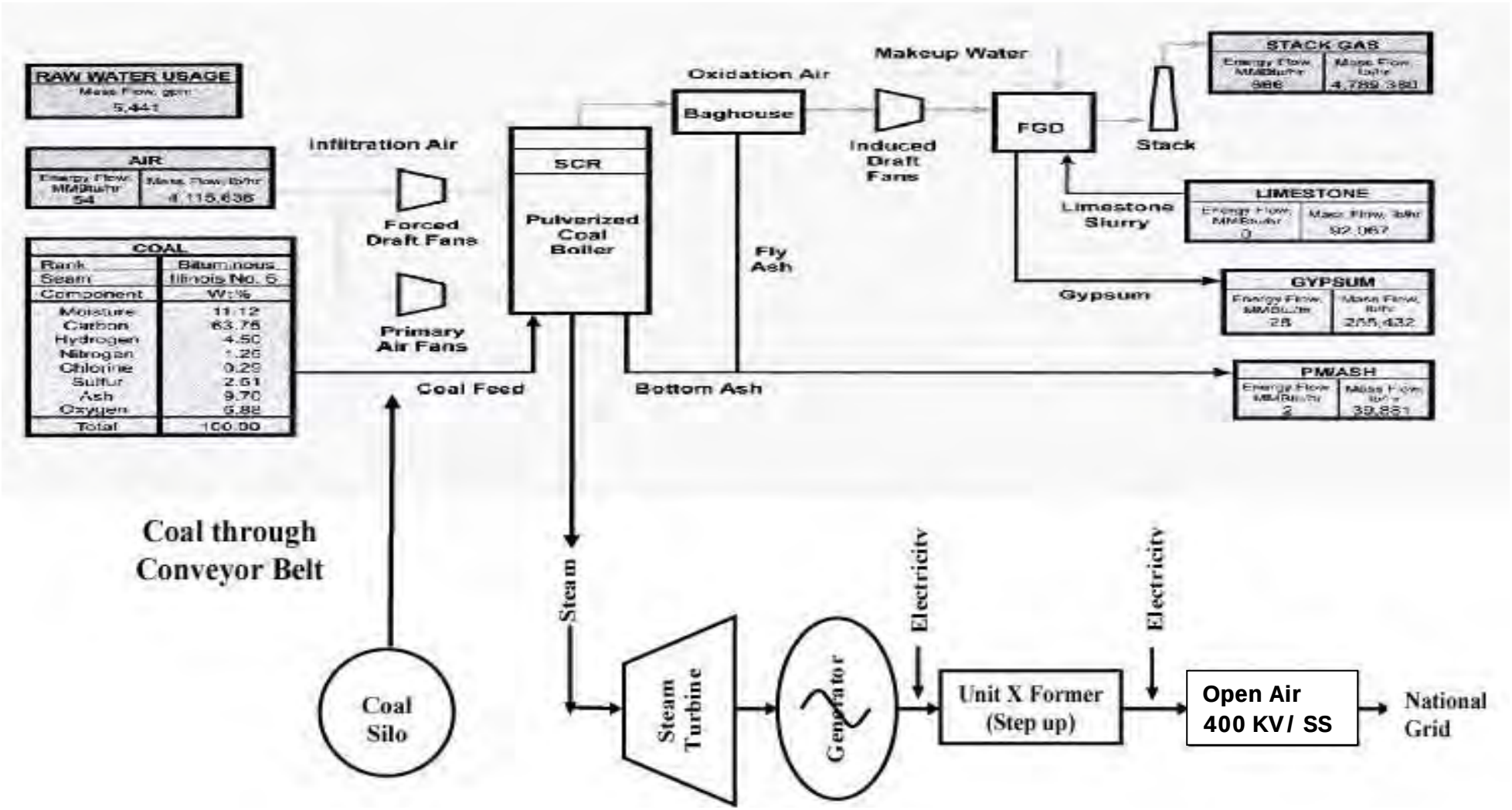


Figure 5.4: Process flow diagram

5.14.9 *Turbine and its auxiliaries*

The scope of each TG unit of 660 MW shall broadly cover the Steam Turbine along with its integral systems and auxiliaries such as lube oil system, control-fluid system, condensers, condenser air evacuation system , HP & LP, bypass system, complete regenerative feed heating system, condensate pumps along with their drives, boiler feed water pumps along with their drives, automatic turbine run-up system, instruments, turbine protection and interlock system, automatic turbine testing system and turbine hall EOT cranes.

5.14.10 *Deaerator*

Horizontal, direct contact spray or spray cum tray type deaerator with a horizontal feed water storage tank shall be provided. The deaerator shall be capable of deaerating all the incoming condensate and HP heater drains.

5.14.11 *Coal handling and storage*

External coal handling system

The coal as received by ship shall be unloaded through rail mounted grab bucket type unloaders and shall be conveyed to plant end by single stream high capacity through conveyor of TPH through series of transfer points.

Internal coal handling system

The coal as received from the port end through single conveyor shall drop onto two dedicated set of screening feeders and crushers. Coal handling plant shall have crushers for ultimately sizing the coal to (-) 20mm. An independent coal handling plant is proposed to cater to the two units of 660 MW. Coal handling plant will be consisting of 1200 TPH coal conveying system (with 100% standby parallel stream) along with reclaimers, trippers etc.

Crushed coal from crusher house shall be conveyed to stockyard through parallel stream conveyors each having capacity of 4000TPH and shall be stocked in stockyard through stackers of 4000 TPH.

Further reclaimers of 1200 TPH capacity is proposed to convey the crushed coal to boiler bunkers by means of one set of parallel double stream (one working and one stand by) of belt conveyors of 1200 TPH capacity. An interconnection is also to be provided to convey coal directly from crusher house to boiler bunker. Figure 5.5 presents an indicative flow diagram of the coal handling system.The overall operation hours of the coal handling plant shall be 16 hours spread over two shift per day leaving third shift exclusively for routine inspection and maintenance. The proposed CHP shall cater to the peak daily requirement of coal for all units in two bunker filling cycles in 12 hours effective operation. The CHP system will also have a dust suppression and extraction system. All chutes will be lined to ensure smooth flow and discharge of coal, and the longer operating life of the chutes. All junction towers and the crusher house will have floor cleaning chutes. Motorized travelling trippers shall be provided to feed crushed coal into the raw coal bunkers of the boilers.

Coal stock for 90 days is envisaged. In practice this amount might be changed. Stock requirement will be decided based on forecasts of maximum numbers of days for which lighterage operation is possible in a year and the continuous periods when the operation is

likely to be affected due to unfavorable weather. In layout plan, space provision has been kept for six months storage.

A centralized main CHP control room shall be provided to control and monitor the operations of the entire coal handling system.

Operation and maintenance of coal handling plant

The design and sizing of coal handling plant has an important bearing on station plant load factor. Hence, the following steps will be considered while designing the coal handling plant so as to ensure high PLF for the station:

a) CHP shall be able to meet the daily coal requirement considering 100% PLF and design coal.
b) Adequate standby capacity will be provided in the coal handling plant and for crushers so that outage of a single crusher or other equipment will have no effect at full load operation of station with worst coal.
c) Coal bunkers shall be designed to avoid choking / rat holing etc after carrying out coal flow-ability studies.
d) Adequate number of property designed suspended magnets and online magnetic separators. Metal detectors will be provided to segregate magnetic and non-magnetic materials respectively.
e) To minimize the dust nuisance in CHP area, effective dust suppression system shall be provided in track hopper, bunker floor, transfer points and stockyard. Dust extraction system shall be provided in the crusher house.
f) Effective provision shall be made for accurate and reliable measurement of incoming coal and coal consumed by each unit
g) In order to take care of unforeseen disruption in coal supplies, coal stockyard equal to 180 days full load requirement will be designed at station end
h) In order to avoid flooring of underground portions, all conveyor galleries shall be over-ground except track hopper and connected conveyors

Energy conversion aspect

Coal handling plant for feeding coal to the boiler bunker has been envisaged with the following major features to minimize the consumption of energy:

a) Coal handling plant layout shall be finalized with minimum number of conveyors in order to minimize the coal conveying path.
b) Crusher house height shall be reduced preventing unnecessary conveying of coal to higher elevations.
c) To control dust at coal transfer point dust suppression system shall be provided exclusively for reducing the energy consumption levels to almost nominal values compared to dust extraction system, which are restricted to crusher house only.
d) Running hours of CHP are optimized to reduce specific energy consumption per MT of coal handled.

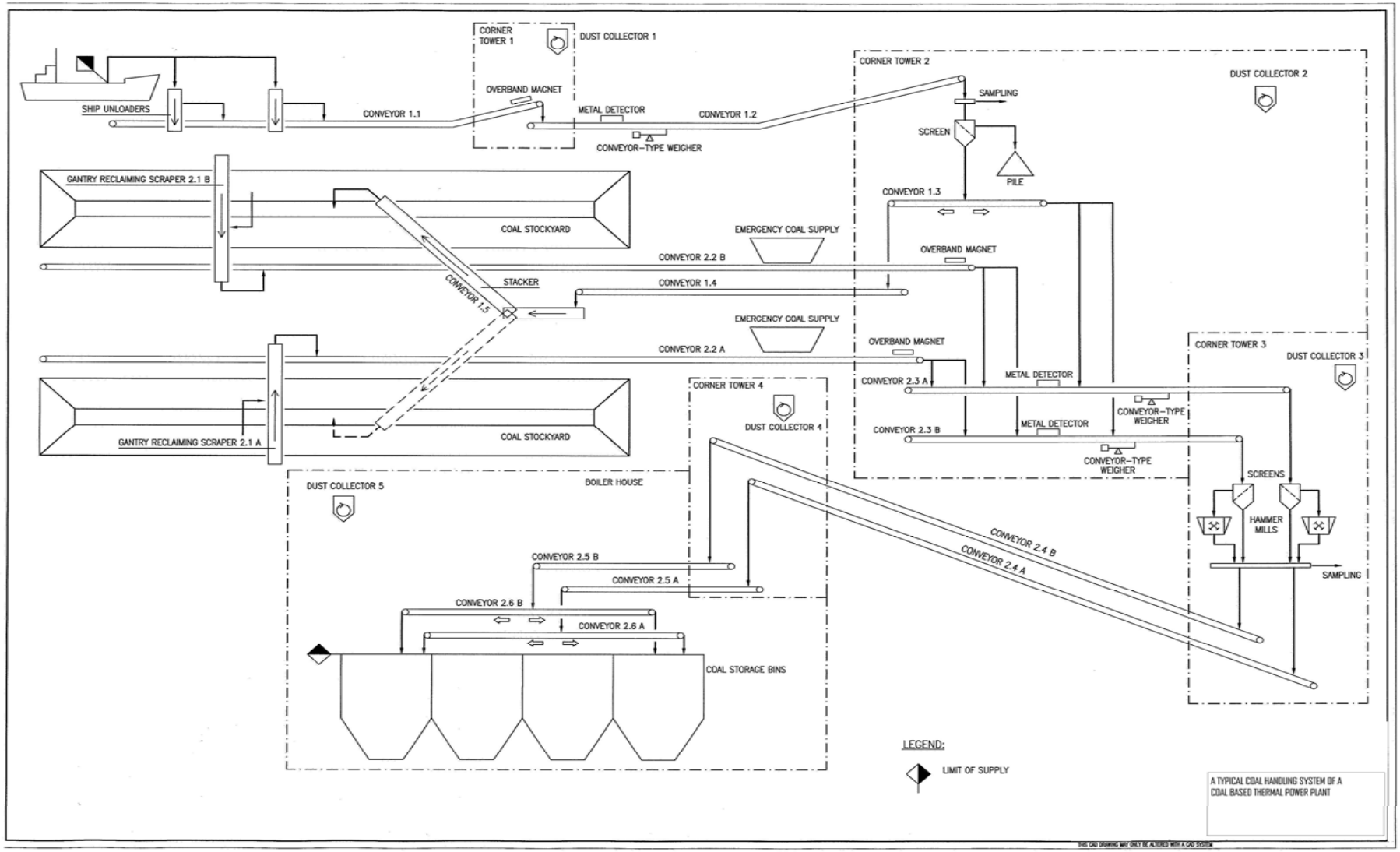


Figure 5.5: Indicative flow diagram of a coal handling system of a power plant

5.14.12 *Fuel oil transport, unloading and storage*

Fuel oil unloading and storage system shall be designed to handle both heavy oil (HFO/LHS/HPS) and light oil (LDO) to be used for cold startup and low part load (up to 7.5 %) operation of the steam generator while firing coal.

The heavy and light oil shall be transported to the power plant by road tankers. The receiving yard shall be designed to unload ten heavy oil road tankers and five light oil tankers at a time. The oil shall be unloaded by gravity to unloading header. This shall then be pumped to storage tanks through unloading pumps.

For storage of heavy oil two numbers of fixed roof type storage tanks each of having 2000 KL capacity shall be provided. Necessary provision of heating of the unloading header shall be provided. For light oil, two tanks each of having 500 KL capacity shall be provided. A set of pressurizing pumps shall draw the oil from storage tanks for pumping the oil to the steam generator units. The auxiliary boiler shall be designed for firing light oil (LDO). A separate day oil tank of 100 KL capacity for auxiliary boiler shall be provided.

5.14.13 *Chimney*

The DoE rules of maintaining stack height of minimum 275m for power plant over 500MW capacity under ECR, 1997 has been considered in design condition. One twin flue steel lined reinforced concrete chimney shall be provided for the 2x660 MW units of plant of the project. The flue gas emission point shall be 275 m above the plant grade level.

5.14.14 *Ash handling and transportation system*

The ash residue left from coal combustion process will be managed through collecting, conveying and interim storage. The total process may employ pneumatic ash conveying or mechanical conveyors. A typical pneumatic ash handling system will employ vacuum pneumatic ash collection and ash conveying from several ash pick up stations-with delivery to an ash storage silo for interim holding prior to load out and transport. Two types of ash will be produced from coal combustion: i) bottom ash ii) fly ash. Cyclonic separator will separate the bottom ash, d an ash collection hopper will collect the bottom ash and later, the collected ash will be transported through pneumatic ash conveying system to the ash silo. The Fly ash will be separated by electrostatic precipitator and transported through the same pneumatic conveying system. A typical diagram of the ash management system is pictured in Figure 5.6.

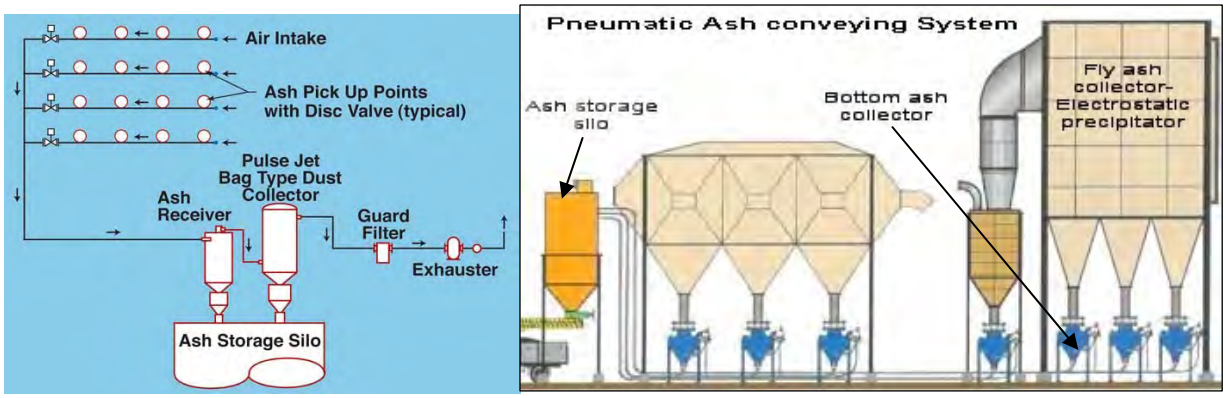


Figure 5.6: Pneumatic ash conveying system

Dry ash will be collected and transported in dry form to storage silo for utilization. In addition, in case of non utilization, this ash will be transported through High Concentration Slurry Disposal (HCSD) system where it will be mixed in agitator tanks for its ultimate disposal to ash disposal pond.

Bottom ash handling system

Bottom ash is extracted by using a continuously operating dry bottom ash evacuation system.

The bottom ash (BA) extracted in dry form from each unit shall be crushed in primary and secondary crusher to granular size of less than 6 mm and shall be collected in an intermediate silo (IM silo). BA can be unloaded and transported through truck from this IM silo. In case of un-utilization of BA, or disposal through trucks, BA from IM silo shall be transported to a BA silo near HCSD pump house. This shall be further mixed with fly ash and disposed off from in form of HCSD slurry.

Fly ash handling system

Pneumatic conveying system (either vacuum system or pressure system) shall be employed for conveying of fly ash from the electrostatic precipitator hoppers and APH hoppers in dry form. This ash shall be taken to buffer hoppers of each unit. The dry ash shall be located adjacent to the ESP. Dry ash from the buffer hoppers shall be transported either to HCSD silo to be located near the chimney or to storage silos near the plant boundary. The transportation system shall be provided for each unit for transportation from buffer hoppers to the silos either in closed tankers or in open tankers.

Space provision has been kept near storage silos for installation of dry fly ash classification system, for users of classified fly ash in future.

Ash utilization

The dry ash is taken to buffer hoppers for its onward transportation in dry form to storage silo near plant boundary for utilization. The residue ash can be used in brick manufacturing, clinker industries, cement industries, compaction purposes, etc. There will be also scope for ash export. Presently another parallel study is going on for this purpose. At initial stage, the generated ash will be used in land development within the project area. At first phase, only 420 acres of land will be developed for the main plant and township by dredged material and the rest area (1,414 acres) will be developed gradually with generated ash.

Many cement plants exist in the vicinity, 100% fly ash utilization has been considered. Hundred percent bottom ash utilization has also been considered. However, ash dyke of 100 acres has been planned in case of non utilization of ash.

5.14.15 Ash slurry disposal system

Fly ash, BA, and economizer ash slurry disposal

The fly ash collected in HCSD silos near chimney and ECO & BA ash from BA silo shall be mixed with water in an agitator tank at controlled rate to obtain the desired high concentration. The high concentration slurry shall further be pumped to ash dyke by HCSD pumps. One HCSD pump house is envisaged for 2 x 660 MW units. There will be two

working streams (one for each unit) and one stand by stream for HCSD pumps. All the pumping streams shall be provided with its individual disposal pipes. No crossover is being envisaged in the disposal piping. About 100 acres of land has been designed for ash disposal area, which is located adjacent to plant boundary. The ash disposal area is planned with a total usable area of about 60 acres for ash storage and 40 acres for starter dyke storage lagoons, maintenance road all along the periphery of the dyke and recirculation system facilities.

Ash water system

There will be no recirculation from dyke as the disposal of BA and FA system will be only by HCSD. Thus the plant make up shall be used for water requirement of ash handling system throughout the plant life.

Ash water re-circulation system

HCSD system is supposed to have no excess water. However, a recirculation system is envisaged for pumping any excess decanted water from the Dyke. Decanted water from ash pond of HCSD pond will be led to the plant area by using 2 x 100% (30 m^3/hr) capacity pumps and the same will be conveyed through one number of carbon steel pipe from ash dyke to plant area. This water will be further used in the ash handling system.

5.14.16 Cooling system

A closed cycle cooling system with induced draft cooling tower shall be provided. Cooling tower blown down shall be used for coal dust suppression and ash handling. In cooling water system, only make up water would be provided and can be easily desalinated. Therefore, re-circulating type Cooling Water (CW) system with cooling towers having open intake channel has been envisaged for the project. Makeup water requirement for cooling system would be 7350 m^3/hr. No treatment will be required for CW system. Saline water shall be supplied to cold water channel of circulating water system. The total circulatory water 72,000 m^3 per hour will require for the condenser and auxiliary cooling per unit considering temperature rise of CW across the condenser of about 10^0 C to 11^0 C. It is proposed to operate CW system at about 1.5 Cycle of Concentration (COC). This condenser and auxiliary cooling water (72,000 m^3/hr per unit) will be withdrawn one time but not at a time from the Passur river before commissioning of the cooling tower.

5.15 Coal source and transportation system

BPDB has conducted a detail study on coal sourcing, transportation and handling by engaging CEGIS to attain at a sustainable solution taking into consideration of environmental safety of Sundarbans and project surrounding environment.

5.15.1 Coal specification and requirement

Considering the safety of Sundarbans & surrounding ecosystem and public health & safety, the specification of the coal has been selected. The specification defined average sulfur content 0.6 %, maximum moisture content 15% and gross calorific value as 5800-6100Kcal/kg. Specification of the coal considered for this power plant is given in Table 5.4.

To ensure reliable supply of coal throughout the project life, the coal sourcing study suggested to import coal from multiple countries instead of a single country.

Table 5.4: Quality of the Coal Available in Selected Source Country

GCV (Kcal/kg	**TM (% Max)**	**IM (% Max)**	**Ash (% Max)**	**VM (%)**	**FC (%)**	**TS (% Max)**	**HGI**	**Sizing (mm)**	**AFT Deg. C (Max)**
ADB	AR	ADB	ADB	ADB		ADB			
For Indonesian Sources									
5500 - 5800	26-42	15-20	5-10	38-44	By Diff.	0.5 - <1	42-60	50	1100-1250
For Australian Sources									
6100 - 7250	6.0 - 18.5	1.0-13.5	8.7 - 21.0	19-50	by diff.	0.2 - 1.0	37 - 82	50	1300 - 1600
For South African Sources									
6100-6500	8 -12	3-5	15	20 – 22	By diff.	0-1.0	45-70	50	1200-1300

Source: collected from different major coal sellers of Indonesia, South Africa and Australia
Note: ADB: Air Dried Basis; AR: As received; GCV: General Calorific Value; TM: Total Moisture; IM: Inherent Moisture; VM: Volatile Matter; FC: Fixed Carbon; TS: Total Sulfur; HGI: Hard-grove Grind-ability Index; AFT: Ash fusion temperature (flow temp. in a reducing atmosphere), By Difference: 100- (IM + Ash + VM).

With high GCV, coal requirement is less. The daily coal requirement of 2x 660 MW units shall be about 12,920 tones based on gross calorific value of 6000 Kcal/kg, 100% plant load factor and 2,447 Kcal/MWh unit heat rate. Coal requirement depends on GCV of coal. The coal requirement will be less with coal of higher GCV value. Coal requirement has been estimated using the formula:

Annual Coal Requirement: (2,447 Kcal/MWh x 1320 MW x 24 hours x 365 days) / 6000 kcal/kg = 4.715 million ton.

5.15.2 Coal sources

Considering suggested coal specification, availability, cost of coal, cost of transportation and reliability to supply coal, judiciously it has been planned to import coal from Indonesia, Australia and South Africa under long term/short term agreement with coal producers and suppliers. In such case, good quality Sub-bituminous coal might be imported from Indonesia (GCV 5500 – 5800 kcal/kg AR basis) and Bituminous (GCV 5800 – 6300 kcal/kg AR basis) coal might be imported from South Africa and Australia. In this case of multiple sources, GCV of average 6000 Kcal/kg to be achieved blending of different coals of different grades has been considered for planning purpose.

BPDB would engage third parties to supply coal and transport coal up to the project site under Coal Supply Agreement and Coal Transportation Agreement with the outsourced agencies.

5.15.3 Coal transportation

The imported coal will be transported through Passur River using Mongla Port facilities (excluding berthing facilities). A separate study has been conducted for finding a best suitable coal transportation plan. The study identified five alternatives considering different vessel type, inland waterways and mode of transshipment:

- Alternative I- Mongla Port Fairway Buoy (MPFWB) anchorage: Mother vessel of 3,80,000 DWT will anchor at MPFWB (near Swatch of no Ground) and then further transshipment up to project site by lighter vessel
- Alternative II- Akram point anchorage: Mother vessel of 80,000 DWT will anchor at Akram point and then further transshipment by lighter vessel.
- Alternative III- Harbaria Anchorage: Mother vessel of 25,000DWT will anchor at Harbaria anchorage and then further transshipment by lighter vessel.
- Alternative IV- Direct discharge of coal from mother vessel of 25,000 DWT at Coal Terminal at Mongla Port Jetty no-11 and then further transshipment by conveyor belt
- Alternative V- Direct discharge of coal from mother vessel of 25,000 DWT at Coal Terminal at plant site

The alternative I has not been considered as sea state condition favors anchorage and ship-to-ship transfer for only four months in a year. Alternative IV and V will not be feasible as maintaining channel by dredging for such vessel would not be feasible.

Anchorage area for alternative II and III are located in Sundarbans. At present, mother vessels of Mongla Port anchor at the down of Harbaria for lighterage operation. Harbaria anchorage permits vessels of maximum 25000 DWT. Carrying coal by 25000 DWT vessels described in Alternative III will require more numbers of vessels and lighters that will increase transportation cost as well as risk of environmental damage. On the other hand, carrying coal by 80,000 DWT vessels as suggested in Alternative II would involve less numbers of vessels as well as less cost. Besides, the river at Akram Point area is wider than that of Harbaria (1.8 to 2.5 km at Akram Point and 1 to 1.5 km at Harbaria), which favors safe ship-to ship transfer and keeps a safe distance from Sundarbans. Considering cost, river state, river depth, environmental hazards, and safe maneuvering and ship to ship transfer, the study on coal sourcing and transportation has finally opted for Alternative II as best suitable coal transportation plan.

The selected plan includes - transportation of coal for Khulna Power Plant from source country to project site by vessel of 80,000 DWT (subject to beam width and length of the vessel) and then further transshipment by purpose built shallower draught coal carrier of 5000 to10,000 DWT having draught of 5.5 m. A total of 59 voyages will be required each year to transport annual coal requirement by vessel of 80,000 DWT from source to Akram Point anchorage. Five lighter vessels of 10,000 DWT would transship total cargo of a mother vessel by making five voyages within four days. The tentative routes of mother vessels from sources to anchorage area are shown in Figure 5.7 to 5.9. The selected route for transshipment from mother vessel position to project site is shown in Map 5.6.

For implementing the selected transportation plan dredging shall be required for improving the navigability of the Passur River as considered in the plan. Under the coal sourcing study a detail investigation has been carried out for assessing dredging requirement.

For approaching the selected 80,000 DWT vessel up to Akram Point, dredging at Outer Bar shall be required. Similarly, for transshipment of coal from mother vessel to project site by 8,000 to 10,000 DWT barge, dredging shall be required from base creek to project site. As such, Dredging of 30 million m^3 at Outer Bar (Length 20km, channel width 160m and design depth 12 m C.D) and 2.1 m^3 from Base Creek to Project site (channel width 100m, length 16 km and design depth 5.5 m) were assessed for effective coal transportation. This dredging shall be carried out by relevant agency of GOB under different work program for which, separate Environmental Assessment Studies may be carried out by the relevant agency (if required) as per the Environmental Regulations.

The coal transportation shall be executed by outsourced agency. The agency shall be responsible for maintaining all IMO conventions, MARPOLs, environmental regulation of Bangladesh, Mongla Port Acts and regulations, regulations of the Ministry of Shipping to ensure ship safety, environmental safety, and prevention of Environmental Pollutions from ships. DG Shipping regulates all ocean going ships monitoring and auditing compliance of ships and shipping activities with the aforementioned regulations and conventions.



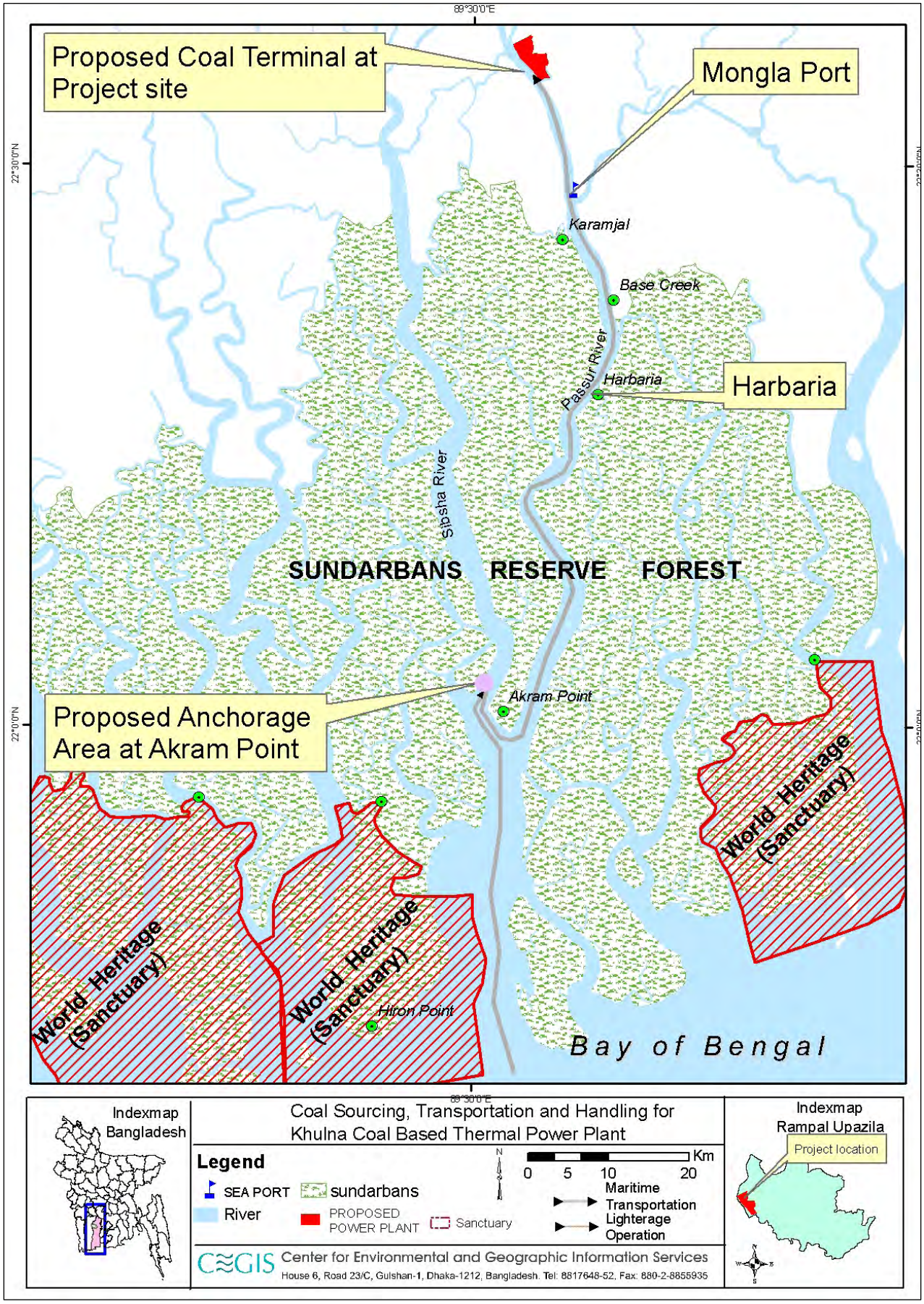
Figure 5.7: Maritime sea route From New Castle CT, Australia to Mongla port, Bangladesh



Figure 5.8: Maritime sea route From North Pulau Laut (NPLCT), Indonesia to Mongla port



Figure 5.9: Maritime sea route From Richard Bay, South Africa to Mongla port, Bangladesh



Map 5.6: Tentative navigational route map for coal transportation

5.16 Water System and Management

Water will be required for steam generation, condenser cooling, coal management, ash handling and disposal, and domestic purposes. Details of water sourcing, use, treatment, and disposal are described in the following sub-sections.

5.16.1 Source of water

The source of the water for the project is Passur river. Passur river water is highly saline and sediment load. This saline water will be used for cooling purpose, coal handling, and ash handling, without any further treatment. Desalination, pretreated, demineralization will be required for meeting potable water, plant service water, cycle makeup (DM water), etc.

5.16.2 Water consumption

Once through system as well as circulating water system has been planned for the project. It has been estimated that water at the rate of 9,150 m^3/hour (e.g. 2.54 m^3/s) will be drawn from the Passur River for operating the project including potable water requirement. This water is less than 1% of the lowest flow condition of Passur River(e.g. 6,000 m^3/s). Finally, 5,150 m^3 water will be discharged to river after appropriate treatment from central effluent monitoring sump. The detail flow diagram of the water management for the proposed project is shown in Figure 5.10.

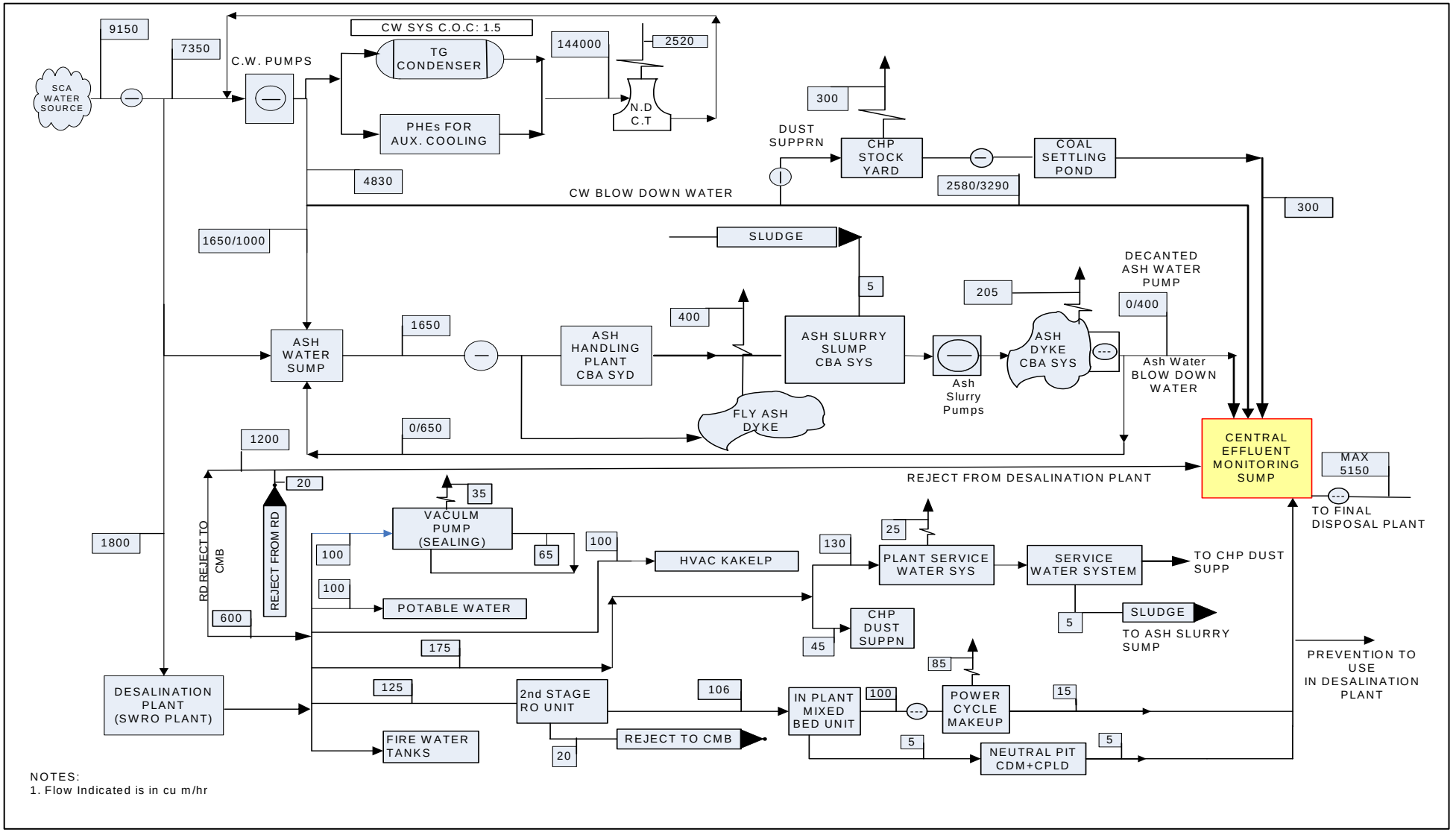


Figure 5.10: Water balance diagram of the proposed power plant

5.16.3 *Circulating and makeup water system*

Circulating water has been envisaged for operating the project. Water system for cooling System, ash handling and disposal system, boiler water, etc will be operated by circulating water system. Make up water will be fed regularly for circulating cooling water system.

For cooling, a re-circulating type Cooling Water (CW) system with cooling towers having open intake channel has been envisaged for the project. The CW system consists of CWPH and SACWPH including fore-bay, intake RCC channels, steel line concrete encased supply and discharge ducts. Cooling water requirement for the auxiliary cooling system of each unit would be tapped from the CW pipe at the upstream of condenser and the return water from the circuit would be led to the CW discharge pipe after condenser. Re-cooled water after cooling tower will be led to the CW pump house through the cold water channel by gravity. CW system blown down would be drawn from CW pump discharge.

The total water requirement for the condenser and auxiliary cooling is estimated to be about 72000 m^3 only one time for each unit. It is proposed to operate circulating water system for 1.5 Cycle of Concentration (COC). Therefore, only 7350 m^3/hr make up water will be provided to circulating water system without any desalinization. Make up water system will also feed boiler water for power cycle make up after desalinization process.

In ash handling system, water in ash pond will be reused in ash water sump for ash handling. Only blow down water from ash pond will be discharged to central effluent treatment plant. This circulating water system will also provide required water to coal stock yard for dust suppression.

The entire water system has been designed for efficient water use where a series of water re-use provision has been kept. The complete water balance model has been depicted in Figure 4.11.

5.16.4 *Water treatment system*

Water treatment system of the project comprises of Desalination System, Chlorination Plant, Condensate Polishing Plant, and liquid waste effluent treatment system. No waste water shall be discharged to the river without appropriate treatment and satisfying effluent standard as defined in ECR 1997.

Desalination plant

It is planned to adopt Reverse Osmosis (RO) process for desalination of sea water. Sea water is proposed to be collected and stored in a storage tank of RCC construction near Sea water Reverse Osmosis (SWRO) plant. The desalination system shall be equipped with water pre-treatment section such as clarification, chemical dosing as per standard practice of the suppliers and filtration Treated water from SWRO shall be stored in steel tanks which shall be used for plant water requirement such as Service water, HVAC makeup, makeup to the fire water storage tanks, sealing water for vacuum pumps of ash handling plant and Potable water for plant and colony. To produce De-mineralized (DM) quality water for cycle makeup, it is required to provide a Second Stage RO unit and a set of Mixed Bed (MB) Ion-exchanger unit at the downstream of SWRO plant. A portion of desalinated water from SWRO units shall be treated through 2nd stage RO unit and MB Bed type ion exchanger units to produce DM water. For regeneration of ion-exchange resins of MB unit, regeneration systems

comprising set of acid tanks and a set of alkali tanks, dosing pumps, acid and alkali unloading pumps, Neutralization pit, effluent disposal pumps etc shall be provided.

Chlorination plant for CW system

Chlorination plant shall be provided for chlorine dosing in the CW to avoid the growth of algae and bacteria. CW chlorination system would consist of three numbers of chlorinator-evaporator sets of 100 kg/hr capacity. Each chlorination system shall be provided with required chlorine tones containers, instrumentation panels, chlorine leak detector, etc. Complete chlorination plant shall be located indoor. Chlorine leak absorption system as plant emergency measure shall be provided for each of the chlorination plants to neutralize chlorine leakage from the plants. As the project uses sea water, alternative to the proposed gas chlorinators, use of electro-chlorination shall be studied and if found suitable the same can be implemented.

Management of waste water from coal stockyard

The runoff and wash off from the stockpile and coal unloading system shall be treated properly before discharging it to open environment. Fog spray or mist the stockpile surface shall be in practiced to maintain the surface of the coal in moist condition. This will minimize propensity of self combustion and dust generation and accordingly no runoff water will be produced. Effluents from coal stockyard - "Coal slurry settling pond" shall be provided to arrest the coal dust.

Effluent treatment, monitoring, and discharge plant

A central Monitoring Basin (CMB) of RCC construction shall be provided to collect all the plant effluents so that the same may be provided to collect all the plant effluents so that the same may be pumped back to the sea. The liquid effluent from different sources e.g. plant operation, domestic sources, coal stock yard, ash sump, etc shall be collected and treated / recycled as per standard practice. A central effluent plant with integrated water and wastewater management has been planned and designed for the project. The management system has been designed by providing facilities like recycle and reuse of waste water. The sludge and waste water to be generated from desalinization plant, R.O. plant, ash sump, etc. shall be discharged after series of reuse and recycling system to the central effluent treatment sump. After treatment, effluent shall be discharged to the Passur River at a rate of 100 m^3/hr.

Effluent quality shall be monitored at different stage of discharge and intake. Before discharging the treated effluent from the central monitoring sump the effluent standard shall be complied with ECR, 1997 defined standard for effluent.

5.16.5 Miscellaneous water system

Two sets of potable water pumps for plants and colony shall be provided to fill the overhead potable water tanks of the plant as well as to supply potable water to the township/colony. A pipe network for distribution of potable water for plant shall be provided from the overhead storage tanks. Rainwater runoff from the plant area and wash water of air pre-heater will be directed through lined drains, channels, and culverts into a harvesting pond.

This runoff will be used for spraying the coal stockyard and landscape irrigation. Any excess rainwater during the monsoon season will overflow into local drainage system.

5.17 Civil structure and urban facilities

A large numbers of civil structures and facilities are planned with the project. The possible civil and urban facilities to be constructed are listed below

- Infrastructures and civil structure
    - Site establishment
    - Office building
    - Dozer maintenance shed
    - Workshop, permanent stores
    - Steel foundation for the plant
    - Ash storage
    - Water treatment, drainage and sewerage network
    - Security fencing
    - Coal terminal
    - Coal corridor
    - Coal handling, storage and transportation facilities
- Residential facilities
    - Rest house
    - Officials' quarter
    - Staffs quarter
    - Guard shed
    - Canteen
- Township
    - School
    - Mosque
    - Medical centre
    - Officers Club
    - Sports complex, Playground, fitness center, etc.
    - Police camp
    - Social facilities-community center, club, auditorium, Bank, post office, shopping center, etc
    - Transportation facilities-transport center, Petrol pump,
    -
- Pollution mitigation facilities
    - Greenbelt around the power plant
    - Eco-park
    - Water treatment plant
    - Central effluent monitoring basin
    - Chimney of 275m height
- Road network
    - Access road - Double lane bituminous Access road
    - Necessary bridge, culvert, sluice, etc
    - Patrol road, internal road network, etc

5.18 Electrical system

5.18.1 Power evacuation

400 KV and 230 KV transmission systems have been planned along with the proposed power plant. Power Grid Company of Bangladesh (PGCB) will design and implement necessary transmission systems. Power generated from each 660 MW unit would be stepped up to the evacuation voltage level through suitably rated Generator Transformer. At the end, this power shall be distributed up to the consumer end through different grid and distribution substation.

5.18.2 Start-up power requirement

The startup power of the plant has been envisaged to be drawn from the 230 KV existing PGCB Khulna South substation through the planned transmission line between generating switchyard and Khulna south substation. The availability of the 230 KV Double Circuit line interconnection from Khulna south substation needs to be ensured matching with the project start up power schedule.

5.18.3 Auxiliary power supply scheme

The plant auxiliary power supply scheme has been evolved with Generator Circuit Breaker along with suitably rated unit transformers associated with each unit.

5.18.4 Generator

The main parameters of Generator would be as follows:

a) Nominal rating 660 MW

b) Rated output 777MVA

c) Power factor 0.85 (lag)-0.95 (leading)

d) Rated Voltage As per manufacturer's Standard (in the range of 21-24 kv)

e) Speed 3000rpm

f) Short Circuit ration Not less than 0.48

Besides the other electrical protections, the Generator shall have the following additional protections/monitoring

- Alkaliser
- End winding vibration monitor
- Online Partial Discharge (PD) Monitoring System

5.18.5 High voltage switchyard and power distribution

A 400 KV open air switch yard shall be installed under this power plant with required number of buses and incoming out going feeders. As per the power purchase agreement, the evacuated power from the plant generated by the project will be sold to two distribution companies owned by the Government of Bangladesh. The main components of the sub-stations are two numbers of unit transformer, required number of circuit breakers as per requirement and design along with Current Transformer (CT), Potential Transformer (PT), Lighting Arrestor (LA), Communication equipment, etc

5.19 Central Control and Monitoring

A central control room for two units at operating floor along with programmer's room will be installed. The boiler, turbine and generator along with their associated auxiliaries would be controlled and monitored from the common control room in BC bay (on CCR common for 2units). For offsite, DDCMIS such as AHP, CHP, water system, makeup water system, etc have been proposed in the respective areas. It is proposed to install Steam Water Analysis System (SWAS). To achieve environmental efficiency, SOx, NOx, O_2, CO_2, CO and dust emission measurement shall be provided.

5.20 Project Design and Construction

5.20.1 Design

The project is being designed in accordance with the international standards for supercritical steam power plant. The design of support facilities and associated works is in accordance with appropriate national and international standards. The plant design will cope with local seismic conditions.

The design life of the plant will be at least 30 Years. Civil works structures and foundations will be designed for a life exceeding 45 years. Equipment for units 1 and 2 will be arranged in a slide along configuration. The station layout and the operability of equipment will require a station operation and maintenance staff team of around 300 persons, excluding contracted laborers.

5.20.2 Construction

The site requires filling and grading to establish the final landform. Site soils consist of sandy to sandy loam topsoil and subsoil, which will require that excavation be undertaken with bulldozers and excavators. Site leveling will use all excess soil produced from excavation with additional soil (if necessary) brought onto the site from outside sources.

Civil works will involve construction of the main power plant and auxiliary facilities and buildings, the water supply pipeline from nearest source. Mechanical and electrical works will include both on-site and off-site fabrication, assembly, installation, and erection of power plant equipment, pollution control equipment including FGD units and the chimney structure, demineralization plant, control system, power system, and various utility systems.

Construction will require between 2,000 and 4,000 skilled and unskilled workers. Construction workers will be engaged by contractors responsible for different construction packages. The power supply for construction will be provided by a single 33 KV distribution line of about 6 MVA rating X-former from nearest substation. Construction water will be sourced through authorized vendors and from ground water sources prior to the operation of the plant water supply pipeline.

5.21 Pollution Mitigation Measures

5.21.1 Air pollution control system

High efficiency Electrostatic Precipitators (ESPs) will be installed to limit the particulate emission to 100 µg/Nm^3. To facilitate wider dispersion of remaining particulates and gaseous pollutants (SO_2 and NO_x), bi-flue chimney of 275m height shall be provided. Space provision has been kept in the layout for retrofitting Flue Gas Desulfurization (FGD) system, if required in future. To control emission of fugitive dust within and around the coal handling plant and coal stockyard, dust suppression and extraction systems shall be installed. The chimney shall also be provided with facilities for online monitoring of stack emissions.

5.21.2 Noise control

The major noise generating sources are the turbines, turbo-generators, compressors, pumps, fans, coal handling plant etc. from where noise is continuously generated. Equipment will be designed to control the noise level below 90 dB. Wherever it in not technically possible to meet the required noise levels at working place, the personnel protection, equipment like ear plug/ear muffler shall be provided to the workers. The buffer area around the plant, boundary wall around the project shall dampen the noise level so that nearby community will not feel any noise.

5.21.3 Intent of water reuse

The entire water consumption and management system has been designed with provision of water use facilities. A circulating water system has been designed for cooling system, boiler water, ash disposal and handling system.

5.21.4 Effluent treatment

A central effluent treatment plant with the facilitation of Central Monitoring Basin (CMB) has been planned to collect, treat and dispose all the plant effluents. The liquid effluent shall be collected and treated / recycled generally as per following design philosophy.

- A portion of CW blow down water shall be used for dust suppression system of coal stockyard and balance shall be diverted to Central Monitoring Basin. Provision shall be kept to use CW blow down water for ash handling plant when system is operating in one thru mode
- Ash water system shall be generally operating in re-circulation mode blow down if any from Ash water system shall be led to the CMB.
- Other plant drains/ effluent of sea water quality shall be collected and pumped to central monitoring basin.
- The reject from desalination plant and sludge, if any, from the pre-treatment section of Desalination plant shall be pumped to be discharged to the CMB.
- Regeneration waste of Demineralization Plant, condensate polishing plant and boiler blow down water shall be pumped to the CMB.
- Water from plant service water system and dust suppression system shall be collected from the plant drains and shall be treated through a set of tube settlers to remove suspended impurities. The treated water shall be pumped to the CMB.

- Drains from coal stockyard shall be drained to a set of coal settling pond for removal of coal particles
- All the plant liquid effluents shall be mixed in CMB and quality of the effluent shall be measured and monitored. Through a set of water effluent disposal pumps and piping, the same shall be disposed off from central monitoring basins up to the final disposal point
- Final disposal will be made maintaining DoE's standard for effluent quality.

5.21.5 Thermal pollution control

A closed cycle cooling system with induced draft cooling towers will be provided. Therefore, no thermal pollution is anticipated. Cooling tower blow down shall be used for dust suppression and ash handling.

5.21.6 Waste management

All kind of solid wastes to be generated will be disposed on site maintaining DoE's standard. Ash particle will be the major waste to be generated from the power plant and the details of the ash management is described in Section 4.11.10. A blanket of water shall be maintained over the ash pond to control fugitive dust emission. Some amount of waste will also be generated from coal storage yard and belt conveyor facilities. To control the coal dust flying, the coal silo for the storage yard and the cover on the conveyor belt will be taken as a preventive measure. A water spraying system will be installed in coal yard and ash disposal area to control the fugitive dust particle.

5.21.7 Water Intake Structure

The water supply pipeline from intake point to the feeder canal shall be provided with sufficient screening to filter out larger aquatic organisms like fishes, frogs etc. Drum screens shall be adopted in order to limit the entrainment of fish in the cooling water system. Temporary water reservoir shall be built for water storage rather than direct abstraction from river. Further, fish conservatory (sanctuary) shall also be established at a safe zone.

5.22 Afforestation and greenbelt development

A green belt of about 100m has been planned all around the main plant area except the switchyard side. In addition, large-scale afforestation and green belt development activities shall be implemented in all available spaces within the main plant area.

5.23 Rehabilitation and resettlement

The proposed project will require acquisition of 1,834.00 acres of land that includes mostly agricultural and shrimp aquaculture pond (gher) and 150 households (approximately). The land acquisition process is progressing under District Commissioner office of Bagerhat as per the Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance II of 1982) of Bangladesh Government. The compensation, resettlement and rehabilitation will also be executed following the Ordinance.

5.24 Post operation monitoring program

Regular monitoring of pollutants in different environmental disciplines like air, stack emission, wastewater, etc shall be conducted and the data shall be submitted to the Department of Environment (DoE) regularly following the Environment Monitoring Plan proposed under this study. The monitoring locations will be finalized in consultation with DoE. Station will be equipped with all necessary equipment and workforce for ensuring effective monitoring.

JV Company shall have provision of environmental quality and safety department for monitoring the EMP implementation during the construction and operation phases of the project. The environmental monitoring officer shall monitor the EMP implementation and submit a quarterly report to the said department. In addition, as well as, another yearly monitoring report with quarterly monitoring data shall be submitted to the DoE for renewing the Environmental Clearance Certificate. Two trainings per year shall be planned for safety professionals.

A few typical monitoring and measuring apparatuses for determining the phenomenal aspects of water system, chemical treatment system and effluent system have been enclosed with the Report. In addition, some monitoring instruments of the gas emissions and particulate matter dispersion are added as solicited with recommendation:

- Liquisys M CUM 223/253 transmitter may be selected in wider range
- Dual Input Intelligent Analyzer M1056 may also be chosen for PH/ORP/ISE Resistivity/Conductivity, % concentration, chlorine, oxygen, ozone, temperature, turbidity, flow etc. This multi- parameter instrument offers a wide range of measurement choices supporting most industrial, commercial, and municipal applications.
- PH/ORP Sensors models 399 and 399VP of EMERSON Process Management:-These aids in the sensors resistance to poisoning ions and helps prolong sensor life. This quality protects the reference elements from ammonia, chlorine and cyanides in the process.
- Endurance Purpose Conductivity sensor-Model 400 and 400VP sensors are intended for the determination of electrolytic conductivity in applications ranging from high purity water to cooling water. The sensors are ideal for use in clean, non-corrosive samples.
- Clarity II Turbidity meter model T1056 is intended for turbidity determination in water. Low stray light, high stability, efficient bubble rejection, and a display resolution of 0.001 NTU make Clarity II ideal for monitoring the turbidity of filtered drinking water.
- For detecting some emissions in flew gas Teledyne Instruments UV Fluorescence SO_2 Analyzer model 100E may be opted (Ranging 0-50 ppb to 0-20 ppm)
- Model 200E Chemiluminsence NO/NO_2 /NOx Analyzer ranging 0-50 ppb to 0-20ppm may be selected for its temperature and pressure compensation to determine the emission values.
- DURAG (D-R 290) Optical opacity/dust monitor may be selected for the plants with dust concentration >50 µg/ m3 for its name signifies that the light beam traverses the measuring distance twice.

Chapter 6: Environmental and Social Baseline Condition

The details of the existing environmental settings and socio-economic baseline condition of the proposed coal based thermal power plant to be constructed by the Bangladesh Power Development Board (BPDB) at Sapmari in Bagerhat district, are presented in this chapter. The baseline environmental and socio-economic conditions have been established in respect of physical environment, water resources, land resources, agriculture, fisheries, ecosystem, and socio-economic settings of the selected study area using both primary and secondary data.

6.1 Study Area

As per recommendation of DoE, an area of 10 km radius from the plant location has been considered for setting environmental baseline condition. Moreover, a 20 km widen strip of Passur and Sibsa River from North end of the project site to Mongla Port Fairway Buoy has been considered for evaluating baseline condition considering the route of coal transportation (the Passur River). For ecological baseline condition assessment, addition to these areas, the entire Sundarbans has been considered. Maps 3.1 and 3.2 present the study area for baseline condition, impact assessment and coal transportation study.

6.2 Availability of Coal

The required coal 4.72 million ton annually. North West part of the Bangladesh is well known for deposition of good quality Gondwana coal. This coal can be the best alternate indigenous source of energy for Bangladesh. So far, five Coal (besides Kuchma and Singra, deep seated deposits) have been discovered having in- situ Coal Deposit of about 2.5 Billion metric tons. Among these, only Barapukuria coalfield has been developed where about one million ton/year coal is being produced by underground method from the central and southern part of the field. The mine produced 0.5 to 0.8 m MT of coal from 2006/7 to 2010/11. The other coal deposits await government's decision and appropriate guideline for mine development. The Coal bearing area of NW Bangladesh is very well to reasonably connect by rail and road to the proposed Khulna coal fired power plant. However, considering the production capacity, mining process, infrastructures, risks and hazards, socio-economic values, political decisions and future energy demand in rational away this project will be imported the required from international sources. Indonesia, South Africa and Australia are the suitable sources considering coal reserves, production of sellable coal, coal export and coal policies of the source countries. A separate study has been carried out for determining coal sourcing, transportation and handling. Potential coal sources and coal transportation plan are briefed in Section 5.15 of Chapter 5.

6.3 Availability of water

The project will be constructed adjacent to the Passur river which is a tidal river. The minimum monthly discharge (occurs during February) of the Passur River is 6000 m^3/s (BWDB, 2005) where the highest flow is 22,500 cubic meter per sec during wet season. Tidal effects this area two times in every days. However, tidal water intrudes maximum during high tide which is mainly saline water. The feasibility study estimates 9,150 m^3/hr (*e.g.* 2.54 m^3/s) water will be required. This water will be collected from the Passur River, which is dominated by tidal flow.

It is estimated that the required volume of water is less than 1% of the net tidal volume of the Passur River during lowest flow condition. Furthermore, after utilization, 5,150 m^3/hr (equivalent to 1.43 m^3/s) water will be discharge back to the Passur River.

6.4 Physical Environment

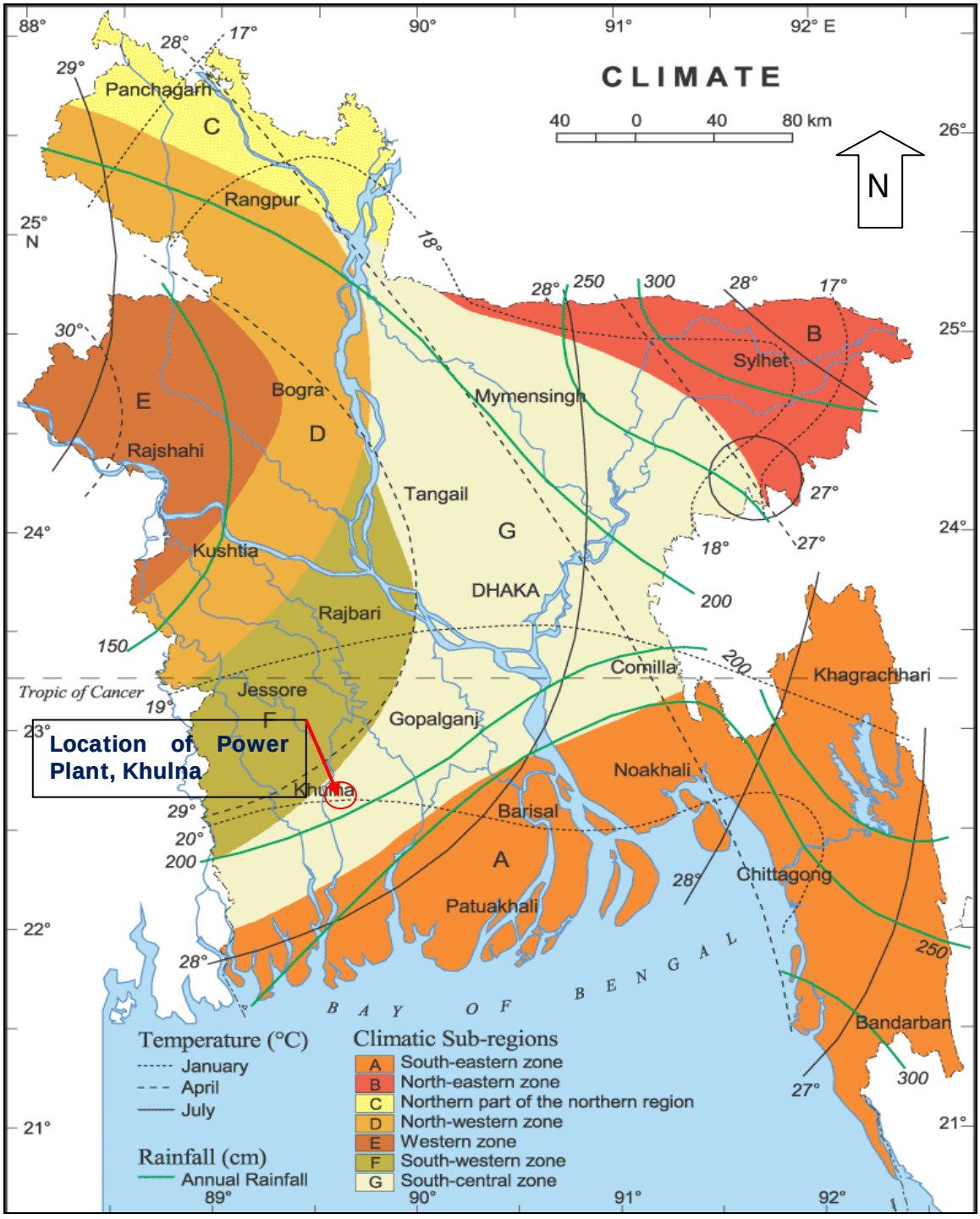
6.4.1 Climate and meteorology

The project area lies in the South-central climate zone of the country (Map 6.1) and shows tropical monsoon climate with three prominent seasons - Summer/Pre-monsoon - March to May; Rainy season/monsoon - June to October; and Winter season - November to February. Monsoon comes in the month of June and recedes in the month of late October.

Seasonal variation of rainfall, temperature, and humidity is the noteworthy aspect of the climate. The rainy season is hot and humid, and characterized by heavy rainfall, tropical depression and cyclone. The winter is predominately cool and dry. The summer is hot and dry interrupted by occasional heavy rainfall.

Gentle north/north-westerly winds with occasional violent thunderstorms called northwester during summer and southerly wind with occasional cyclonic storm during monsoon are prominent wind characteristics of the region.

Meteorological condition has been established using data on different metrological parameters accumulated from nearby Mongla station of the Bangladesh Meteorological Department. Summary of the analysis of metrological parameters are given in the following sections.



Source: ASB,2006

Map 6.1: Climatic Sub-region of Bangladesh

Temperature

Seasonal variation of the temperature is distinct but does not vary largely. Data of last 20 years (1989-2008) shows that monthly maximum temperature varies from 23.3^0 to 36.5^0 C while April is the warmest month and the monthly minimum temperature varies in the range of 12.2^o to $27.8\ ^0$C while January is the coldest month. The highest maximum temperature ever recorded within the last 20 years is

36.57^{0}C during May 1995 and the lowest ever recorded minimum temperature is 12.21^{0}C during January, 2003. The monthly maximum and minimum temperature of last 20 years (1989-2008) are given in Table 6.1 Figure 6.1 shows the monthly average maximum and minimum temperature of twenty years (1989-2008)

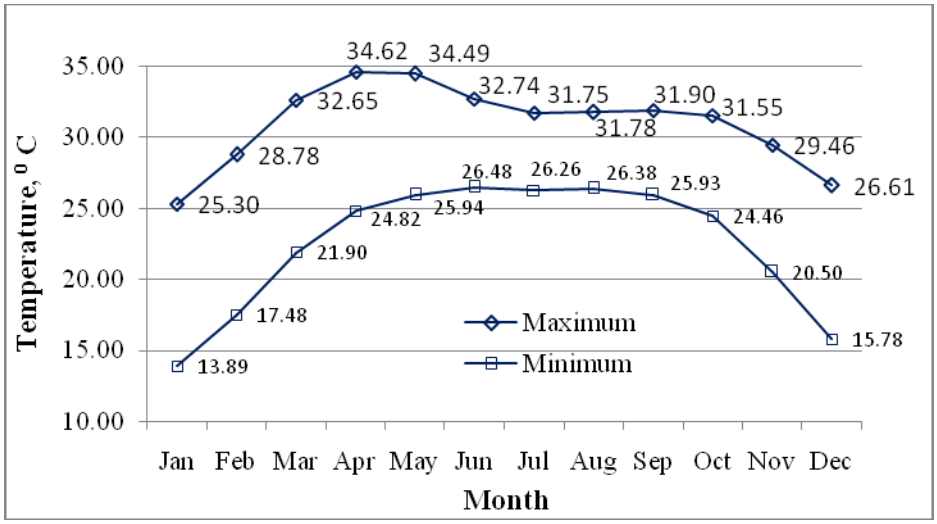


Figure 6.1: Twenty years (1989-2008) average of monthly temperature

Humidity

The collected data from Mongla Station shows that monthly average relative humidity in the project area varies seasonally from 70% to 90%. June, July and August are the most humid months (80 % to 90 %) while during January to March it remains lowest (20% to 30%). Figure 6.2 and Table 6.2 show average monthly maximum, minimum and average humidity of last thirty-one years (1978 to 2008).

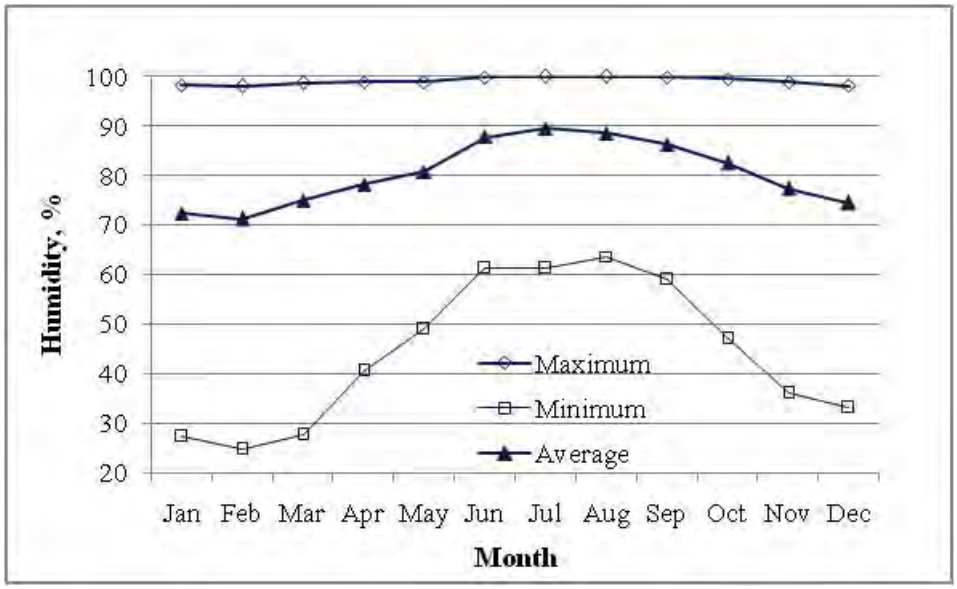


Figure 6.2: Thirty-one years (1978-2008) average of monthly Humidity

Table 6.1: Monthly minimum and maximum temperature recorded in Mongla Weather Station

	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Year	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1989	24.42	13.06	28.81	17.54	32.67	21.76	35.02	25.34	34.55	26.35	32.51	26.48	31.42	26.30	31.78	26.26	31.87	25.86	30.94	24.53	29.53	20.05	26.08	15.01
1990	26.20	14.37	28.50	19.10	29.62	20.28	32.79	24.55	33.84	25.49	32.68	26.80	30.97	25.68	32.27	26.20	31.92	26.08	30.27	23.57	29.57	21.19	26.72	15.67
1991	24.62	14.01	29.42	18.17	33.47	23.08	34.32	25.37	33.81	26.91	32.35	26.09	31.93	26.43	31.94	26.38	32.28	25.68	31.38	23.94	28.53	18.96	25.85	15.52
1992	24.67	13.64	26.56	17.20	32.59	22.78	35.93	25.00	34.02	24.78	33.69	26.40	31.26	25.94	31.53	26.26	31.28	26.05	31.35	24.58	28.91	20.41	26.12	14.59
1993	25.52	14.07	29.04	17.85	31.23	20.38	33.95	23.83	33.41	25.10	32.24	26.08	31.86	26.61	31.22	26.42	30.85	25.33	32.10	24.68	29.55	20.45	26.98	16.14
1994	26.18	14.65	27.25	16.65	33.07	22.55	34.01	24.21	34.55	25.99	31.56	26.66	31.69	26.38	31.21	26.18	32.14	26.01	31.71	24.29	28.74	20.46	26.88	15.08
1995	24.50	13.09	28.30	16.68	33.02	21.56	36.57	25.75	34.82	27.08	32.41	27.14	31.95	26.34	31.75	26.61	31.37	26.12	31.34	24.78	27.98	20.78	26.62	15.74
1996	25.40	14.82	28.82	16.84	33.55	23.37	34.54	24.77	35.39	26.34	32.13	25.82	32.03	26.41	30.41	25.92	32.74	26.41	31.29	24.16	29.45	20.03	26.26	15.73
1997	25.14	13.67	27.41	16.98	32.64	22.46	32.11	22.20	34.23	25.08	33.68	26.01	31.37	26.04	31.76	26.39	31.43	25.48	31.44	23.53	30.53	21.20	25.00	15.57
1998	23.33	13.66	28.22	17.74	30.35	20.35	33.66	24.00	34.34	26.43	34.14	27.78	32.36	26.68	31.72	26.53	31.95	26.09	32.34	25.84	30.01	22.27	27.34	16.56
1999	26.18	14.12	30.37	17.87	34.36	22.58	35.79	26.16	33.65	25.80	32.45	26.36	31.64	26.02	31.22	26.09	30.81	25.83	30.81	24.86	29.67	20.29	27.35	16.47
2000	26.22	14.44	27.20	17.25	32.50	21.97	34.49	24.67	33.66	25.74	32.62	26.41	31.63	26.14	32.43	26.66	32.06	25.73	31.67	24.97	30.21	20.81	26.98	15.19
2001	25.41	13.12	29.84	17.66	33.60	21.63	35.57	25.49	33.52	25.28	31.10	25.99	31.35	26.26	32.45	27.10	32.55	26.02	31.93	25.13	29.35	21.74	27.03	15.27
2002	26.45	14.93	29.66	16.79	33.71	21.93	33.42	24.17	34.65	25.94	32.94	25.95	33.53	26.87	31.73	26.14	32.44	25.73	31.85	24.01	29.54	20.59	27.05	16.25
2003	24.01	12.21	29.44	17.78	31.27	20.66	34.71	25.61	35.29	26.19	32.67	26.45	32.70	26.75	32.67	26.67	32.68	26.25	32.18	25.20	29.99	20.05	25.93	15.91
2004	24.45	14.01	29.14	16.58	33.46	22.40	34.19	24.92	35.62	26.40	32.96	26.12	31.90	26.00	31.78	26.24	31.91	25.97	31.48	23.89	29.68	19.38	27.45	16.72
2005	25.64	14.52	30.54	18.23	33.11	22.80	35.78	25.35	35.31	25.78	34.52	27.41	31.65	26.13	32.15	26.48	32.34	26.08	30.97	24.84	29.25	19.53	26.96	15.88
2006	26.63	13.78	32.30	19.36	33.81	22.34	35.65	25.51	34.79	26.06	33.16	26.91	31.06	26.15	31.41	26.15	32.02	25.88	32.60	24.69	29.67	20.73	27.24	15.92
2007	25.45	13.14	27.89	17.70	32.06	20.45	34.55	24.65	34.74	26.29	33.08	26.65	31.50	26.17	32.26	26.49	31.29	26.08	31.68	23.85	29.40	20.98	26.00	15.34
2008	25.50	14.43	26.92	15.60	32.84	22.57	35.32	24.88	35.66	25.82	31.85	26.12	31.24	25.93	31.84	26.36	32.15	26.00	31.67	23.91	29.66	20.12	26.43	17.04

All data are in degree Celsius

Source: Bangladesh Meteorological Department

Table 6.2: Monthly maximum and minimum humidity of last 31 years (1978-2008)

	Jan			Feb			Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov			Dec		
Year	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
1978	94	25	66.8	95	25	64.6	95	24	68.8	100	37	74.4	100	58	81.3	100	67	86.2	100	50	86.6	100	64	88.1	100	58	86.4	100	52	82.2	97	40	73.6			
1979	100	19	70	95	22	66.9	95	21	71.3	100	60	80	100	58	78.9	100	59	87.5	100	63	87.1	100	69	89.8	100	59	87	100	42	78.5				100	39	71.5
1980	100	24	66.4	100	24	67.9	100	32	77.6	100	25	77.4	100	49	82.3	100	59	89.7	100	16	90.3	100	56	89.6							100	30	72.8	100	33	73.5
1981	100	32	72.6	100	24	69.5	100	23	71.1	100	43	80.6	100	40	80.6	100	48	90.7	100	64	93.3	100	54	88.2	100	60	86.1	100	39	76.9	96	29	73.5	100	37	74.9
1982	100	32	69.6	95	25	69	97	24	67.8	100	50	77.5	95	45	76	100	60	89.2	100	67	89.1	100	68	90.3	100	62	86.2	100	49	80.9	100	24	74.7	100	34	72.4
1983	97	30	71.9	100	27	73.3	100	46	79	100	42	80	100	61	84.3	100	66	89.6	100	61	89.2	100	64	88.1	98	62	86.7	100	55	84.5	100	42	84.4	100	33	75
1984	97	26	73.7	95	26	68.1	100	23	80.3	100	27	80.7	100	63	82.9	100	73	93.4	100	59	90.7	100	67	91.7	100	53	84.3	100	54	83.3	100	33	74.4	100	25	73.1
1985	100	30	71.8	100	21	70	100	58	80.4	100	51	78.6	100	36	80.7	100	67	89.1	100	69	89.9	100	67	89.5	100	60	85.7	100	41	78.5	100	33	74.1	99	37	72.9
1986	100	25	71.5	95	22	66.4	98	22	73.9	95	49	75.3	100	43	76.8	100	60	88.3	100	69	89.9	100	65	87.8	100	61	85.2	100	47	81.2	100	37	75.3	94	37	70.9
1987	94	29	71	97	28	71.2	98	29	74.1	100	55	79.4	96	55	77	100	61	85.2	100	73	91.8	100	67	88	100	67	87.2	98	41	80.7	100	51	79.1	97	37	75.3
1988	97	27	70.8	95	25	72.1	97	24	73.2	100	51	78.4	100	63	83.9	100	55	89.2	100	68	88.9	100	67	89	100	63	86.3	100	47	82.4	97	40	79.2	97	36	79.8
1989	95	26	68.7	100	30	75.1	98	22	72.2	100	30	77.6	100	50	76.6	100	57	85.2	100	58	86.6	100	66	85.7	100	64	85.8	100	60	88.3	97	30	73.4	95	27	71.1
1990	100	31	78	100	28	77.8	100	31	78.6	95	39	79.7	97	55	80.5	100	60	87.9	100	70	90.9	100	66	85.1	100	61	85	97	48	81.9	100	35	80.4	100	37	77.7
1991	100	13	72	100	25	73.2	100	32	76.5	100	37	78.3	100	58	82.4	100	66	89.3	100	20	87.9	100	60	89.1	100	25	86.8	97	45	83	97	17	77.4	100	35	73.7
1992	97	36	75	98	21	76.5	100	58	82.5	97	37	78.1	96	44	78.4	98	54	83.5	100	66	88.8	100	63	86.9	100	64	85.9	100	37	83.8	98	39	78.5	96	32	75.3
1993	100	25	71.9	98	24	75.1	97	27	74.1	97	23	77.7	98	57	81.8	98	67	89.3	100	65	87.5	100	66	88.6	98	66	85.9	97	46	82.3	97	38	76.7	96	35	73.4
1994	98	27	72.3	100	18	66.4	98	24	77.6	100	34	80.9	97	27	81.9	100	60	87.7	100	63	90.1	100	68	87.9	98	41	83.8	98	42	81.4	100	30	75.7	100	28	70.9
1995	96	23	68.6	98	28	74.6	100	15	70.1	98	32	77.7	97	41	78.7	100	66	86.7	100	69	88.5	100	66	87.4	100	66	87	97	58	82.1	100	49	84.7	96	34	74.5
1996	98	32	70.4	98	28	71.2	100	30	80.5	97	44	77.8	100	50	81	98	52	85	100	65	87.4	100	67	88.8	100	60	86.3	100	43	82.7	98	35	78.7	97	35	74.4
1997	95	31	69.4	98	24	72.3	100	38	79.4	100	35	76.9	100	51	79.3	100	65	86.2	100	72	91.3	100	52	87.4	100	55	86.9	100	42	79	100	38	75.6	100	37	74.5
1998	100	37	78.3	100	29	75.7	97	18	70.2	100	39	78.7	100	30	81.1	100	53	85.3	100	47	90	100	46	89.8	100	59	85	100	28	81.7	100	40	77.7	98	33	74.1
1999	97	30	72.2	96	30	68.7	100	19	76.7	97	53	76.5	100	49	83.8	100	65	88.7	100	66	90.4	100	69	91.3	100	62	88.5	100	60	86.1	98	40	76.5	100	32	77.1
2000	96	32	73.9	98	18	66.9	100	20	76.2	100	52	79.3	100	49	85.7	100	60	87.9	100	60	89.6	100	62	88.6	100	60	88.3	100	39	85.2	97	39	77.4	97	31	73.4
2001	96	28	69.6	100	30	74.4	100	25	71.6	97	45	76	100	56	82.9	100	72	91.8	100	67	90.2	100	68	88.6	100	60	87.8	100	58	87.5	100	36	83.5	97	36	76.2
2002	100	28	76.5	96	26	68.8	98	24	74.4	98	43	82.5	98	60	85	100	59	88.8	100	70	92.3	100	65	88.4	100	57	85.2	100	43	83.6	98	47	82.8	98	32	77.6
2003	100	24	77.9	100	26	72.1	98	20	75.6	100	41	79.4	100	55	83.7	100	67	90.9	100	67	87.8	100	67	88.5	100	66	87.6	100	49	84.6	100	41	76	97	40	77.6
2004	100	33	79.8	100	23	72.8	100	28	76.7	100	58	81.7	98	39	80.5	100	54	86.3	100	64	88.6	100	60	88.6	100	60	86.8	100	51	83.8	100	27	75.9	96	27	72.1
2005	97	29	71.4	98	26	71.8	97	39	78.9	100	18	76.6	98	44	76	100	61	84.7	100	63	88	100	70	91.3	100	62	87	100	55	82.4	100	39	77.1	98	29	77.7
2006	100	19	73.2	98	19	75.9	100	15	68.6	96	31	73.5	100	45	80.9	100	63	87	100	66	89.7	100	60	86.8	100	61	86.1	100	54	81.9	100	27	75.1	98	27	73.8
2007	100	22	73	100	24	72.8	96	16	67.5	100	48	77.3	100	50	80.4	100	60	84.2	100	60	90.2	100	63	86.3	100	56	86.6	100	38	83.5	98	40	81.2	100	29	72.2
2008	100	21	73.3	97	18	67.1	100	30	78.6	98	25	72.4	96	38	76.7	100	60	85.8	100	63	90.4	100	62	88.2	100	59	86.6	100	49	81.4	97	35	75.3	97	31	76.5

All the data are in %

Source: Bangladesh Meteorological Department

Rainfall

Rainy season is very prominent in this region like other coastal areas of the country. The annual average rainfall is 1946 mm/yr as per last 18 years recorded data of Mongla weather station. Since 1991, maximum monthly rainfall ever recorded is 983 mm in the month of June during 2002. Eighteen years average of monthly rainfall is presented in a graph (Figure 6.3) that shows June to September have maximum rainfall of the year and it varies in the range of 300 mm to 350 mm. On the other hand, December shows no rain or very little.

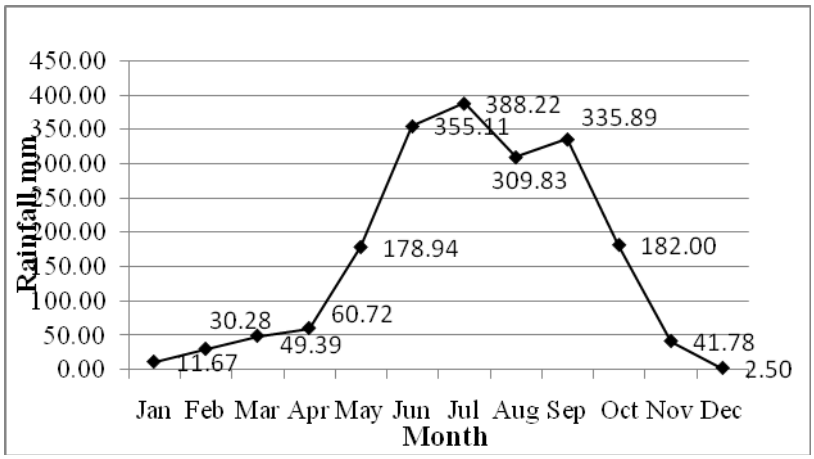


Figure 6.3: Eighteen years (1991-2008) average of monthly rainfall

Table 6.3: Last eighteen years (1991-2008) monthly rainfall in mm recorded in Mongla station

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1991	29	29	20	88	91	419	395	298	323	259	4	2	1957
1992	8	108	0	4	118	174	350	243	170	55	2	0	1232
1993	9	21	167	72	186	424	225	379	243	91	36	0	1853
1994	4	18	40	149	139	344	278	380	123	130	3	0	1608
1995	4	70	11	9	208	304	244	268	302	148	229	0	1797
1996	2	22	24	47	119	453	386	357	133	274	1	0	1818
1997	2	70	123	131	214	233	478	355	591	12	0	14	2223
1998	29	65	149	97	234	229	294	443	553	110	207	0	2410
1999	1	0	0	25	202	262	435	442	479	321	12	0	2179
2000	28	9	15	134	283	309	356	209	327	124	5	0	1799
2001	1	19	6	22	301	539	445	136	181	251	53	0	1954
2002	13	5	32	74	206	983	389	441	492	62	89	0	2786
2003	0	2	175	41	127	351	284	229	188	263	0	28	1688
2004	0	0	7	95	109	293	280	336	506	274	3	0	1903
2005	28	0	93	25	238	342	633	264	391	390	1	1	2406
2006	0	0	14	9	243	255	462	318	390	48	6	0	1745
2007	2	71	1	64	57	226	580	262	355	267	101	0	1986
2008	50	36	12	7	146	252	474	217	299	197	0	0	1690
Avg	11.67	30.28	49.39	60.72	178.94	355.11	388.22	309.83	335.89	182.00	41.78	2.50	1946.33

Source: Bangladesh Meteorological Department

Evaporation

The monthly average evaporation in Mongla varies from 3 to 5 mm/day in a year. The monthly maximum average evaporation occurs in the month of July and it is 16 mm/ day.

Wind speed and direction

Like the country's wind characteristics the region is characterized by Southerly wind from the Bay of Bengal during monsoon and Northwesterly wind from Himalaya during winter. The recorded data of last 20 years (1989 to 2008) shows that monthly average maximum wind speed in Mongla weather station region varies from 300 to 750 km/day. The average wind speed is 1.7 m/s. The detail data of wind speed for the last 20 years (1989 to 2008) is given is Table 6.4. Wind speed has been measured (meters/second) at 10 meter height that is 1.7 m/s in average. According to the Pasquill-Gifford Stability Index the atmospheric stability mostly falls into very Unstable to Unstable classes on the basis of wind speed, cloud cover, location etc.

The wind roses for Khulna generated using observed data of Meteorological Department of Khulna (Figure 6.4-6.7; source: SMEC, 2006) show average wind direction and speed for different period of a year. The yearly average wind rose shows that wind prevails flowing from south to north direction in most of the time in a year (figure 6.4). During November to February, maximum prevailing wind flows from north and north-west to south and Southeast direction (Figure 6.5) and for rest of the period it flows from south. During March to April wind mostly flows from south and southwest to north and northeast, (Figure 6.6) and for May to October it flows from south and southeast to north and northwest direction (Figure 6.7).

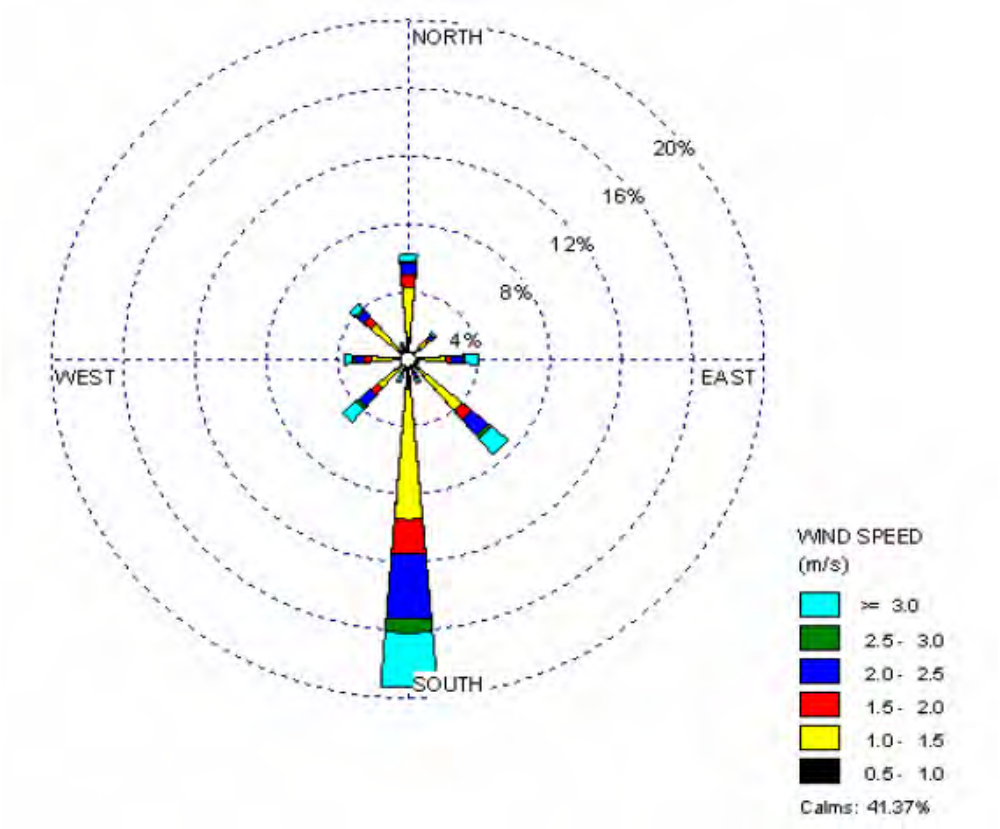


Figure 6.4: Wind rose for Khulna for a full year

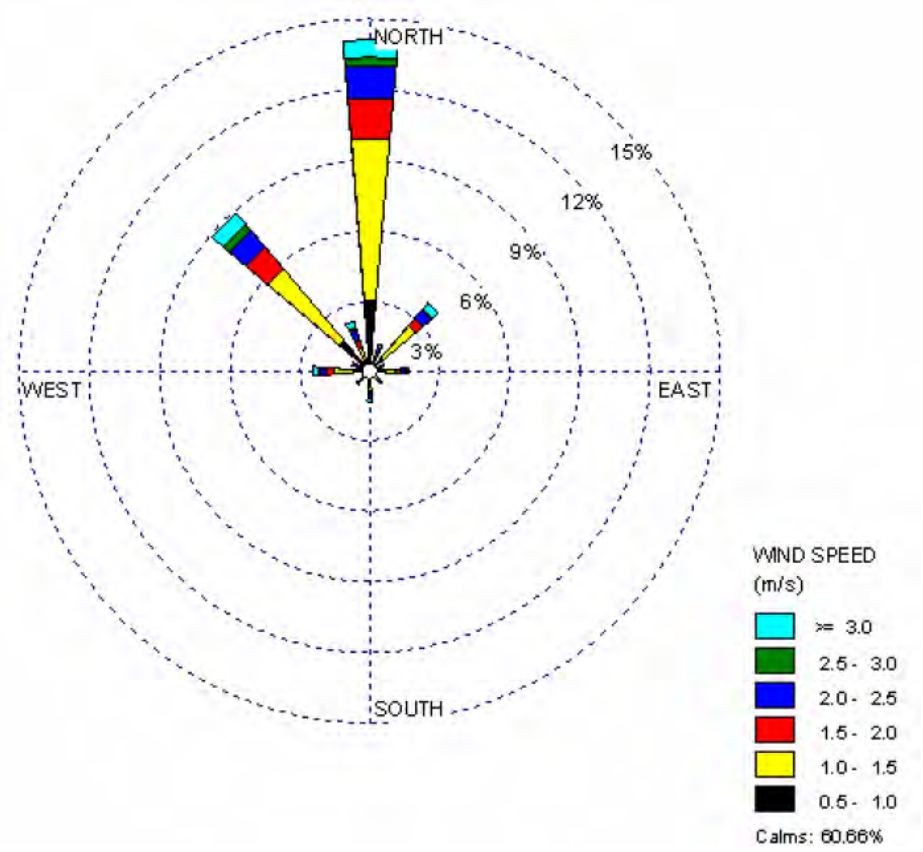


Figure 6.5: Wind rose for Khulna for the period of November to February

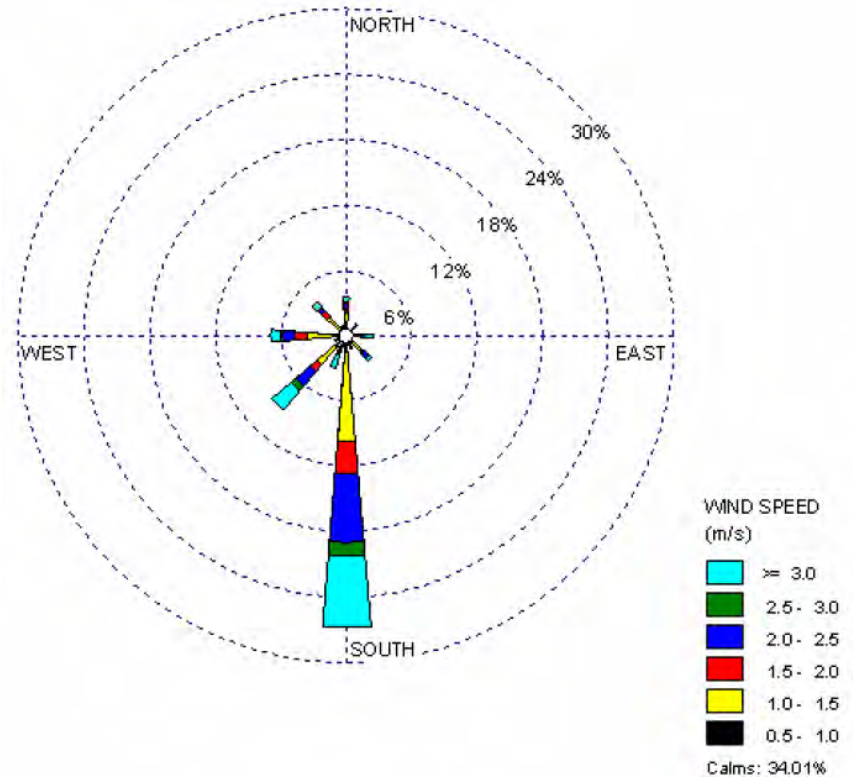


Figure 6.6: Wind rose for Khulna for the period of March to April

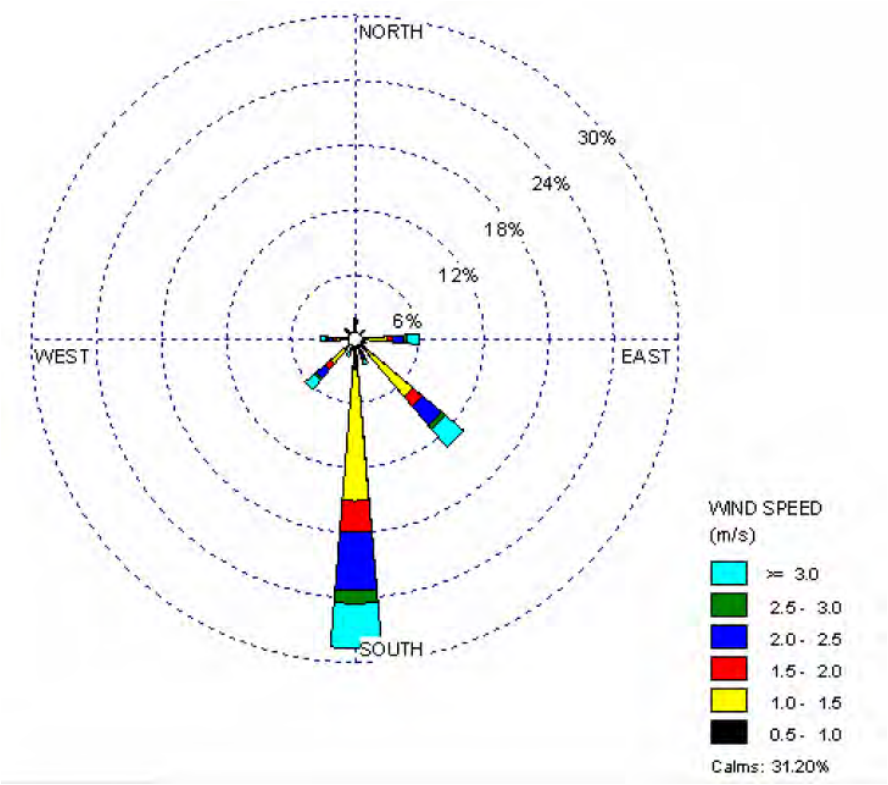


Figure 6.7: Wind rose for Khulna for the period of May to October

Note for Figure 6.4 to 6.7: Wind direction shows from which it originates, Source: SMEC 2006

Sun-shine hours

The monthly average sunshine hour in Mongla varies from 4 to 9 hour/day in a year. In general, maximum sunshine hour of 12 hour in a day is found in May.

Table 6.4: Monthly maximum, minimum and average wind speed (km/day) of last 20 years



Source: Bangladesh Meteorological Department, Mongla weather station

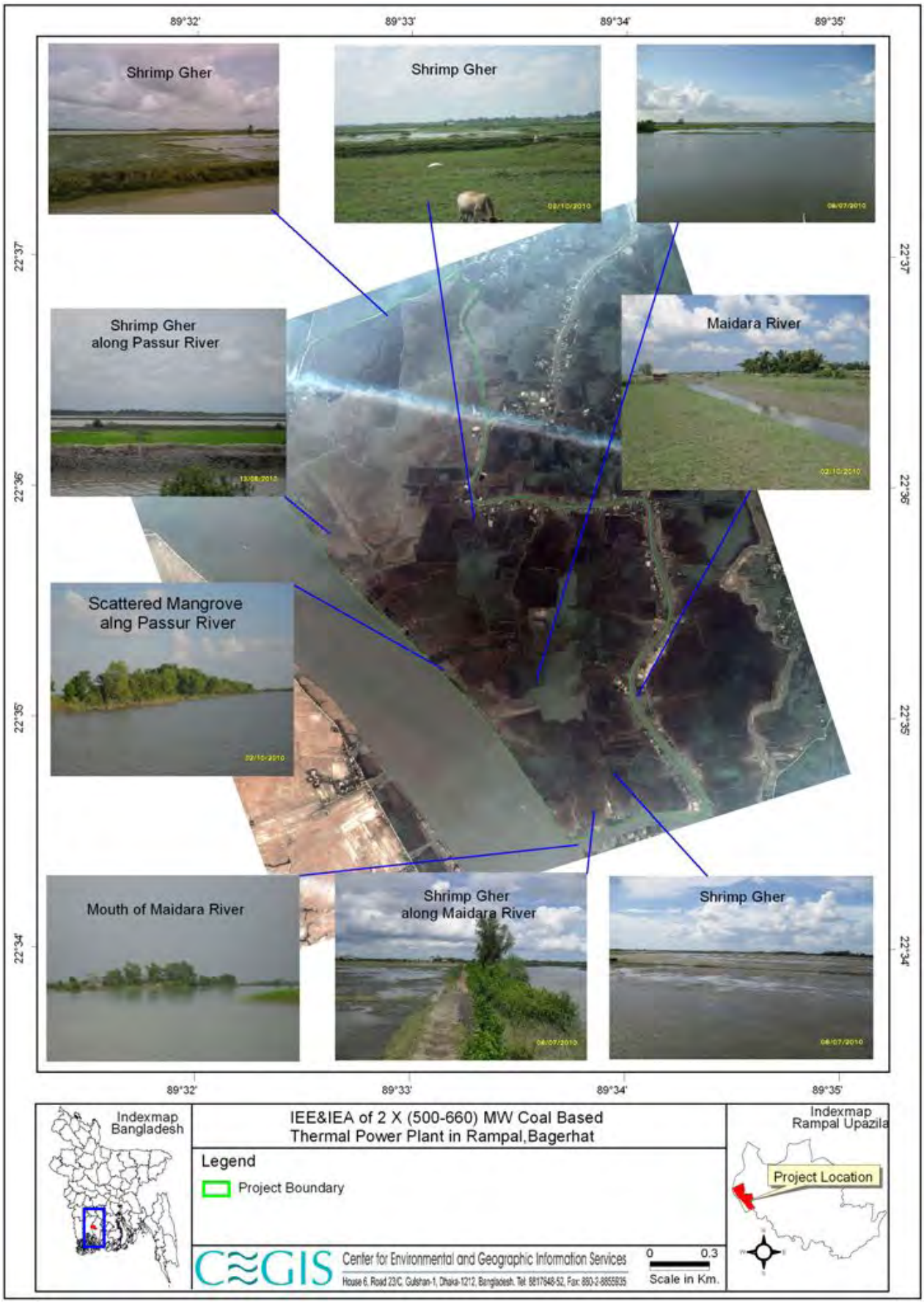
6.4.2 *Landscape and Topography*

The proposed area is located in the Southwestern region of Bangladesh, which is a part of alluvial delta formed by major rivers originating from the Himalayas in the North. The landscape of the proposed site is characterized by plain coastal land with very gentle slope and tidal creeks. Intensive shrimp farming land, scattered mangrove along the rivers and canals, homestead forest, roadside plantation are the common landscape features (Map 6.2a). Tidal action is dominant in the nearby Passur River and Maidara - Ichamoti river system.

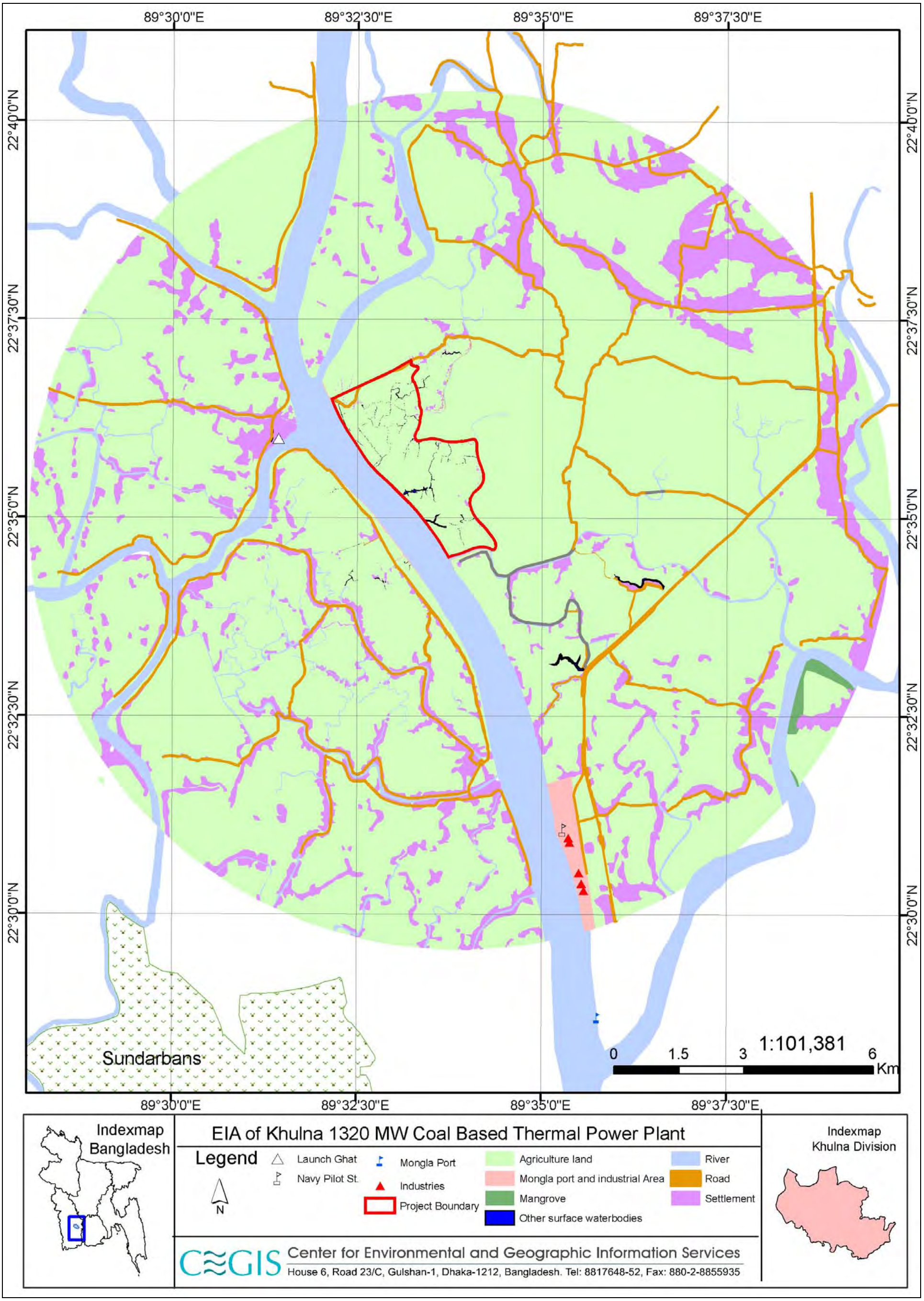
The land use of the area is dominated by shrimp aquaculture cum rice cultivation. In general, this agricultural land covers 75% of the study area and 95% of the project area. Settlement density is very low. Settlement area covers 4940 ha (14.13%) in the study area and only 5.5 ha (0.75%) in project area. Detail land use maps of the study area and the project area are given in Figure 6.2b and 6.2c.

The general landscape of the study area as well as the project area is flat topography with some low lying swampy areas, some inter-tidal canals, intensive shrimp farming land, rural settlements, homestead and roadside planted vegetation and natural scattered mangrove along the River and inter-tidal canals. The entire agricultural area (including shrimp farming pond) is protected from tidal inundation by raised levee of the river by shrimp farmers. The study area is characterized by numerous tidal creeks of Maidara-Ichamoti system. Similar tidal creeks also exist within the project site that are occupied for shrimp farming activities and the tidal flow in creeks is controlled by the local people by constructing indigenous water control structures (wooden structure).

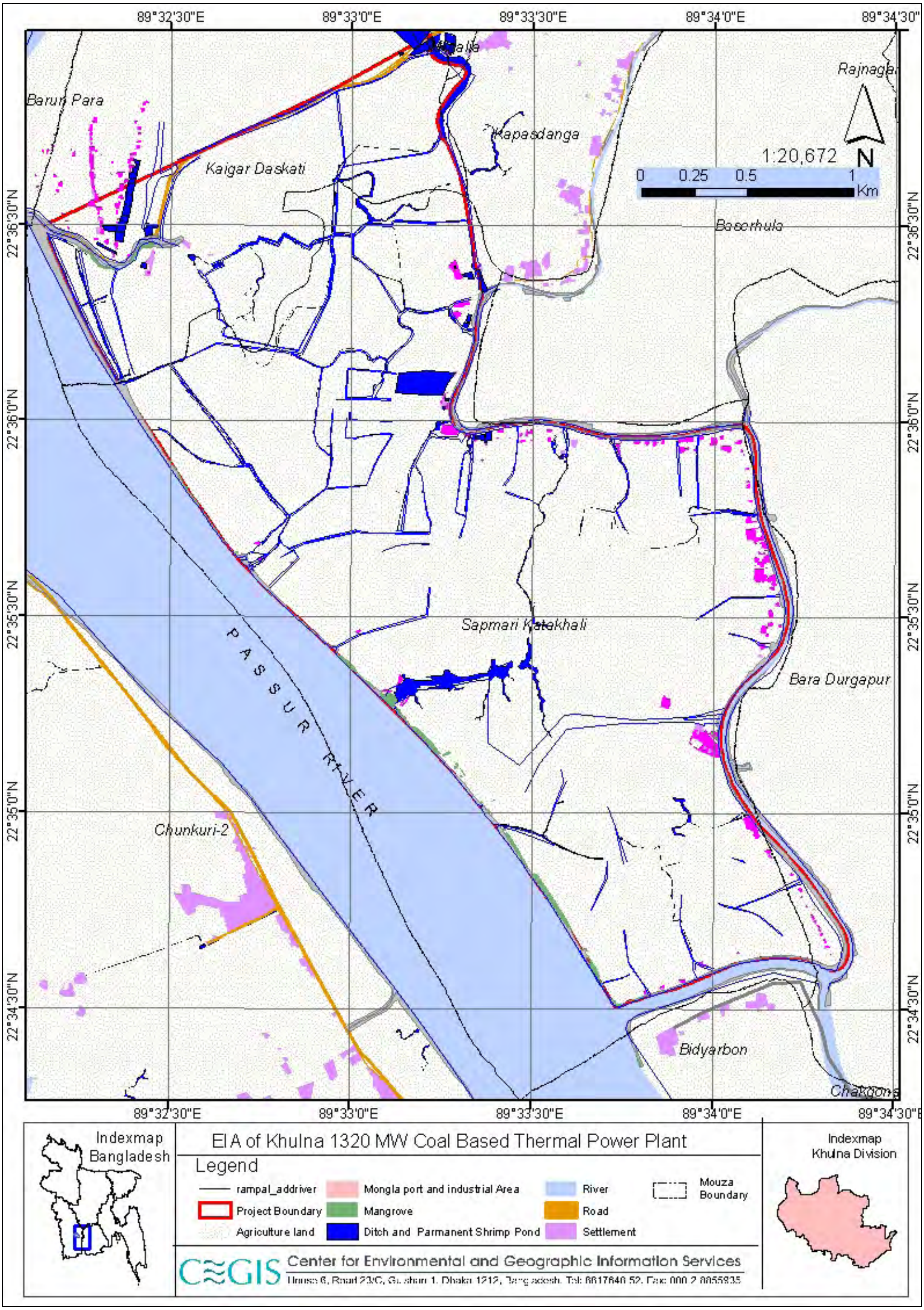
Topographic variation within the area is not significant. From the latest Digital Elevation Model (DEM) map prepared after topographical survey and the FINMAP data set of BIWTA (Map 6.3a) it is found that project site elevation along the Passur river ranges from 1 m to 2 m PWD above mean sea level, while only 1% of the area is more than 3 m PWD above mean sea level. The average elevation of the project area is +2m PWD that is very low considering the Basement level of the Mongla port administrative building that is +5.642 m PWD. After detailed topographical survey a DEM for the project area has been developed. The DEM with contour line is presented in Map 8.3b and the values are presented herein are in meter SOB (Survey of Bangladesh).



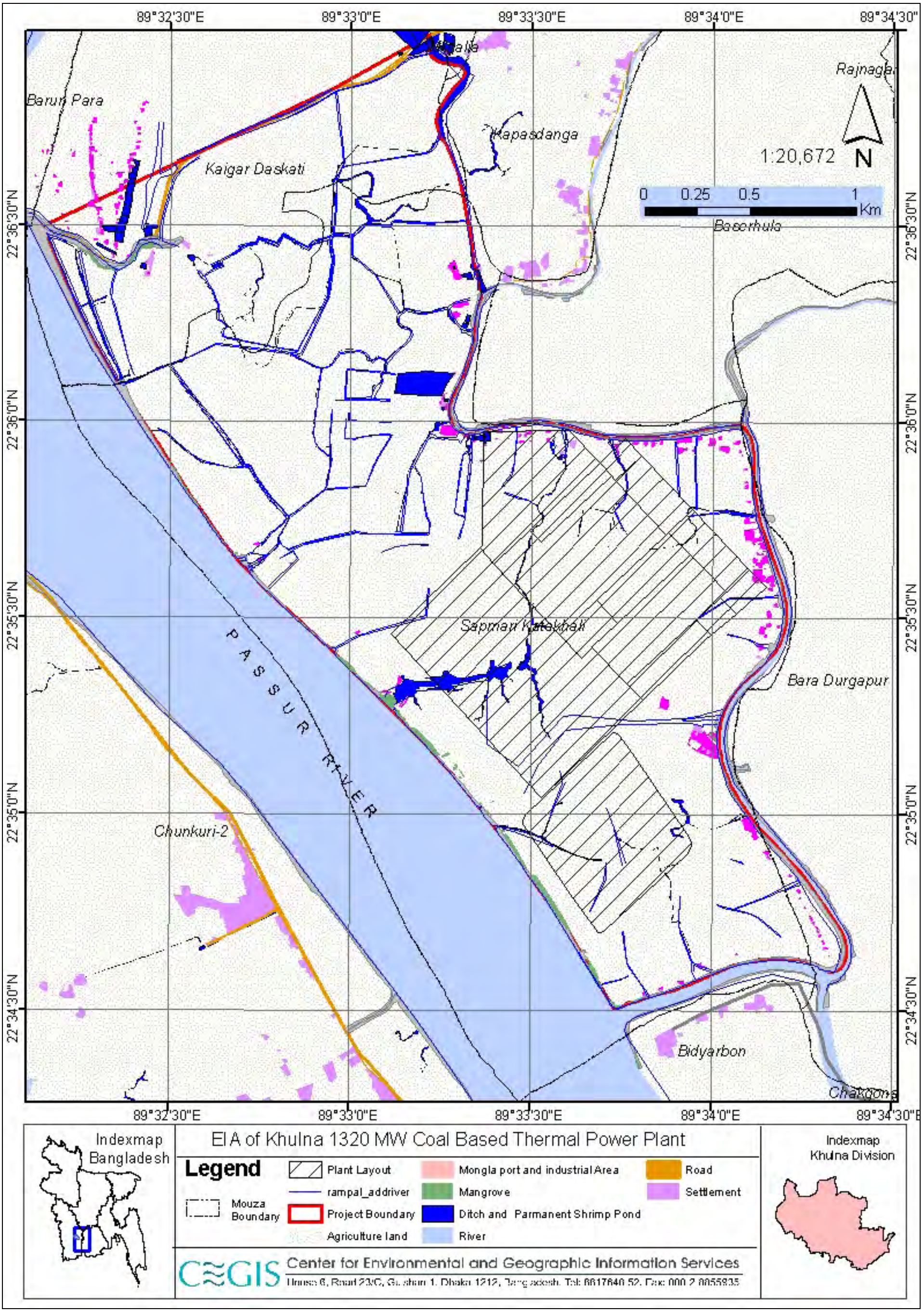
Map 6.2a: General landscape of the project site dominated by shrimp aquaculture



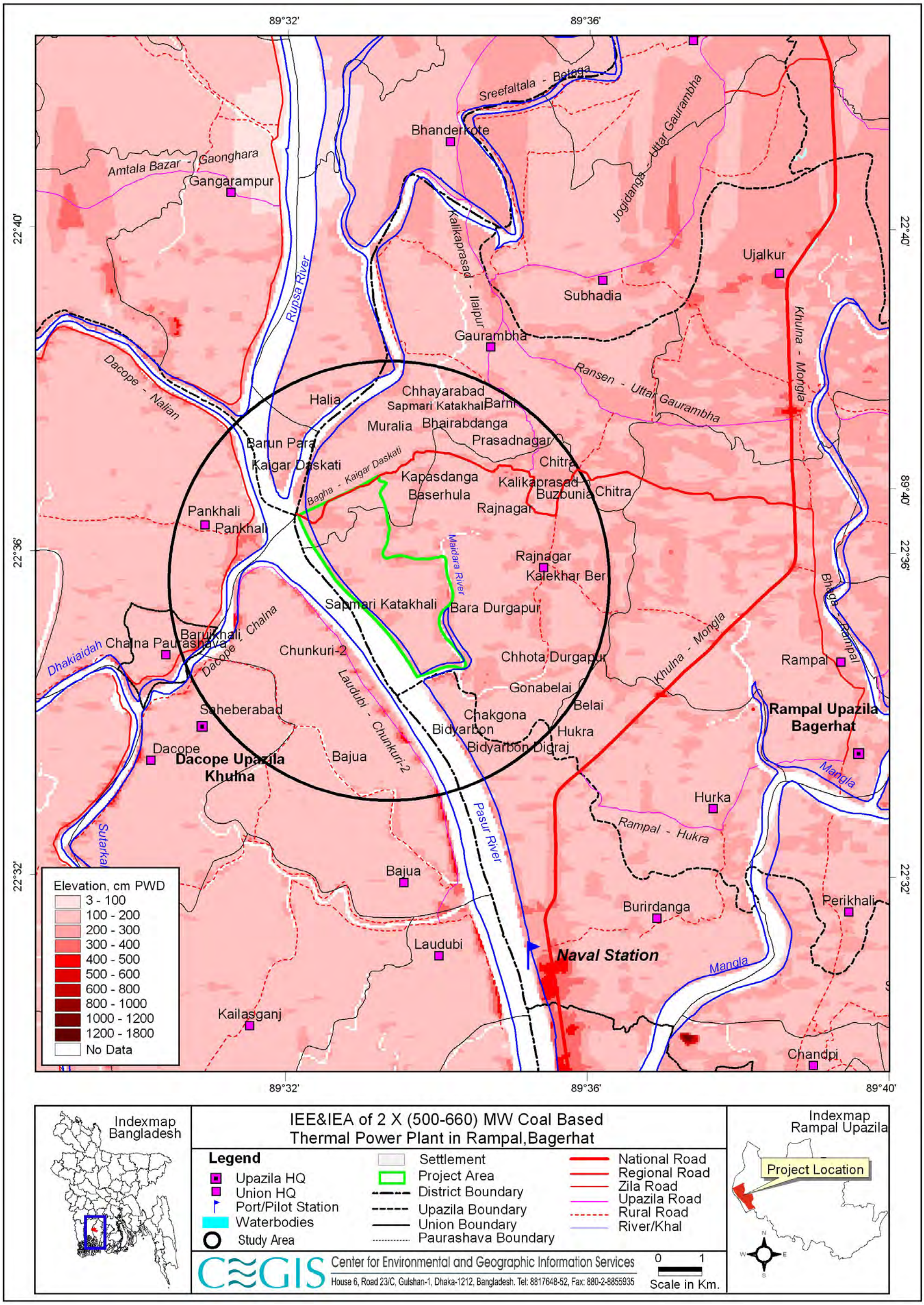
Map 6.2b: Detail land use map of the study area



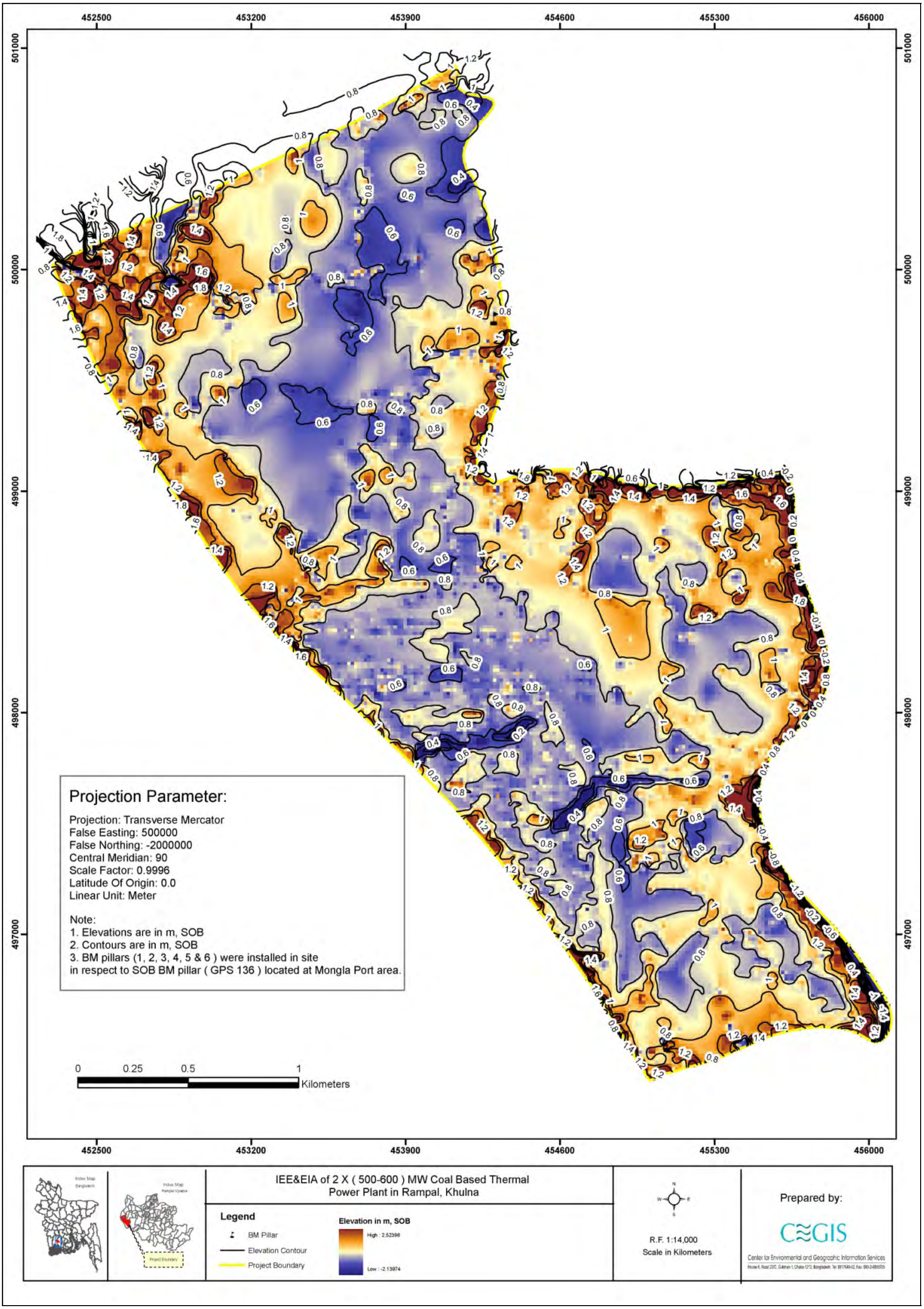
Map 6.2c: Detail land use map of the project area



Map 6.2d: Detail land use map of the project area with layout of first phase



Map 6.3a: Area elevation from DEM analysis



Map 6.3b: DEM of the project area

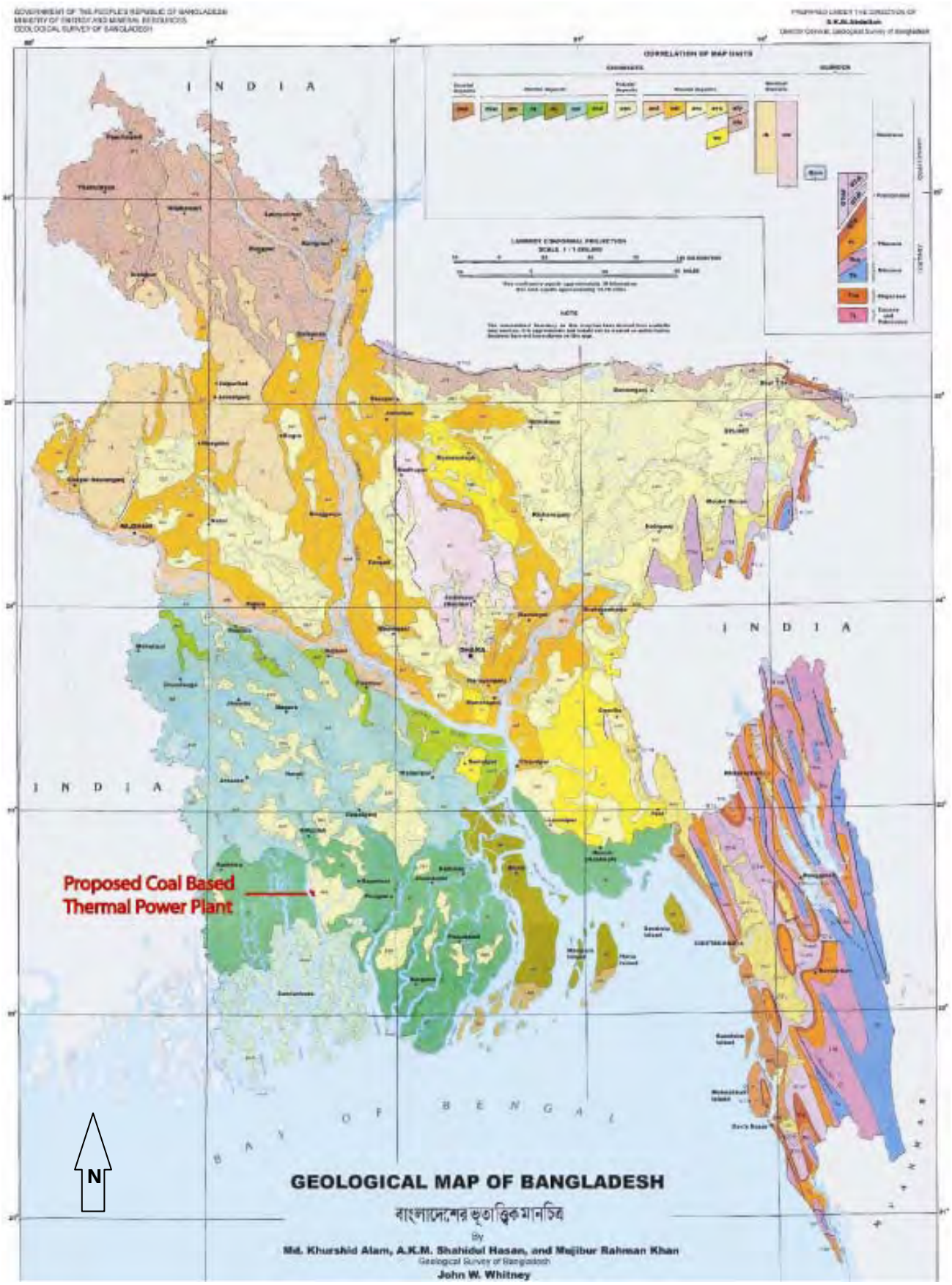
6.4.3 Geology

Physiographically, the area is tidal delta with dominant tidal flushing and saline enriched shallow aquifer. The area is located in Bengal basin –an extensive alluvial plain of the Quaternary sediments laid down by Ganges-Brahmaputra-Meghna river system.

Stratigraphically, the area is covered by paludal deposit comprised by Holocene River alluvium, meander, inter-stream and swamp deposit (Map 6.4) with 16,000 m thick sequence of quaternary sediments (Alam et al., 1990 and USGS-Bangladesh Gas Assessment Team, 2001).

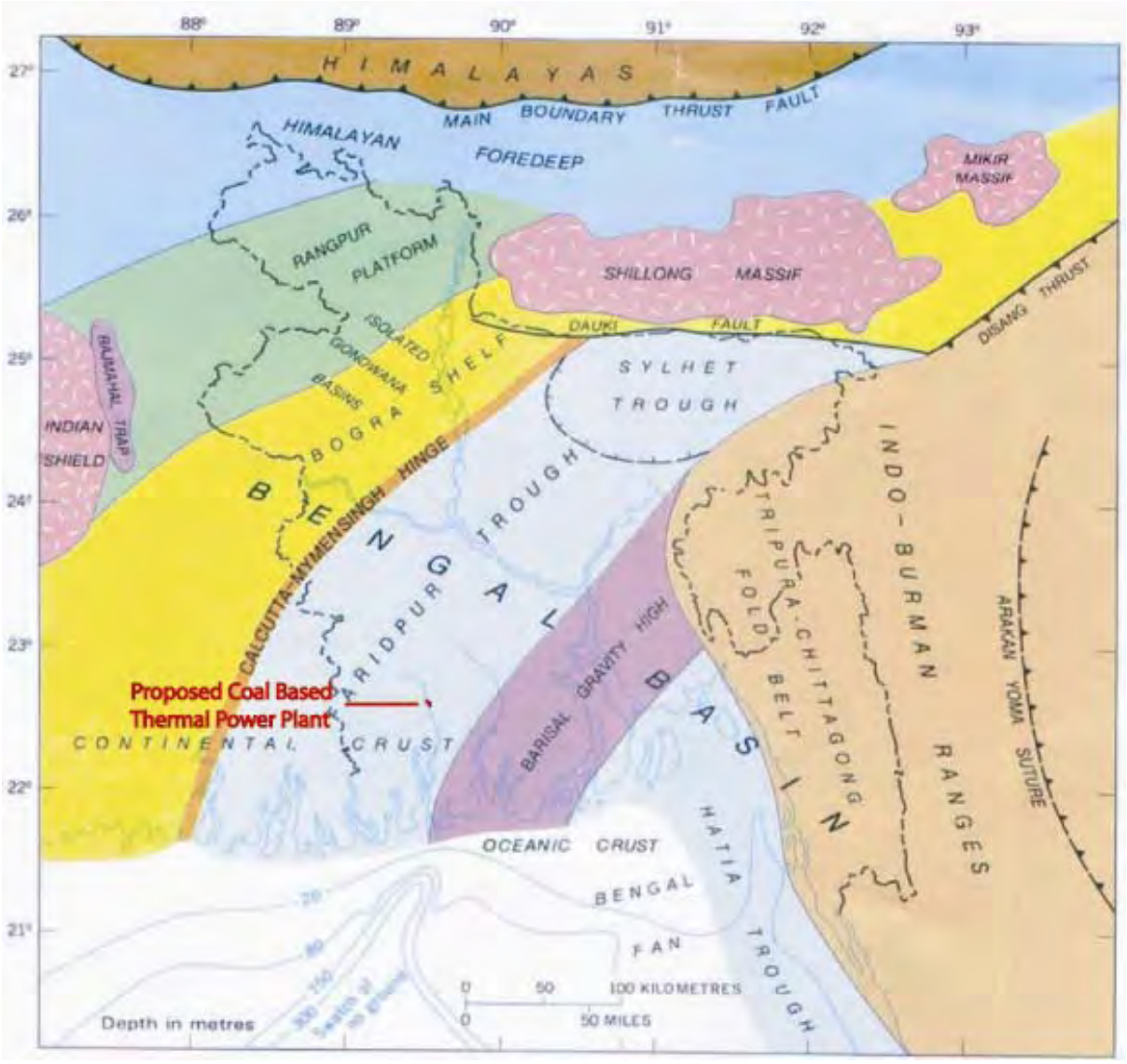
As per tectonic classification, the area falls under Faridpur trough of Western platform flank which is adjacent to the hinge line (Map 6.5).Tectonically this area is inactive and no apparent major structure like fault or fold exists in the region that might be geologically significant (Sir William Halcrow and Partners ltd., 1993).

Lithology shows that the area comprises of clay on the upper part and sand in the deep. The upper surface layer consists of clay, the intermediate layer of mainly fine sand and deeper layer contains mainly fine to coarser sand.



(*Source: Geological Survey of Bangladesh)*

Map 6.4: Geological map of Bangladesh



(*Source: Geological Survey of Bangladesh*)

Map 6.5: Generalized tectonic map of Bangladesh

6.4.4 *Ambient air quality*

Air quality

The project location and the surrounding area is highly exposed and there is no terrain or structure that may act as wind barrier. Therefore, both Northeasterly and Southwesterly winds strongly prevail in the study area. Consequently, the local air quality remains within the standard of ECR 1997. Apart from regular prevailing winds, the cyclonic winds also disperse the air pollutants from local emission sources.

Considering downwind location of the project site, air quality has been monitored at; cement industries (approximately 8 to 10 km south of the plant location), Sarankhola Upazila (approximately 43 km southeast of the plant location), Khulna City area (approximately 23 km northeast of the plant location). The table 6.5a and 6.6b presents air quality monitoring results of the aforementioned locations. The locations are represented in Map 3.3.

Table 6.5a: Air quality monitoring results of different location

Date	Sample location	SPM (µg/m^3)	SOx (µg/m^3)	NOx (µg/m^3)
01/05/2012	Shibbari More, Khulna	410.0	<25	46.0
	College More, Khulna	320.0	<25	36.0
	Natunrasta More, Khulna	350.0	<25	33.0
	Sonadanga Bus stand	335.0	<25	41.0
Bangladesh Standard (ECR 1997) for residential and rural area		200	80	80
02/05/2012	Bus stand more, Sharankhola Sadar	155.0	10.0	21.0
	In front of Upazila Palli Unnoyon Board Office, Sharankhola Sadar	140.0	11.0	20.
	Thana More, Sharankhola Sadar	150.0	09.0	18.0
	In front of Upazila Health Complex Office, Sharankhola Sadar	148.0	08.0	16.0
Bangladesh Standard (ECR 1997) for sensitive area as the location is within the ECA of Sundarbans		100	30	30

Source: CEGIS investigation, 2012

Note: Experts from DoE, Khulna collected samples and all the parameters were tested in the labs of DoE, Khulna. During sample collection, the day was sunny and gentle wind was flowing northwestwards.

Table 6.5b: Proposed location for air quality data collection during preconstruction phase

Season	Locations	Time	Parameter	Institution
▪ Summer/ Apr. ▪ Monsoon/ Jul. ▪ Post-monsoon/Oct. ▪ Winter/Jan.	▪ At 1 km, 2 km, 3 km and 4 km distance from the stack point towards windward direction ▪ Coal stockpile ▪ Coal transfer point ,Akram point ▪ Ash disposal pond ▪ Harbaria	Every 3 hours in a complete day	SOx, NOx, $PM_{2.5}$ and PM_{10}	BPDP/JV Company/DOE

Sources of emission

The study area is non-urbanized and free from major industrial set up. The assessment was made to identify the existing and potential emission sources. The air pollution sources in and around the study area are mainly cement industries, road dust, black smoke from water vessel, engine vehicle, windblown dust from agricultural lands and exposed earth, and domestic cooking. The potential and existing sources of air pollution are listed in Table 6.6a.

Table 6.6a: Major sources of air pollution

Sl. no.	Source	Location	Principal Pollutants	Scale of emission
1	Domestic biomass burning	Scattered, about 2 km beyond the project boundary	NOx, SO_2, CO, CO_2, $PM_{2.5}$, PM_{10}	Local within 100 m radius
2	Dhaka-Mongla highway	About 9.5 km from northern part and 5 km from southern part of the Project	NOx, SO_2, CO, CO_2, $PM_{2.5}$, PM_{10}	Significant only within 200m of road centerline
3	River traffic	On Passur River	NOx, SO_2, CO, CO_2, $PM_{2.5}$, PM_{10}	Significant within proximity of the river
4	Meghna Cement industry	About 7 km south-eastward from the project boundary	$PM_{2.5}$, PM_{10}	Significant with 0.5 km Radius of the industrial unit
5	Dubai Bangladesh Cement Mill	About 7 km south-eastward from the project boundary	$PM_{2.5}$, PM_{10}	Significant with 0.5 km Radius of the industrial unit
6	Mongla Cement Factory	About 7 km south-eastward from the project boundary	$PM_{2.5}$, PM_{10}	Significant with 0.5 km Radius of the industrial unit
7	Mongla EPZ (under development)	About 10 km south-eastward from the project boundary	-	-

Source: Field investigation, 2010

Apparently, the cement industries are significant pollution sources. However, the air quality monitoring data of those industries show that the levels of emissions are within DoE standard. The collected air quality data from the cement industries is given in Table 6.6b. The air samples were collected from the front side of industrial units. The sampling and analysis were carried out by the Department of Environment, Khulna.

Table 6.6b: Air quality monitoring data matrix of different cement industries

Sl. No.	Name of the industry	SPM concentration ($\mu g/m^3$)				
		2010	2009	2008	2007	2006
1	Meghna Cement Industry	11 January	28 Sept.	15 Sept.	20 Oct.	12 Oct.
		410.17	166.19	205.35	274.99	341.00
2	Mongla Cement Factory		02 Sept.	15 Sept.	04 Sept.	12 Sept

Sl. No.	Name of the industry	SPM concentration (µg/m^3)				
		2010	2009	2008	2007	2006
			225.25	225.10	378.78	287.57
3	Dubai-Bangladesh cement Mills Ltd.	12 June	14 July	22 July	30 July	
		430.25	305.35	300.25	118.28	

Source: Relevant Cement Industries
Note: samples were collected on sunny day.

Sensitive receiver

The sensitive receivers of the emitted air pollutants are surrounding settlements, vegetation, and shrimp aquaculture lands. Another sensitive receiver is the Sundarbans, which is about 14 Km Southwestwards from the project location and 6km from the cement industries.

6.4.5 *Acoustic environment*

Since the study area is completely rural no major point source of noise exists within the vicinity of the study area. The major noise receivers are rural settlers. The significant noise sources in and around the study area are shown in Table 6. 7a.

Table 6.7a: Significant noise sources

Sl. no.	Source	Location	Significance
1	Dhaka-Mongla highway	About 9.5 km from northern part and 5 km from southern part of the Project	Significant only within 0.5 km of road centerline
2	Kapasdanga Kheyaghat Bazar (Boat landing station market)	About 100 m within the northwestern edge of the project boundary	Significant within 100 m radius of the source
3	Rajnagar Kalibari temple Bazar	Around 3.5 km eastwards from the northeastern edge of the project boundary	Significant within 100 m radius of the source
4	Rajnagar Kacharibari Bazar	Around 3.5 km eastwards from the northeastern edge of the project boundary	Significant within 100 m radius of the source
5	Kalekar Ber boro Dighi Bazar	Around 5 km eastwards from the project boundary	Significant within 100 m radius of the source
6	River traffic	On Passur River	Significant within above proximity of river
7	Meghna Cement industry	About 7 km south-eastward from the project boundary	Significant within 200 m Radius of the industrial unit
8	Dubai Bangladesh Cement Mill	About 7 km south-eastward from the project boundary	Significant within 200 m Radius of the industrial unit
9	Mongla Cement Factory	About 7 km south-eastward from the project boundary	Significant within 200 m Radius of the industrial unit
10	Mongla EPZ	About 10 km south-eastward from	

Sl. no.	Source	Location	Significance
	(under development)	the project boundary	
11	Mongla Port	About 8 Km southeastwards from the project boundary	Significant within 200 m Radius of the industrial unit
12	Dighraj Boat Landing station	Around 5 km southeastwards from the project boundary	Noise is generated from engine boat and significant within 200 m radius of the source
13	Kaigardashkatthi Boat landing station	About 100 m northwest of the project boundary	Noise is generated from engine boat and significant within 200 m radius of the source

(Source: Field observation, 2010-2011)

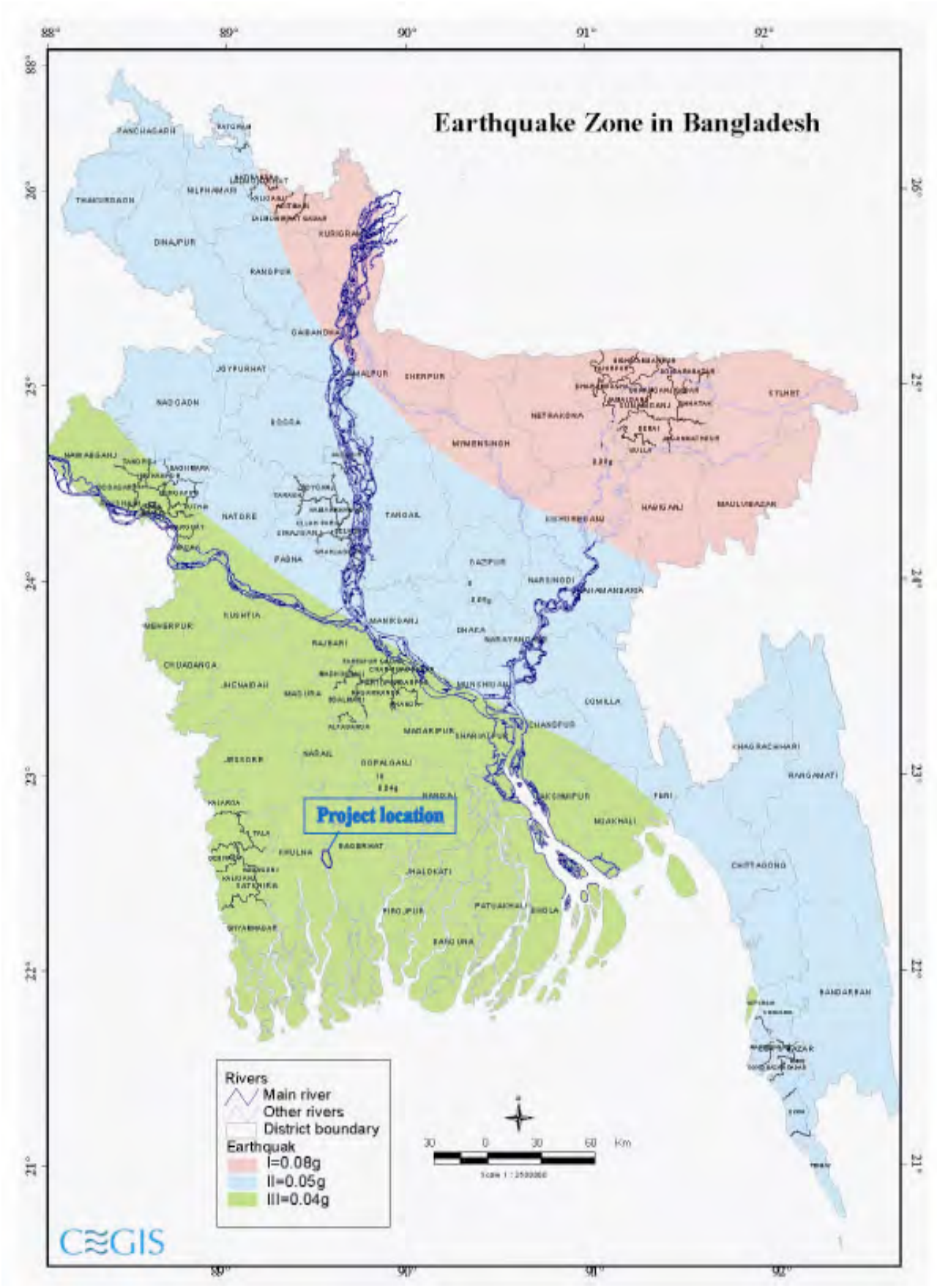
The study area is occupied with settlements, agricultural fields and shrimp farms. The acoustic environment of the study area is silent due to low noise level and the homestead gardens act as the noise barrier to the receivers (settlers). The area falls under the residential area category for which the maximum standard sound level is 50 dB during day time and 40 dB during night time. In order to control the noise level around the project site, monitoring instruments have to install during preconstruction phase. Table 6.7b specifies the acoustic monitoring process and Map 3.5 represents different monitoring points for monitoring.

Table 6.7b: Proposed location of acoustic environment monitoring during preconstruction phase

Season	Locations	Time	Parameter	Institution
▪ Summer/ April ▪ Monsoon/ July ▪ Post-monsoon/ Oct ▪ Winter/January	▪ Within 100 m of the plant, ▪ Immediate outside of the project boundary ▪ 1km away towards different direction from four different side of the project ▪ Harbaria ▪ Akram point	Day and Night	Noise level	BPDP/JV Company/ DOE

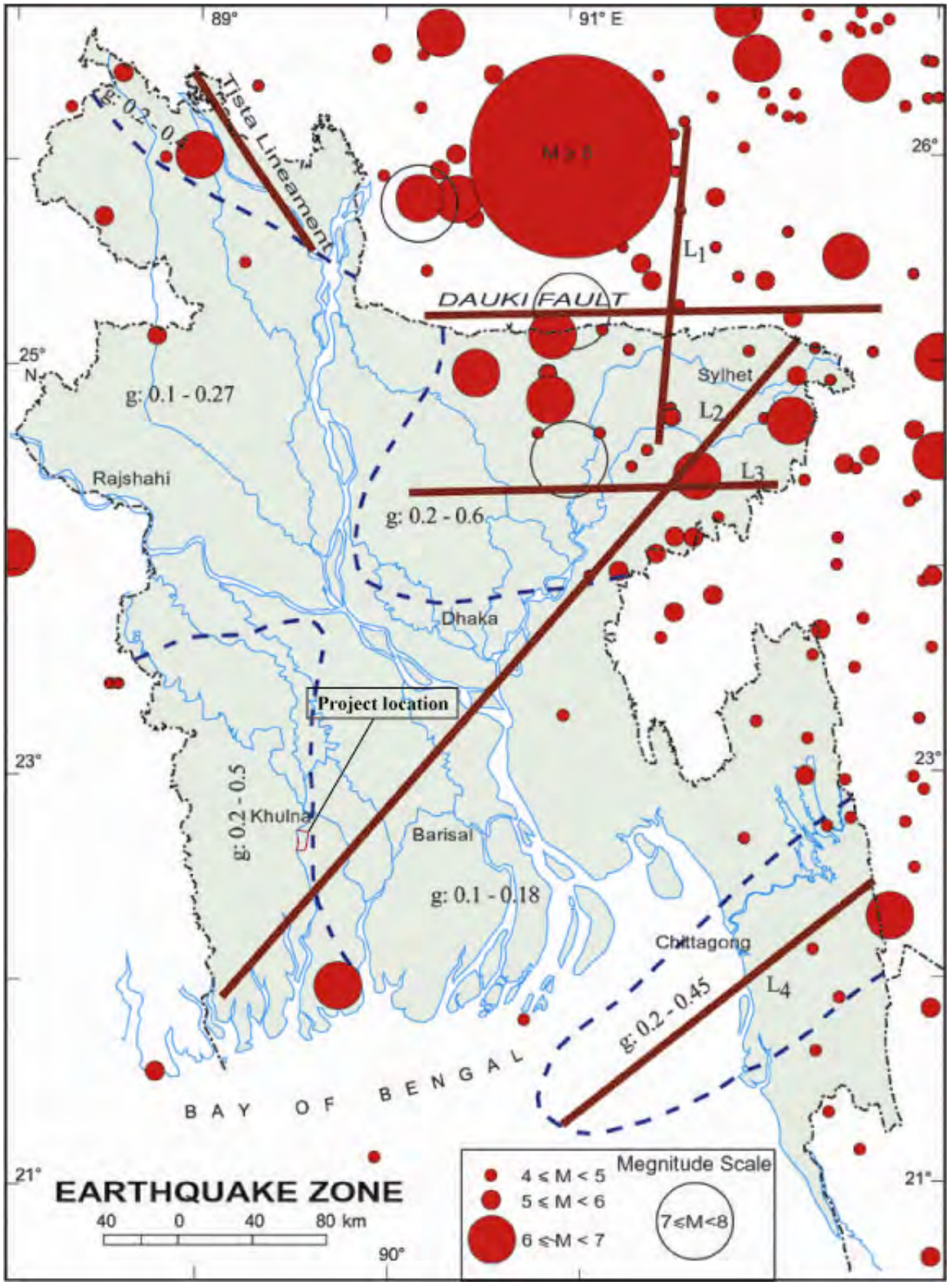
6.4.6 Seismicity

As per Seismic Zone Map of Bangladesh compiled by the Bangladesh Meteorological Department in 1979, the project area occurs in the seismic zone III where hinge line would be the major potential source of earthquake (Map 6.6a). Seismically it is in the quiet zone and the only historic high magnitude earthquake occurred in this zone was centered in the Sundarbans (Map 6.6b). The possible maximum earthquake magnitude in Richter's scale is 7.0 The suggested Basic Horizontal Seismic co-efficient for this zone is 0.04.



(Source: Bangladesh Meteorological Department)

Map 6.6a: Seismic zone map of Bangladesh



(*Source: Geological Survey of Bangladesh*)

Map 6.6b: Tectonic map of Bangladesh

6.5 Surface Water Resources

6.5.1 Surface water system

There are two river systems surrounding the project site, the Passur River and the Maidara-Ichamoti River. The Maidara-Ichamoti river system serves as a tidal creek and runs outside the project area supporting mangrove vegetation along the banks. The river is a favourite fishing ground for a large number of fishermen where several '*behundi*' nets are found to be in use. The resident water birds roosting along the river side mangrove vegetation.

The Passur River system

Passur River is the major river in the study area as an extension of the Rupsha River. South of Khulna, the Bhairab or the Rupsha flows further South and is renamed as Passur near Chalna and falls into the Bay of Bengal flowing to the right of Trikona and Dubla islands while from down of the Mongla port, the river flows through the Sundarbans. The maximum flow of the Gorai-Madhumati passes into this river through the Nabanganga. The Mongla canal joins the river at about 32 km south from Chalna. Flowing further south, the river meets the Sibsha at about 32 km from north from its mouth and debouches into the sea keeping its original name Passur.

The river is navigable throughout the year and ships can approach with the maximum allowable draught of 6 to 6.5m easily up to Mongla Port. The Passur is an important river route through which Indian vessels under transit agreement, clinker carrying vessels, LPG carrying vessels, fuel carrying vessels, maritime transportation vessels of approaching and departing Mongla Port, barges, Khulna-Barisal steamboats and other vessels ply round the year. The river is about 460 m wide at Rupsha, about 790 m wide at Bajiyan and about 2.44 km wide at the confluence of the Passur-Sibsha. The total length of the river is about 142 km. The Passur and all its distributaries are tidal channels and is the main river to control drainage system of the total study and project area. The average elevation of the proposed Power Plant site is about 2 m above the mean sea level. The project area slopes gently towards Southwest. Small tributaries and canals that finally join the river Passur drain the area. . The river Passur flows in Southern direction. The name of connected drainages or tidal channels of Passur River are Maidara, Ichamoti and Chunkuri rivers. All these channels are acting as creeks through which tidal water enters into the project site during high tide and drains out during the ebb tide.

Passur River would be the main navigational channel for transportation of the construction materials and imported coal. The general features of Passur River at different location of its longitudinal profile are presented in Table 6.8.

Table 6.8: General characteristics of the Passur River

Sl. No.	Characteristics	Description
1	*Off take*	Rupsha River
	Geographical Location	Batiaghata, Khulna
2	*Outfall*	Bay of Bengal
	Geographical Location	Akram point
3	*River flow path*	Batiaghata, Dacope, Khulna, Mongla and Bagerhat

Sl. No.	Characteristics	Description
4	Physical settings of river	
	Length	51 km
	Width	850 m at Khulna
	Depth	8.00 m at Mongla
	Catchment area	425 sq. km
5	Discharge	
	Seasonal/Perennial	Perennial
	Minimum discharge month	February
	Minimum of monthly minimum discharge (February)	6000 m^3/s
	Minimum depth in dry season	6 to 6.50 m at Mongla
	Maximum discharge month	August
	Maximum of monthly maximum discharge	22500 m^3/s
	Maximum depth in wet season	8 m at Mongla
	Tidal	Yes
	Flooding pattern during normal flood	Tidal Flood (tidal inundation, storm surge)
6	*Station name*	SW 241-Khulna, 243- Chalna and 244-Mongla
7	*Location of Major urban area*	Khulna metropolitan city, Chalna river port (old), Dacaope and Mongla Sadar and Mongla port
8	*Name of prominent Barrage/ Regulator/Bridge*	no Barrage/Bridge/ major Regulator exist
9	*Revetment work*	No revetment work
10	*Spur/Groyance*	No spur/Groyance

Source: BWDB, Mongla Port Authority, BIWTA and field survey

Other surface water system

Within the study area a large *dighi* (artificial lake) – Kalekarber Boro dighi - was found which is considered 'sacred' by the local people. The *dighi* contains a lot of water lilies for bio-filtration and the water from the *dighi* is used for drinking purposes. The *dighi* embankment supports lot of timber species, and other commonly found homestead tree species like koroi, etc. A large number of Arjun trees were also observed along the pond and not seen anywhere else. The freshwater ponds are scanty and are mostly concentrated on the eastern side of the study area.

6.5.2 Hydrology

The proposed power plant site is located along the Passur river at Sapmari Mauza in Rampal Upazila under Bagerhat district for a distance of approximately 67 km from the Akram point. The width of the river along the proposed coal transport route varies from 1km to 3 km.

River flowing along the proposed route are a combination of upstream river flows and tide movements. The flow of the Passur River is dominated by the Atai and Bhairab rivers. The wet season brings extra volume of water from the Ganges through Gorai-Nabaganga-Atai into the system, slightly adding the ebb tide speed. According to the most recent study (IWM, 2004), volume of fresh water flowing through the Passur River has been reduced over the past 38 years due to upstream river diversions specifically through Farakka Barrage, establishment of polder, and increased sediment rates. The following sections draws on both primary and secondary data gathered specifically for the power plant project.

6.5.3 *Surface runoff during rain*

The rainfall pattern of the study area as well as the project area has been discussed in sub-section 6.4.1. The project is located in highly rainfall prone areas where the historical maximum 18 year decadal rainfall is 349 mm during June. Almost 80% rainfall occurs in monsoon and a negligible amount in winter. The rainfall initially stores in the ditches, agricultural lands, shrimp farms and other low lying areas. Aftermath, multiple creeks in the project area receive the rainfall runoff and finally discharge into the Passur River. Maximum surface runoff from this flat or nearly flat land is found during monsoon. It is estimated that the possible maximum surface runoff for the rainfall of 34.9 mm/day (maximum rainfall of last 18 years) might be 12.95x105 m3 per day. The surface runoff (Q) has been estimated considering the equation of $Q = C\ i\ A$, where runoff coefficient (C) is 0.5, intensity of rainfall (i) is 34.9 mm/day and area of the project (A) is 742.9 ha (equivalent of 1,834 acre). This runoff flows to the nearby Maidara and Passur River.

6.5.4 *Water Level*

The water level hydrograph at Mongla shows the variation of maximum and minimum monthly water level. The water level of the Passur river rises from January-February to till July-August then recedes up to December-January. A typical hydrograph of Passur River based on water level data of Mongla station is given in Figure 6.8.

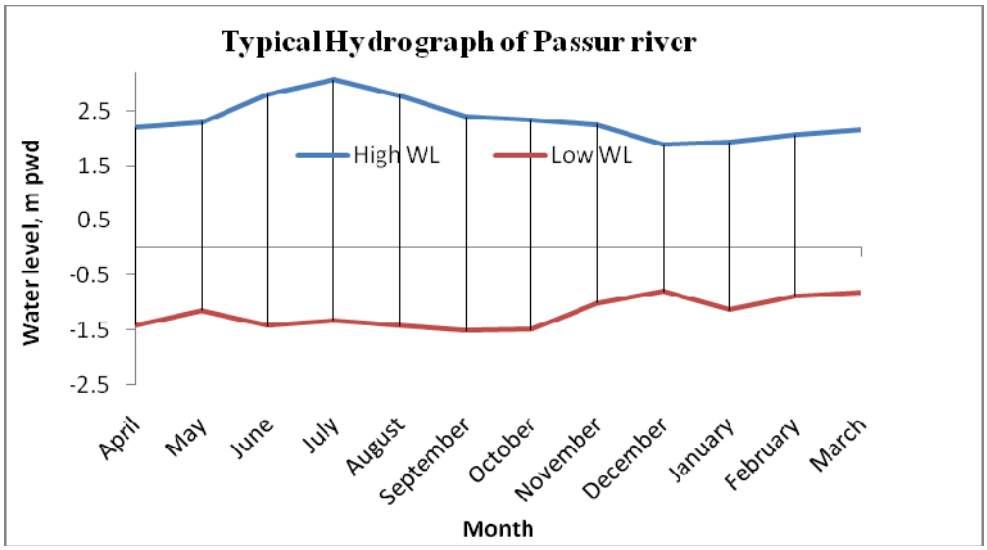


Figure 6.8: Typical hydrograph of the Passur River

As per recorded water level data of Mongla BWDB gauge station, the long term average highest high water level at Mongla station is 2.56 m and minimum is 0.51 m. Figure 6.8 shows the historical highest high water level and lowest low water level. From the recorded

data (1960-2009), the maximum water level ever recorded is found as 4.2 m (PWD) during 1996 and lowest low water level as -0.82 m (PWD).

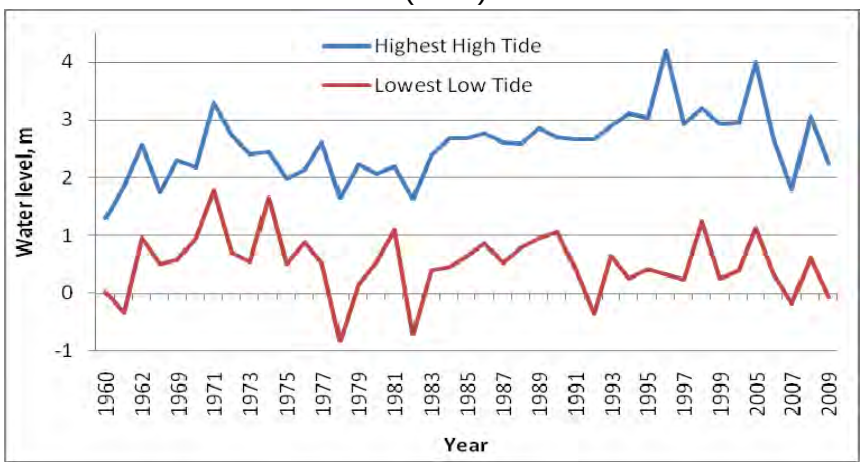


Figure 6.9: Historical yearly highest and lowest water level of the Passur river at Mongla station

6.5.5 Tidal Behavior

Tides in Bangladesh coast originate in the Indian Ocean. It enters the Bay of Bengal through the two submarine canyons, the 'Swatch of No Ground' and the 'Burma Trench'. Tide arrives with semi diurnal features all over the coastal zone of Bangladesh. The periods of oscillations are 12 hours 25 minutes or 12 hours respectively.

The coastal area of Bangladesh has three tidal zones. These are: a) Western zone: consists of Malancha and Raimongal River system; b) Central Zone: consists of Passur-Sibsha system; and c) Eastern zone: Meghna estuary. The proposed study area is located in the SW region of Bangladesh and is characterized by the large estuaries of the Passur, Sibsha, Malancha and Raimangal interlinked by numerous smaller creeks and are maintained by tidal spill, and fresh water flows. Differences in the time of tidal propagation cause net flow from one estuary to another.

The western part of the area is saline even during the monsoon season, whereas the central part (the Passur-Sibsha Rivers) is fresh during monsoon and gradually increasing of salinity during rest of the year. The intrusion of salinity is controlled by the upland flow coming down the rivers. During wet season, the salinity front recedes towards the sea and migrates upstream in the dry season.

The tides of the Passur River are important for navigation as determines the possibility of crossing the shallow outer bar at the entrance. The approximate range of the tide observed at Mongla station is between 1.2 m to 3.5 m and the tidal amplitude is around 3.25m (Observation of Mongla Port Authority). The tide is semi-diurnal in nature.

Two tides (*e.g.* flood and ebb) are regularly observed in the Passur River, which enters into the project site through numerous connected creeks. Earlier, maximum areas of the proposed project were inundated because of tidal flooding. Tidal water intruded into the land during high tide, flooded twice in a day and discharged with the creeks during low tide when the river water is in lower stage. The average height of flood tides rise during spring tide and decline during neap tide. Eventually, those areas have been raised due to regular sedimentation with tidal flooding

Tidal motion dominates during pre-monsoon and post monsoon period. However, fresh water from the river plays a very important role, especially during monsoon. During storms and cyclones, the short waves and storm surges are important morphologic factors.

The tidal range varies between 1.2 and 3.1 meters. The mean water level (CD) is about 0.87 meters (PWD=CD –1.17 meters). The mean high water level varies due to spring-neap tide conditions between +1.60 m and +2.6m PWD. The Highest High Water Level (HHW) is about +3.1m PWD and the Lowest Low Water Level (LLW) is about –1.4m PWD.

6.5.6 Tidal Inundation

Semi-diurnal tide (two flood tides in 24 hour) occurs in the Passur River, which enters inland area through numerous connected creeks. Within the study area, lands that are not protected by coastal polders are inundated by tidal floods twice in a day. Tidal water intrudes into these lands during flood tide, and flows back to Passur during ebb tide with the numerous tidal creeks. On the other hand, the lands protected by coastal polders are free of tidal floods.

The project site is dominated by seasonal shrimp cultivation and agricultural practices. This area is protected by earthen made local levees, which is the common practice to prevent tidal inundation of the project area at present. Most of the lands within the proposed project areas are occupied by shrimp farms where river water intrusion through tidal creeks is regulated by indigenous wooden water control structures. These fragile wooden structures allow river water to enter during flood tide according to the demand of the shrimp farms.





Plate: Earthen Levee along the Passur river to prevent tidal intrusion in the Project area





Plate: Earthen Levee along the Maidara river to prevent tidal intrusion in the Project area





Plate: Indigenous wooden structure for regulating tidal intrusion

6.5.7 *Waves*

The outer Bar is at the edge of the Bay of Bengal and is under the direct influence of long ocean waves and storm generated local waves coming in from the south. A study undertaken by IWM (2005) showed that the wave at the Bay of Bengal has a significant wave height (Hs), equal to three meters, a wave period of 8.8 seconds and a wavelength of 125m. Waves propagate over the Outer bar and slowly reduce in height when progressing over the outer Bar towards the Passur River. Approximately 23 km from the entrance to the Bay of Bengal, the wave height is reduced to less than one meter (SMEC, 2006a).

High wave in the mouth of the Passur River only occurs during monsoon. During this period, sea level is up to one meter higher than the dry season level due to the wave set up towards the coast. The wave height (Hs) in the Passur River is 0.5m.

6.5.8 *River bed sediment*

Five numbers of boreholes were executed up to 15 m below the riverbed for investigating the riverbed material along the Passur River (Map – 6.6c). Clay dominates up to 4.5 m. Silty Clay and Silt dominates in 4.5 to 9.0 m depth below the riverbed. Sands are abundant after 9 m. coarse size of sand increases with depth. The rate of sedimentation needs to be accounted during preconstruction phase and the project authority would regularly monitor and the measures will be taken accordingly.

6.5.9 *Aquatic monitoring*

The details of hydrological and morphological monitoring included water level, tide, erosion, accretion, water quality of both ground and surface water have been described in Section 6.2.1 and Section 6.2.3. The fisheries resources have been described in 6.7. The other aquatic lives and their habitats have been described Section 6.8.

6.5.10 *Water quality*

Ambient surface water quality is represented by some selected parameters, which are crucial for drinking purpose, industrial use and to maintain optimum aquatic environment.

Salinity levels along the Passur river system vary according to the volume of fresh water entering the system. The Passur River receives a significant proportion of fresh water from the Gorai River. Accordingly, salinity levels are influenced by the seasonal nature of this river flow. According to Halcrow *et al.* (2001), salinity concentration is 27 parts per thousand (ppt) at the mouth of the Passur River. IUCN (2006) report shows surface salinity levels

ranging between 10 to 29 ppt throughout the year, with an increase with depth in the upper 20 to 30m.

IWM (2003) reported that in-situ dissolved oxygen (DO) measurements in the Sundarbans areas of an average value of 6 mg/L. The oxygen content decreases rapidly with depth within the upper part of the thermocline. The isocline for one ml/l are reached at about 80 m in May and 100 m in November-December. Data indicate that the minimum DO level in the vertical oxygen distribution is in between 200 m and 400 m (IUCN, 2006).

In 1993, Delft Hydraulic Institute (DHI) estimated that suspended sediment concentration is approximately 800 mg/l at the Passur River entrance in the monsoon season, dropping to around 300 mg/l in the dry season (IWM, 2006).

Surface temperature ranges between 22.9° C to 33.0°C throughout the year. The vertical temperature typically has a subsurface maximum of approximately 10 m to 70 m in depth (IUCN, 2006).

Water quality of the Passur River at Mongla was collected for both dry and wet seasons from the DoE laboratory of Khulna division, as mainly the river receives waste water only from Cement factories of Mongla. Different water quality parameters of Passur River have been shown in Table 6.9a especially at Mongla port station. Numbers of sampling point have been identified around the project site for water quality monitoring. The details of data collection points are represented in Table 6.19b that are pointed out in the Map 3.4 of Chapter 3.

It is observed that pH and DO are within the standard limit of ECR'97 for fisheries, drinking and industrial use but BOD is higher than the standard level. Standards for other parameters are not specified in ECR' 97

Table 6.9a: Different water quality parameters of the Passur River at Mongla port station

location	Date	Temp.	pH	EC	Cl^-	T. Alkalinity	Turbidity	T S	TDS	SS	DO	BOD	COD	Salinity
		°C		µS/cm	mg/l	mg/l	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	7-Jan	27.4	7.74	3010	879	36	68.7	1565	1510	55	5.1	0.8	55	1.6
2	7-Jan	27.1	7.72	3020	878.8	36	68.5	1570	1510	60	5.1	0.8	55	1.6
3	7-Jan	27.8	7.71	3030	879	36	68.8	1565	1510	55	5.1	0.8	55	1.6
1	11-Feb	29.8	7.66	4380	1262	36	182	2390	2180	210	4.7	1	76	2.3
2	11-Feb	29.2	7.63	4380	1268	36	178	2390	2190	200	4.7	1	76	2.3
3	11-Feb	29.1	7.65	4380	1263	36	179	2380	2180	200	4.7	1	76	2.3
1	9-Mar	32.6	7.56	11780	2944.4	38	176	6080	5890	190	4.7	1.2	76	6.7
2	9-Mar	32.6	7.57	11780	2945.2	38	178	6080	5890	190	4.7	1.2	76	6.7
3	9-Mar	32.1	7.55	11780	2946.4	38	177	6090	5890	200	4.7	1.2	76	6.7
1	17-Apr	32.6	7.59	25300	8273	36	185.6	12950	12700	250	4.6	0.7	136	15.5
2	17-Apr	32.6	7.59	25300	8273	36	186.2	12950	12700	250	4.6	0.7	138	15.5
3	17-Apr	32.6	7.59	25300	8273	36	184.8	12950	12700	250	4.6	0.7	136	15.5
1	5-May	32.6	7.59	29200	9480	36	198.6	14900	14600	300	4.5	1.2	177	17.6
2	5-May	32.9	7.54	29200	9470	36	198.6	14900	14600	300	4.4	1.2	177	17.6
3	5-May	33.2	7.57	29200	9470	36	199.6	14900	14600	300	4.5	1.2	177	17.6

location	Date	Temp.	pH	EC	Cl^-	T. Alkalinity	Turbidity	T S	TDS	SS	DO	BOD	COD	Salinity
		°C		µS/cm	mg/l	mg/l	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	13-Jun	31.6	7.69	18000	5820	36	112.6	9200	9000	200	4.7	1.1	97	10.8
2	13-Jun	31.6	7.69	18000	5800	36	113.2	9200	9000	200	4.7	1.1	97	10.8
3	13-Jun	31.6	7.69	18000	5810	36	112.4	9200	9000	200	4.7	1.1	97	10.8
1	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
2	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
3	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
1	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
2	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
3	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
1	8-Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
2	8-Sep	31.6	7.76	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
3	8-Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
1	12-Oct	30.6	7.79	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-
2	12-Oct	30.6	7.78	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-
3	12-Oct	30.6	7.78	290	25.6	36	62.6	192	145	47	5.6	0.7	22	-
1	5-Nov	24.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
2	5-Nov	26.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
3	5-Nov	25.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
1	12-Dec	21.5	772	520	62.6	36	72.6	320	260	60	5.1	0.9	25	0.4
2	12-Dec	20.9	7.71	520	62.6	36	73.6	320	260	60	5.1	0.9	25	0.4
3	12-Dec	21.1	7.72	520	62.6	36	71.6	320	260	60	5.1	0.9	25	0.4

Source: DOE, 2010

Note: All samples collected from Mongla port (location 1 - Port side river sample, location 2 – middle of the river and location 3 - Opposite of Mongla port) during high tide period in 2010

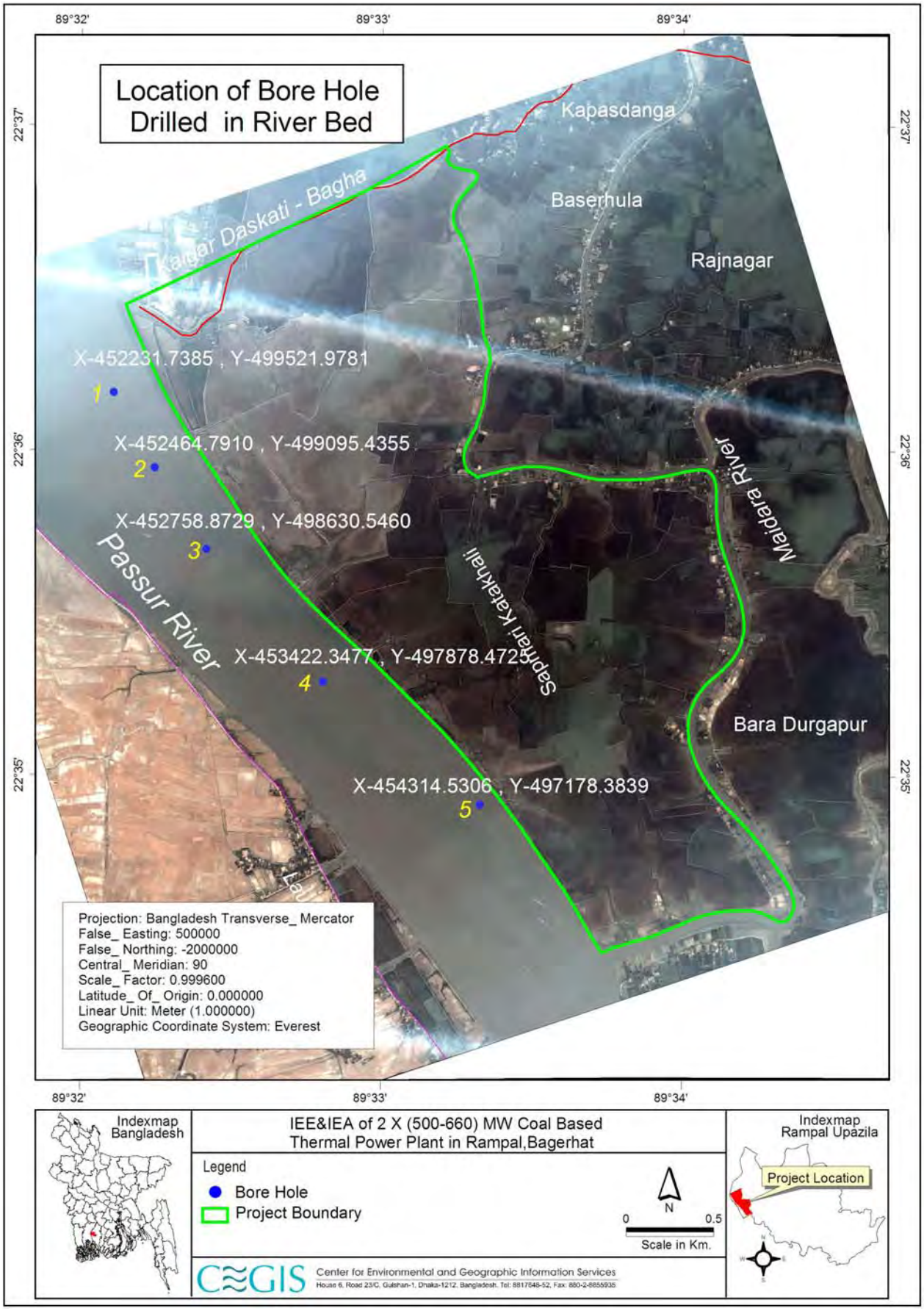
Table 6.9b: Proposed location of water quality data collection during preconstruction phase

Season	Locations	Tide	Parameter	Institution
▪ Summer/ Apr. ▪ Monsoon/ Jul. ▪ Post-monsoon/Oct. ▪ Winter/Jan	▪ Effluent discharge point ▪ 500 m u/s and d/s from the effluent disposal point ▪ 100 m u/s and d/s from the project plant ▪ Maidara River ▪ Sundarbans area ▪ Base Creek ▪ Karamjal ▪ Akram Point ▪ Hiron Point ▪ All samples should be collected	Low and high	Temp. pH, Salinity, DO, EC, Cl^-, P. Alkalinity, Total Hardness, TS, TDS, BOD, COD, Heavy metals	BPDP/JV Company/ DOE

	from three points (left, middle and right bank) along the cross section of the river at suggested locations			

6.5.11 Water Use

In the study area, surface water use in domestic sector is very limited due to high salinity. Gher owners are the major users of surface water for shrimp and white fish firming.

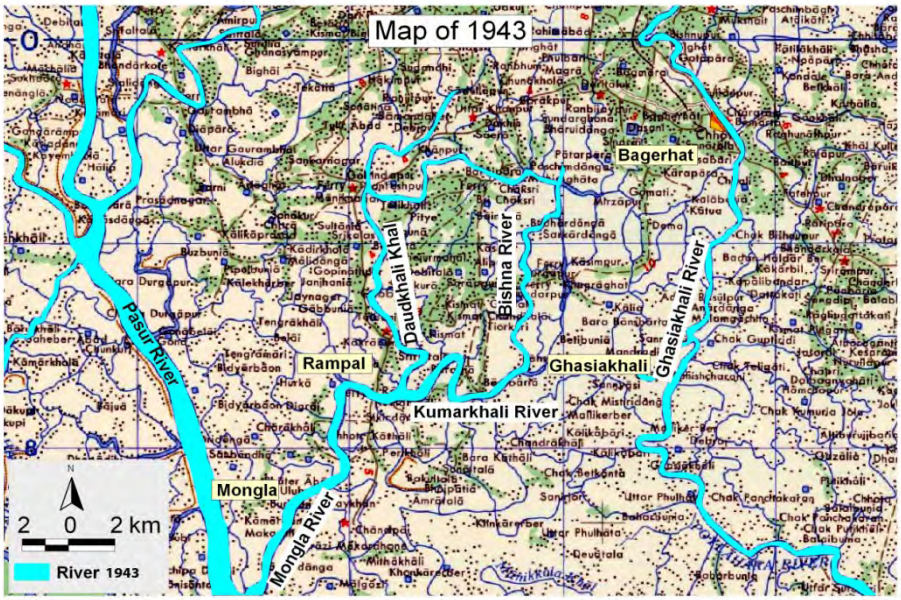


Map 6.6c: Sub-soil investigation borehole location of the Passur River

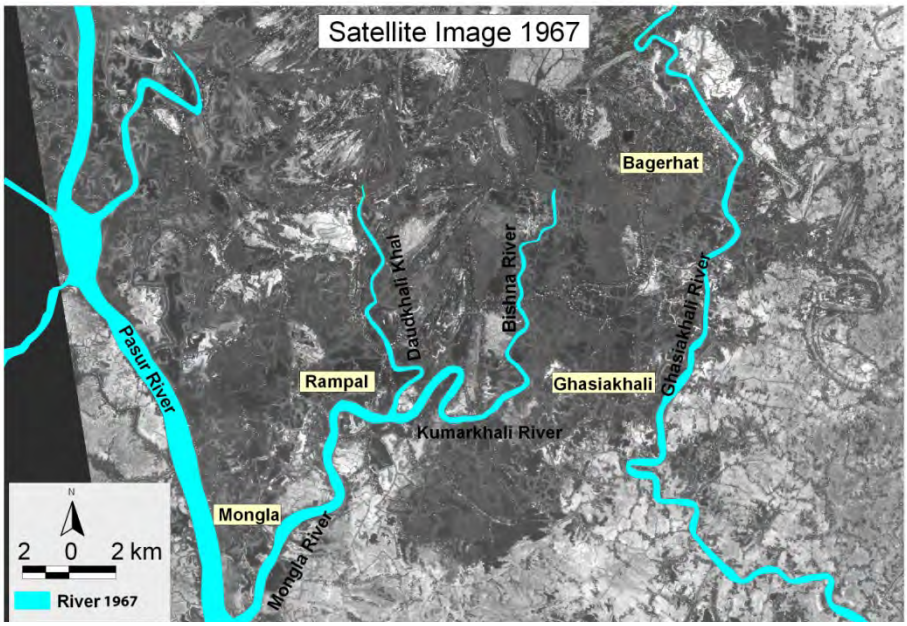
6.6 River Morphology

6.6.1 River plan form

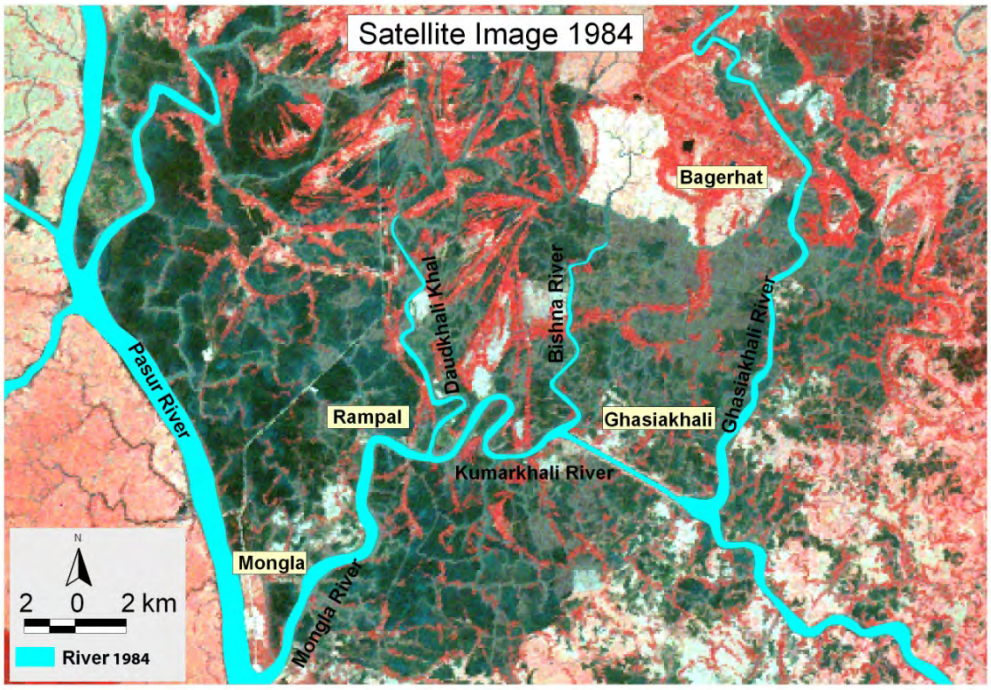
The River Passur is a morphologically stable river. The change in river platform of the Passur river and its channels from 1943 to recent is represented in Map 6.7 (a, b, c, d, e).



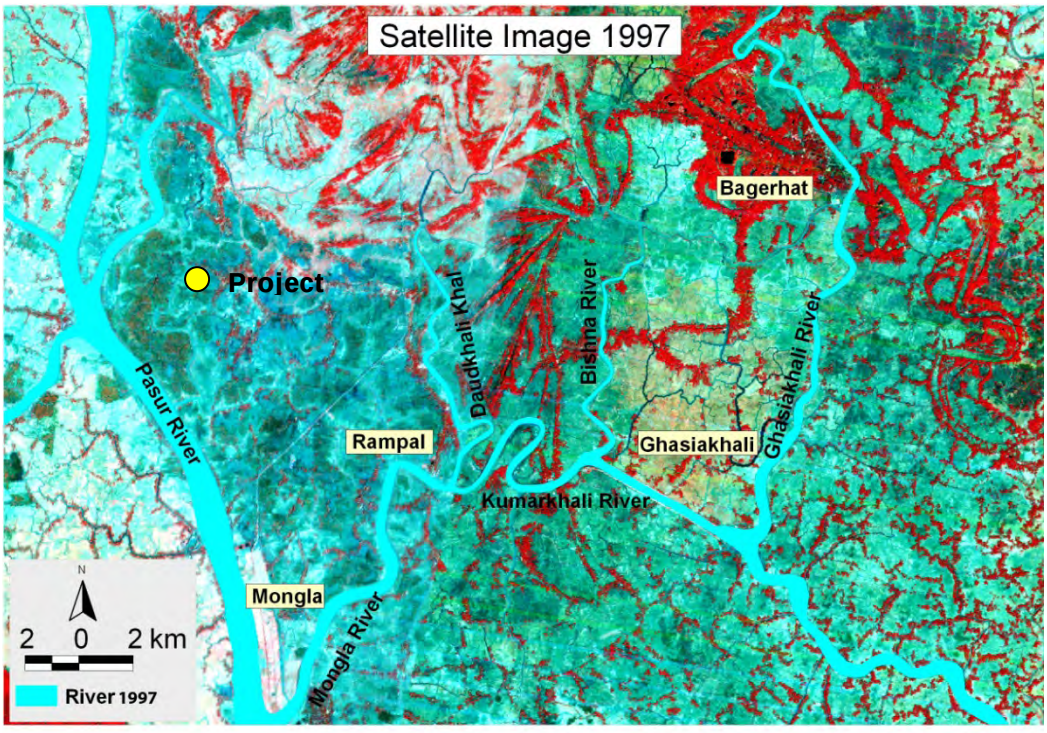
Map 6.7a: The Passur river systems during 1943



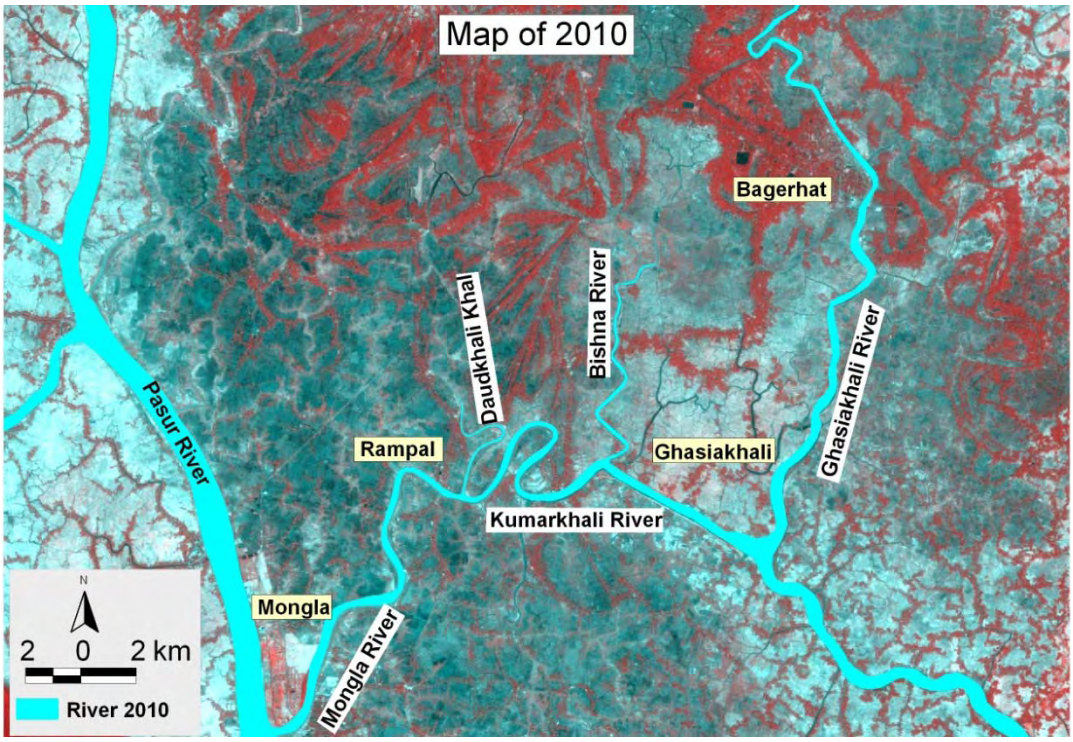
Map 6.7b: Aerial photograph of Passur river systems during 1967



Map 6.7c: Satellite image showing Passur River System during 1984



Map 6.7d: Satellite image of 1997 showing Passur River System



Map 6.7e: Satellite image of 2010 showing Passur River System

6.6.2 Erosion and accretion

The site is not subject to severe erosion. Some erosion was observed only on the right bank of Passur River (Plate 6.1). People reported that the erosion rate in the Passur River is too low but accretion rate on the right side the riverbed is high.

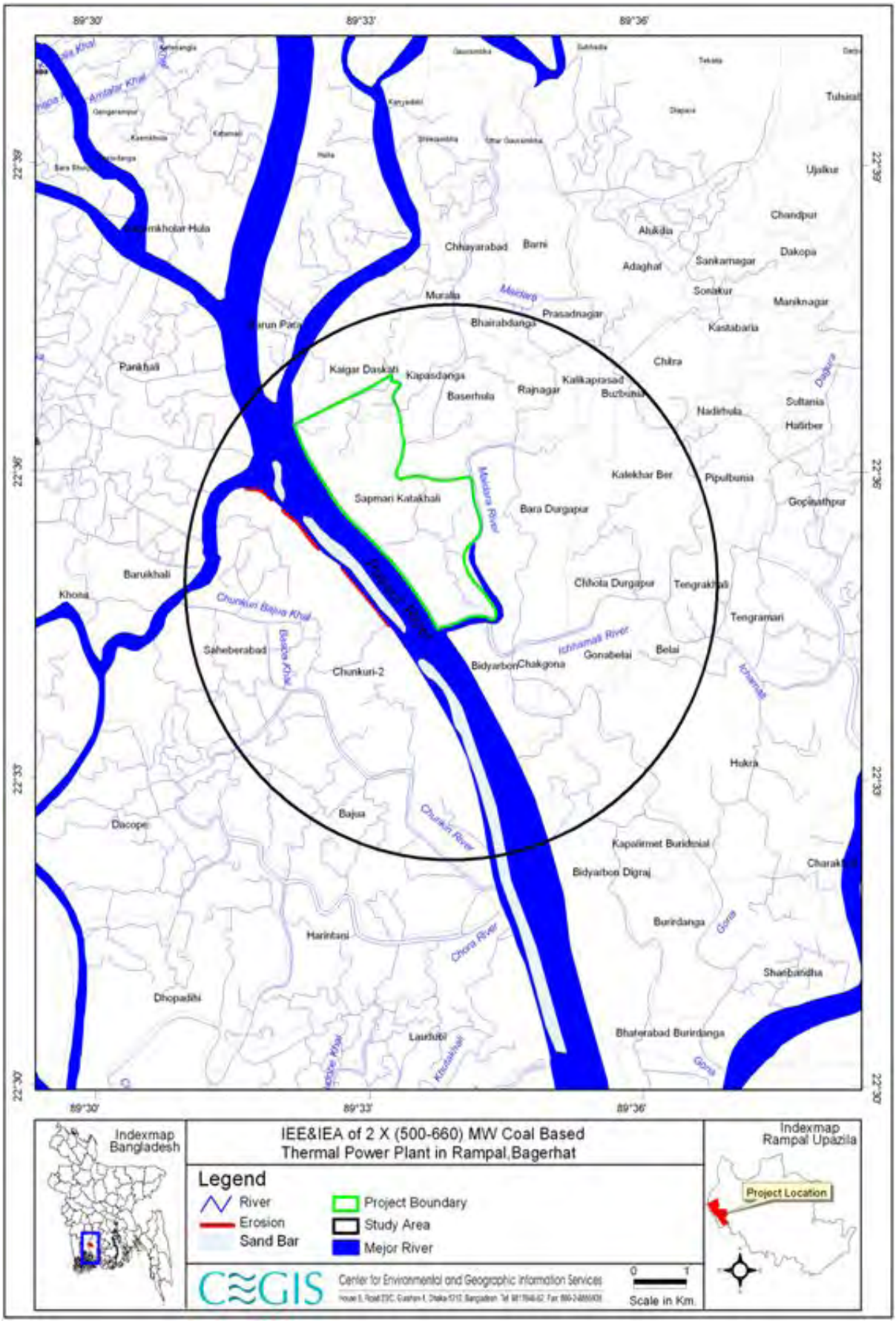
During field visits, three sand bars were found in the Passur River in the reach of Mongla to Project site (Plate 6.2). These sand bars might be suitable source of land filling material for the project site for up gradation of land elevation. The location of sand bar is represented in Map 6.8.



Plate 6.1: Erosion at right bank of the Passur River (Chunkuri village)



Plate 6.2: Sand bar at project site (Playing football during low tide on the river bed)



Map 6.8: Extent of erosion and accretion in Passur river

6.6.3 River bathymetry

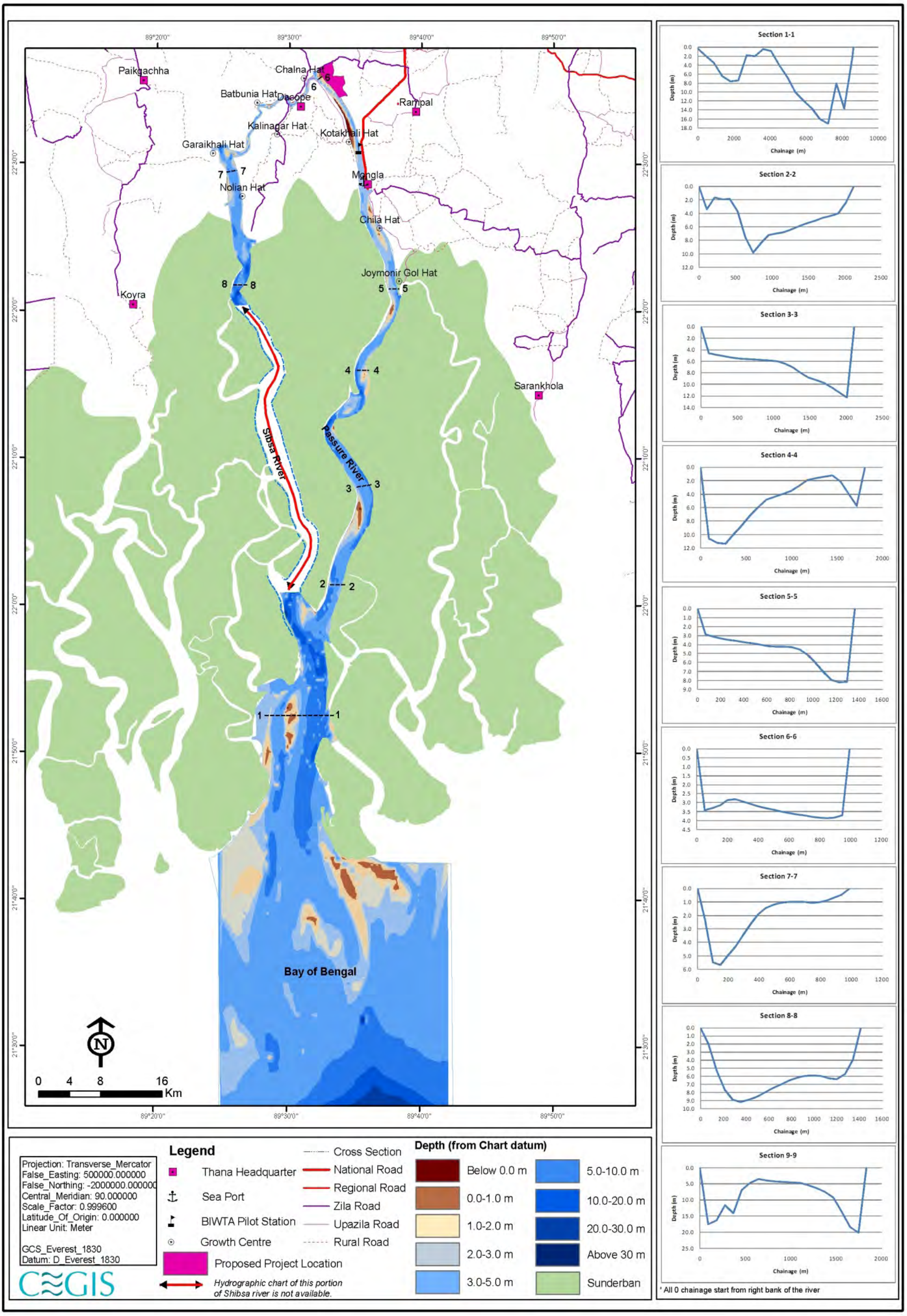
Bathymetric map and cross sections are prepared based on latest hydrographic charts, which were collected from Bangladesh Navy, BIWTA and Mongla Port Authority. A surface is generated with the help of Arc Map 9.3 to observe the bed profile and to find out the suitable paths for navigation of coal carrying vessels up to project

sites. Hydrographic chart of the Passur and the Sibsha River are collected from BIWTA and Mongla Port Authority to analyze two alternative routes for project site of Khulna 1320 MW coal based thermal power plant.

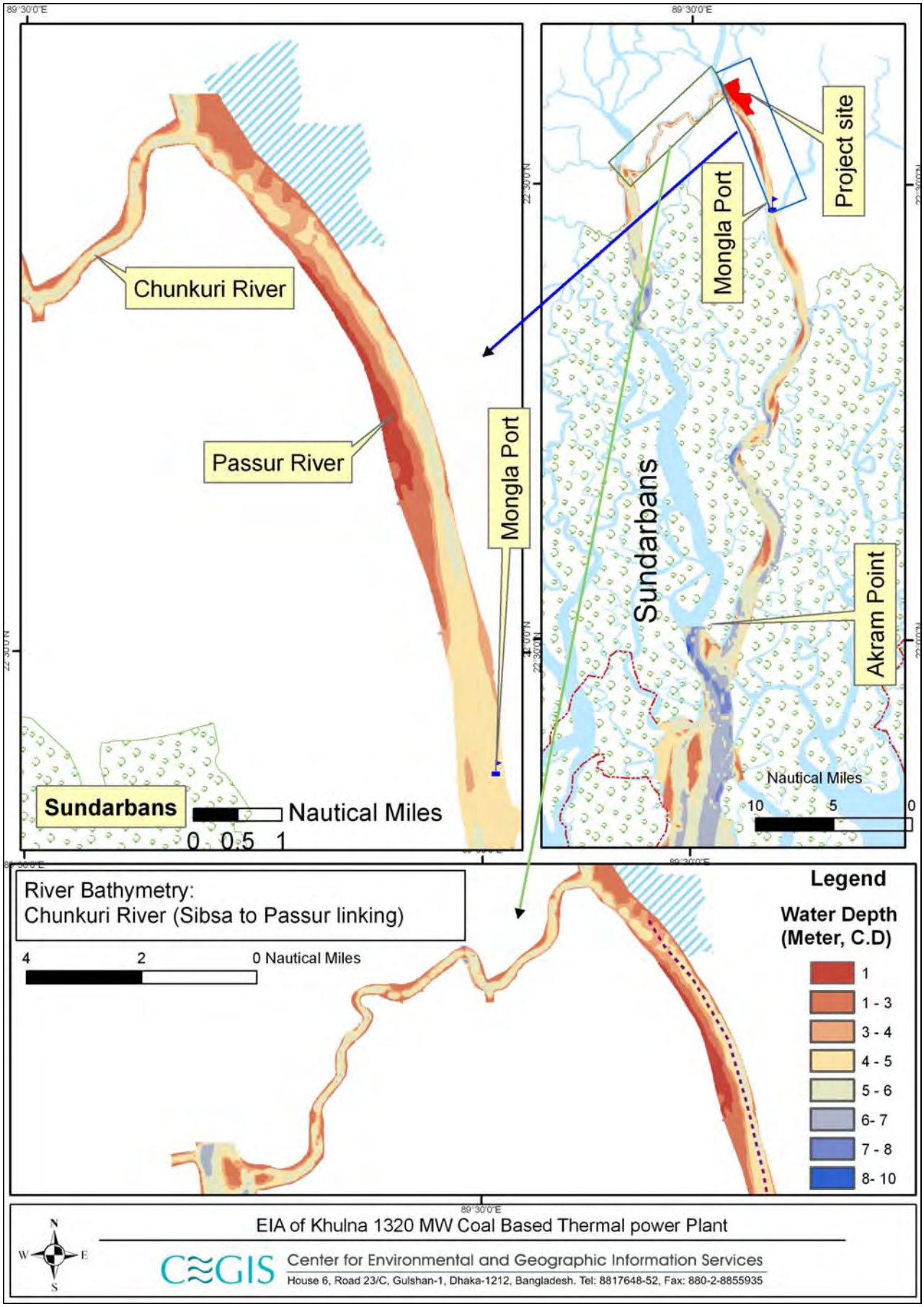
In the Passur River, Mongla Port Authority conducted survey from 2007 to 2009. BIWTA conducted bathymetric survey up to 1 km downstream of Nalian Hat (village market) in the Sibsha River in 2010. Hydrographic chart of the rest portion (red marked line in map 6.9 and 6.10) of the Sibsha River is not available. For better understanding of the bathymetry of two rivers with cross-sections at different locations are shown in map 6.9 as section 1-1, 2-2, 3-3, 4-4, 5-5, 6-6, 7-7, 8-8 and 9-9. Map 6.10 shows the details of the bathymetry of the Chunkuri River and the reach of the Passur near the project area.

In existing condition, Akram point shows depth of 15 m to 20 m but there are some shoals in outer bar area that limit approaching of vessels having draught over 8m. Same vessels can proceed up to Harbaria (12 nautical miles downstream of Mongla Port Jetty). Presently, vessel of maximum 5 m – 6 m draught can proceed up to port jetty utilizing tidal advantage. Draught is improving further upstream of the Mongla port. Up to south end to the project area draught varies from 4 m to 7 m. However, in some places, shoals restrict draught. Further upstream of the south end of the project, the draught decreases due to some shoals and submergible sand bars.

About 35 km of the Sibsha River (North of Akram Point) and 25 km of the Chunkuri River's bathymetric maps are not available. This bathymetric information is very important in respect of studying alternative route the project site from Akram Point. BPDB may request Bangladesh Navy to carry out the survey at the earliest.



Map 6.9: Bathymetric map of the Sibsha-Passur River System



Map 6.10: River bathymetric map of Passur and Chunkuri River

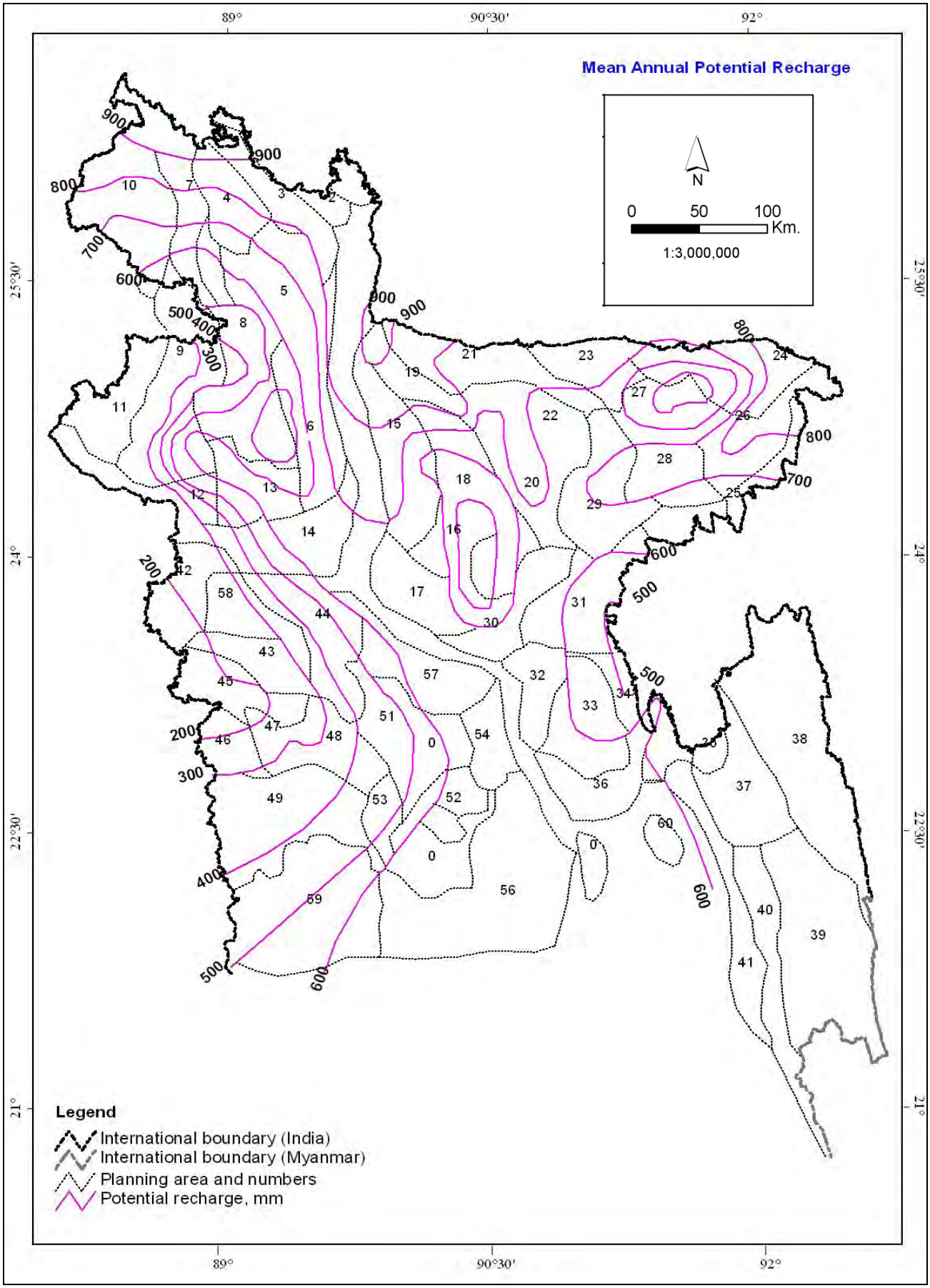
6.7 Groundwater Resources

6.7.1 Hydrogeology

Deep ground water aquifer is the main source of domestic water supply in this area as the shallow aquifer shows salinity, which is also subject to salinity intrusion from river and sea. The depth to the fresh ground water table in the project area ranges from 700 ft (213.36 meter) to 900 ft (274.32 meter) (DPHE, Rampal). Mean annual recharge rate of the project site is 500 m (Map 6.11).

Previous reports from DPHE have made a number of inferences regarding quality, which summarize that the ground water of the project site has total dissolved solids (TDS) content of less than 500 mg/l. In coastal areas, tidal movement allowing salt water in estuaries to percolate into ground water leads to TDS values greater than 1000 mg/l. The value of less than 1500 mg/l is generally regarded as potable and as such, this water would appear safe to drink as far as TDS content is concerned. The ground water salinity in the project area is 256 ppm (*source: DPHE*). The rate of ground water level fluctuation in the project site is 7 to 10 feet (*source: DPHE*).

The pH of ground water in Bangladesh is generally neutral or slightly alkaline and in the range of 6.5 to 7.5, although the pH may be as high as 10 in some areas. In other areas, particularly in association with peat soils, acidic pH values may occur. As peat deposits are not known to occur at the proposed site and coastal influences are absent, it is anticipated that a value within the range 6.5 to 7.5 is most likely.



Map 6.11: Mean annual potential recharge

6.7.2 Groundwater level

Groundwater is the main source of water for drinking and irrigation in South West region of Bangladesh. The present study determines where groundwater can be found, and how much more water might be available for construction of power plant.

Salinity level in the study area is high in the shallow aquifer, but salinity level in deep aquifer is within tolerable limit of drinking water standard.

In the study area, 13 boreholes (Map 6.12) were drilled up to 60 meter of depth for geotechnical investigation and measuring ground water level. The result of the investigation shows the average static water level is 1.35 m. below the existing ground level. Table 6.10a represents the depth of static water level observed in different boreholes.

Table 6.10a: Static ground water level observed in different boreholes

Bore Hole (BH) No	Depth of GW static level from ground (m)
BH 1	2.0
BH 2	1.5
BH 3	1.0
BH 4	1.5
BH 5	1.0
BH 6	2.0
BH 7	1.0
BH 8	1.5
BH 9	1.3
BH 10	1.0
BH 11	1.2
BH 12	1.0
BH 13	1.6

Source: Field investigation by CEGIS, 2011

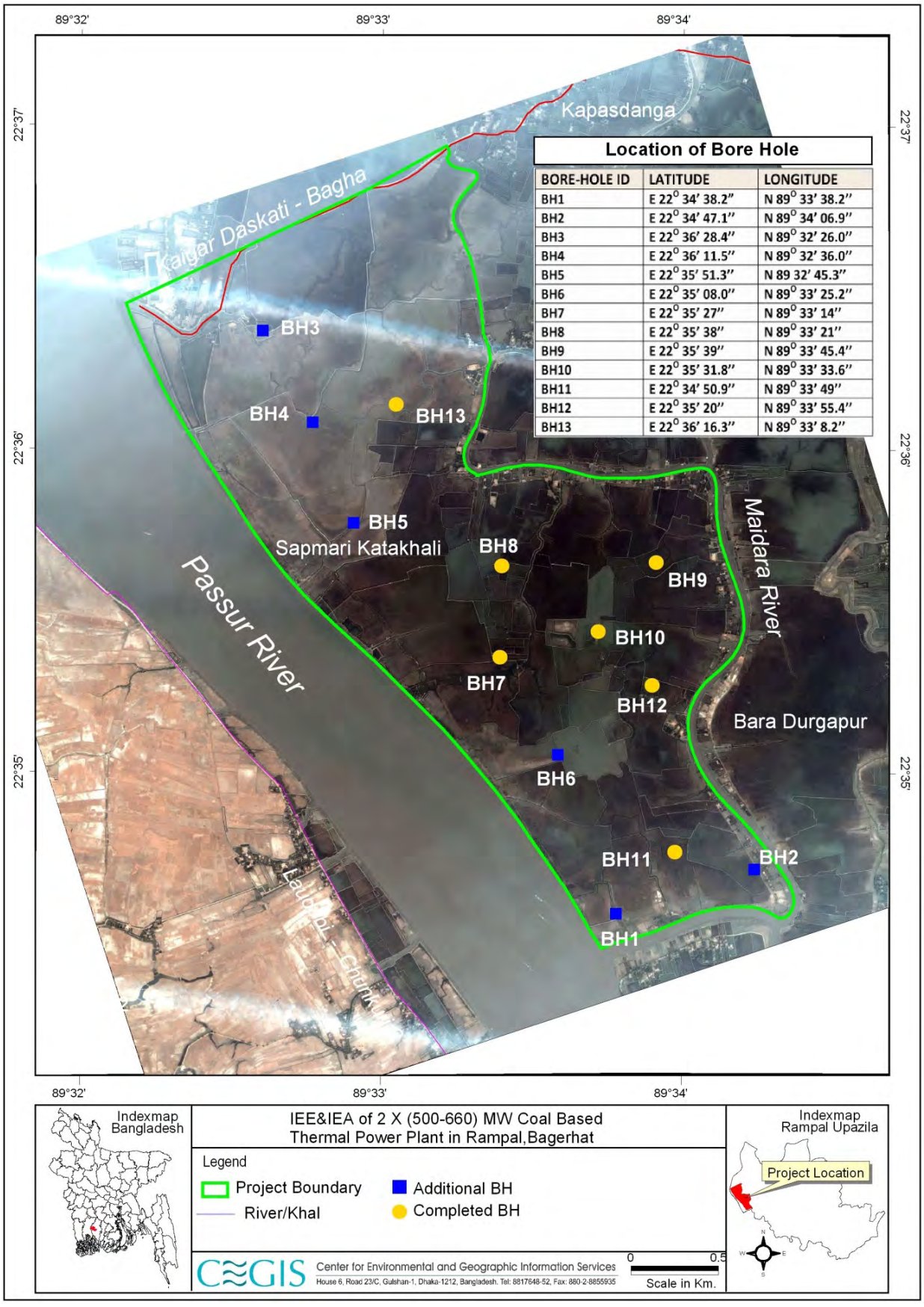
However, from the records of the Department of Public Health and Engineering (DPHE) on installed hand tube wells, depth of the freshwater aquifer varies within a range of 650 ft – 800ft in the study area. There are 21 numbers of DPHE's installed hand pumps, depths of groundwater level observed in these wells are given in table 6.10b bellow:

Table 6.10b: Depth of groundwater table observed in different hand pumps tube wells within the study area

Sl. no	Village	Water level (ft)	Name of DTW owner	Salinity
1	Rajnagar	660	Sultan Ahmed	356-445ppm
2	Rajnagar	750	Dilip kumer Sirker	
3	Khaleker-Ber	675	Murshed	
4	Khaleker-Ber	765	Sobuj Kumer Mondal	
5	Khaleker-Ber	760	Abdul Daud	
6	Basher hula	750	Ponchanon Bala	
7	Basher hula	810	Monsor Mollah	
8	Basher hula	776	Afjal	
9	Basher hula	747	Abdur Rauf	
10	Bara	765	Pornendo Shekor	

Sl. no	Village	Water level (ft)	Name of DTW owner	Salinity
	Durgapur			
11	Bara Durgapur	760	Krishnopod	
12	Buzbunia	700	Mosque	
13	Guna-Belai	700	Monorongon Mondal	
14	Guna-Belai	810	Nitish chandra sirker	
15	Chak Guna	758	Biswajit	
16	Sapmari	755	Najmul Huda	
17	Kapash Danga	420	Wahab Sheikh	
18	Kapash Danga	860	Hannan Sheikh	
19	Kapash Danga	441	Abdus Salam Mollah	
20	Banni	827	Abdus Salam	
21	Banni	997	Madrasa	

Source: DPHE, Khulna



Map 6.12: Location of the boreholes installed for groundwater level observation and water quality monitoring

6.7.3 Groundwater use

Ground water is the main source of domestic, irrigation and industrial water supply in the study area. All households in the study area are using ground water to fulfill their daily requirement. Hand tube wells (depth of pipe 600-900 ft) are used in households for domestic water supply. Other industries in the study area use Deep Tube-Wells (DTW) for water supply in their factory.

6.7.4 Groundwater quality

To establish a base line situation three-groundwater samples were collected and analyzed to identify its quality. It had other objects like

a) Whether the water may be used for drinking purpose

b) Impact of the project activities on the ground water.

The results show that most of the parameters are within the standard limit except the total hardness, which is higher.

Table 6.11: Groundwater quality of the study area

Sl No.	Parameters	Units	Sample from BH 7	Sample from BH 8	Sample from BH 9	Standard
1.	pH		8.10(20.5^{0}C)	8.09 (20.6^{0}C)	8.11 (20.7^{0}C)	6.5-8.5
2.	Total Hardness	ppm	89.62	62.72	98.56	200-500
3.	Chloride	ppm	34.34	23.31	36.20	150-600
4.	Sulphate	ppm	41.5	28.16	43.75	400
5.	Iron	ppm	0.132	Trace	Trace	0.3-1.0
6.	Arsenic	ppm	0.005	0.002	0.002	0.05

Source: Laboratory test, 2011 (done by CEGIS)

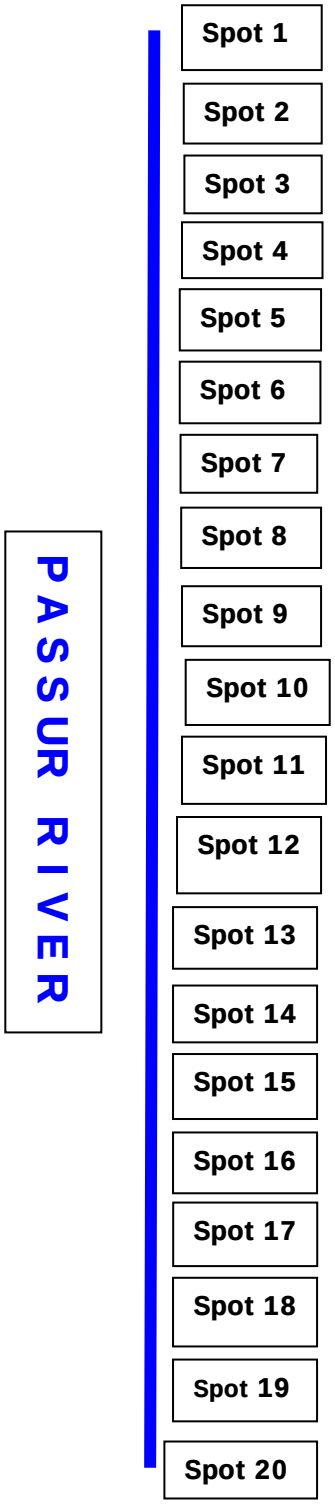
6.8 Navigation

6.8.1 Navigation system

Analysis of time-series hydrographic level surveys of BIWTA shows a gradual decline of navigability especially in the reach of Harbaria to Mongla Port. On the other hand, Mongla port to Maidara River reach shows gradual improvement of navigability. After the confluence of Maidara to further upstream, the depth is decreasing. The following table (Table 6.12a) represents the draught of the Passur river from Akram point to Chalna Port. At Passur approach, water depth is above 14 m up to Akram point but outer bar is the obstruction that limits approach of vessels more than 9m draught. Fortunately, this approach is also improving.

Table 6.12a: Draught of the Passur River from Akram point to Chalna Port

SPOT NUMBER	SPOT NAME	DRAUGHT	SCHEMATIC DIAGRAM OF PASUR RIVER FROM DEEP ANCHORAGE TO CHALNA PORT
Spot 1	Proposed Deep Draught Anchorage	22.2 m	
Spot 2	Akram Point	9 m	
Spot 3	Kaga Baga Canal	13.2 m	
Spot 4	BM Sundarikota	9.6 m	
Spot 5	Cheilabogi Canal	29.3 m	
Spot 6	Monkey point	26.4 m	
Spot 7	D'Souza point	10.3 m	
Spot 8	Harbaria Canal	8.1 m	
Spot 9	Sagir Canal	7 m	
Spot 10	Sultan Canal	5.6 m	
Spot 11	Chila bazar	5.7 m	
Spot 12	Khaikami Canal	4.5 m	
Spot 13	Coast guard jetty	4 m	
Spot 14	Mongla port jetty	6.4 m	
Spot 15	Mongla port berthing Jetty	4 m	
Spot 16	United Summit LP gas	4.87 m	
Spot 17	Nevel Jetty	5.79 m	
Spot 18	Bindarban	4.87 m	
Spot 19	Sapmari	4.26 m	
Spot 20	Chalna port	3.65 m	



Source: BIWTA

6.8.2 *Aids to navigation*

Navigation facilities is essential for coal transportation from Akram point to plant site. Mongla Port Authoirty provides aids to navigation within its port limit only. Besides, BIWTA provides aids to navigation in inland water transportation routes. The channel from Mongla Port Fairway Buoy (MPFWB) to Mongla Port Jetty is properly marked by necessary aids for day time navigation only. Channel from Port Jetty to project site is marked by both day time and night navigational facilities e.g. lightened buoy and beacons by BIWTA.

6.8.3 *Mongla Port Facilities*

Mongla port is located at 14 km south from the proposed power plant site. The plant has been envisaged with the aim of using Mongla Port facilities (not berthing/jetty facilities) for primary fuel-coal transportation from source countries to the project coal terminal. With the capacity of handling 6.5 million tons in a year, at present, Mongla Port handles 1.6 million tons of cargo yearly. The average turn around time (in day) for a bulk cargo is 5.5 and 2.5 for a container cargo. In 2009-2010 fiscal years, the port handled 153 numbers of vessels. They had formulated a budget for handling 250 vessels for 2010-2011 fiscal years. At present, Mongla port operates five general cargo/container berths, seven river mooring berths, and fourteen anchorage berths. In addition, there are seven specialized private berths. The port has cargo-handling equipments of different capacity including dockside, mobile crawler, truck mounted forklift truck, prime mover, trailer cargo handling, etc. At present there are four transit sheds having an area of 19628 sq m, two warehouse of 19,630 sq m, and open dumps of 3,00,000 sq. m available for cargo storage. Moreover, three container yards of 35,754 sq. m are also available. However, no facility for coal cargo handling prevails in the port at present.

Maintenance of draught is the main challenge for Mongla port. Presently, maximum allowable draught at jetty is 6.5 m. Vessels having 6.0 m. to 6.5 m. draught can take berth at port jetty. The navigational information provided by Mongla Port Authority including allowable draught, fleet size, capacity are given in the following Table 6.12b.

Table 6.12b: Navigational information of Mongla Port

Sl. no	Location	Max allowable draught	Allowable Fleet size	Berthing capacity
1	Fairway buoy	Nov. to March: 20m April to Oct.: 16m		
2	Akram point	9 m	200m	7 nos ship
4	Harbaria (A)	7.5 m	180 m	2 nos ship
5	Harbaria (B)	8.5 m	180 m	4 nos ship
6	Jetty area	6.5 m	165 m	5 nos ship

Source: Mongla Port Authority

The port has a master plan of upgrading its capacity of ship handling up to 450 ships per year within 10 years. Accordingly, the channel up to Jetty-10 will be improved for maintaining 7.5 m draught at jetty site.

6.9 Transportation system

6.9.1 Road communication system

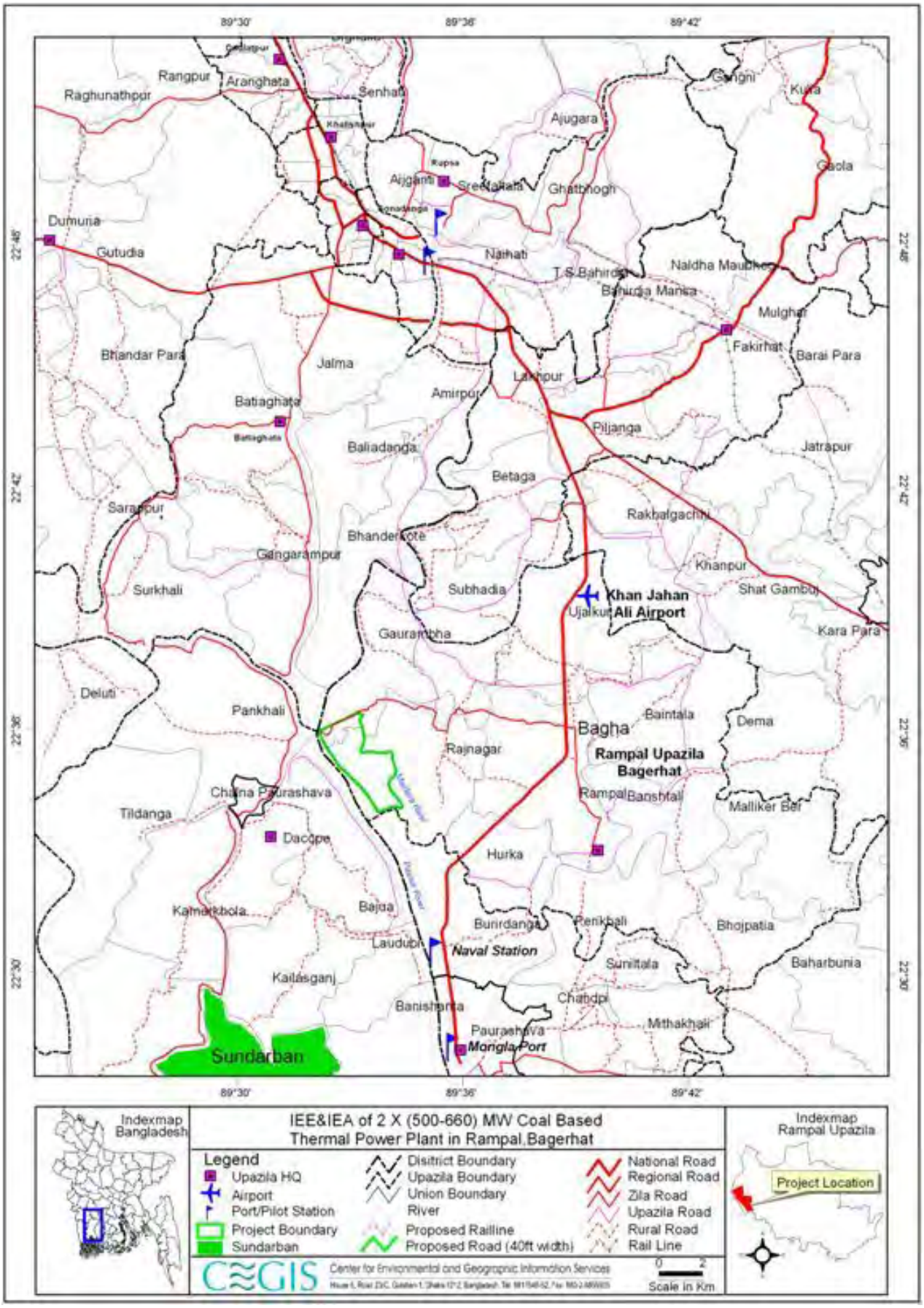
Road communication is very important for any development in the economic sector. The proposed project site is located in Sapmari union of Rampal Upazila of Bagerhat district. The distance between Bagerhat and project site is 35 km by road communication. The study area is located at the Western side of the Dhaka-Mongla high way, which is the main mode of road communication with District, Division and the Capital city. Three brick soling roads connect the study area with the said high way. The existing road communication system is very poor. Most of the internal rural roads are earthen that frequently become muddy due to rainfall. For the project purposes, the Bhaga-Kaigar Daskati road (about 12 km) will be re-constructed with a width of 40 ft that would be the main mean of road communication for the study area as well as the proposed project. The existing communication network is presented in Map 6.13.



Plate 6.3: Internal road communication system



Plate 6.4: Dhaka-Mongla high way



Map 6.13: Existing communication network

6.9.2 *Water communication*

Passur River is the main water communication system in the proposed project area. There are two ports in the study area. These are Mongla port as a seaport and Chalna port as a river port. The depth range of Passur River is now 8 to 11 meter during high tide. The river is very deep and navigable throughout the year and large marine ships can easily enter the Mongla seaport through from Akram point. The water depth at Akram point is 15 to 20 meter. Passur is an important river route through which Khulna-Barisal steamboats and other vessels ply. Few local ***boat points*** exist in Dighraj, Biddarbaon and Kaigar Dashkati in the study area.



Plate 6.5: Present status of Chalna port



Plate 6.6: Digraj Boat point

6.9.3 *Railway communication system*

Since the termination of the Khulna-Bagerhat rail route, there is no railway communication system in the study area. However, in Khulna division, the broad gauge line has been established that connects Khulna with other areas of Bangladesh. Recently, Bangladesh Railway has planned to establish the rail traffic between Khulna and Mongla.

6.9.4 *Air communication system*

In terms of air communication, the nearest air port is in Jessore which is about 80 km (Arial distance) away from the project location. Another new airport is under construction in Rampal at about 12 km northward from the project location.

6.10 Tropical Cyclones and Surges

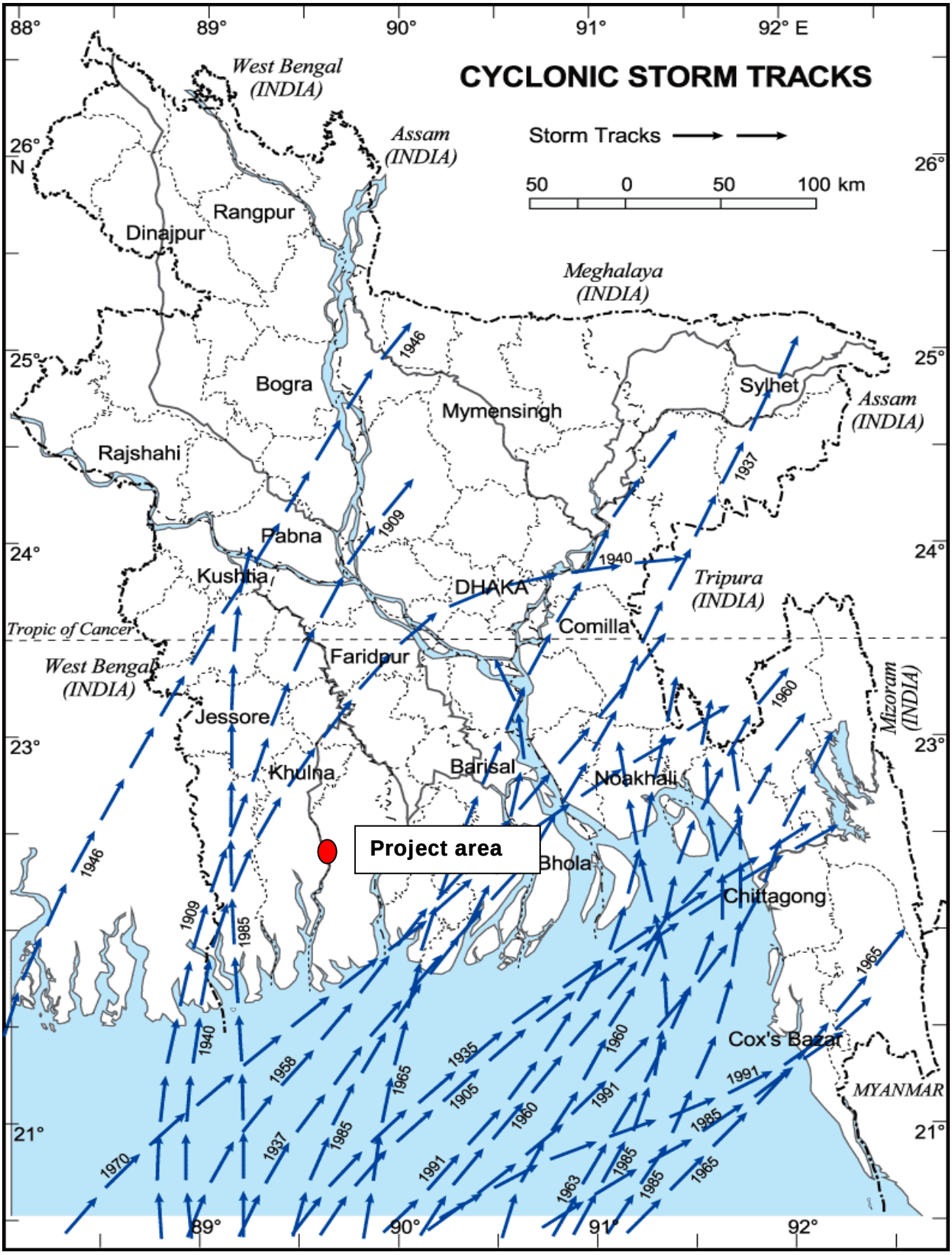
Tropical cyclones and surges are the major threats to the coastal areas, causing loss of human lives and livestock and severe damage to crops and properties. During last 125 years, more than 42 cyclones had hit the coastal areas (Map 6.14) and 16 cyclones (Table 6.13) have occurred in the last 25 years. Last devastating cyclone (Aila) hit the study area and project site on 25th may 2009. The project area is located in the wind risk zone of Bangladesh (Map 6.15)

The area is vulnerable to cyclone and storm surge. During Aila, surge water entered the project area by overtopping the left bank of the Passur River. As per local community perception, the site has experienced the maximum surge height during cyclone Aila. As per local perception, the area was inundated by the surge by 4.47m during Aila.

Table 6.13: Major cyclones hitting the Bangladesh coast

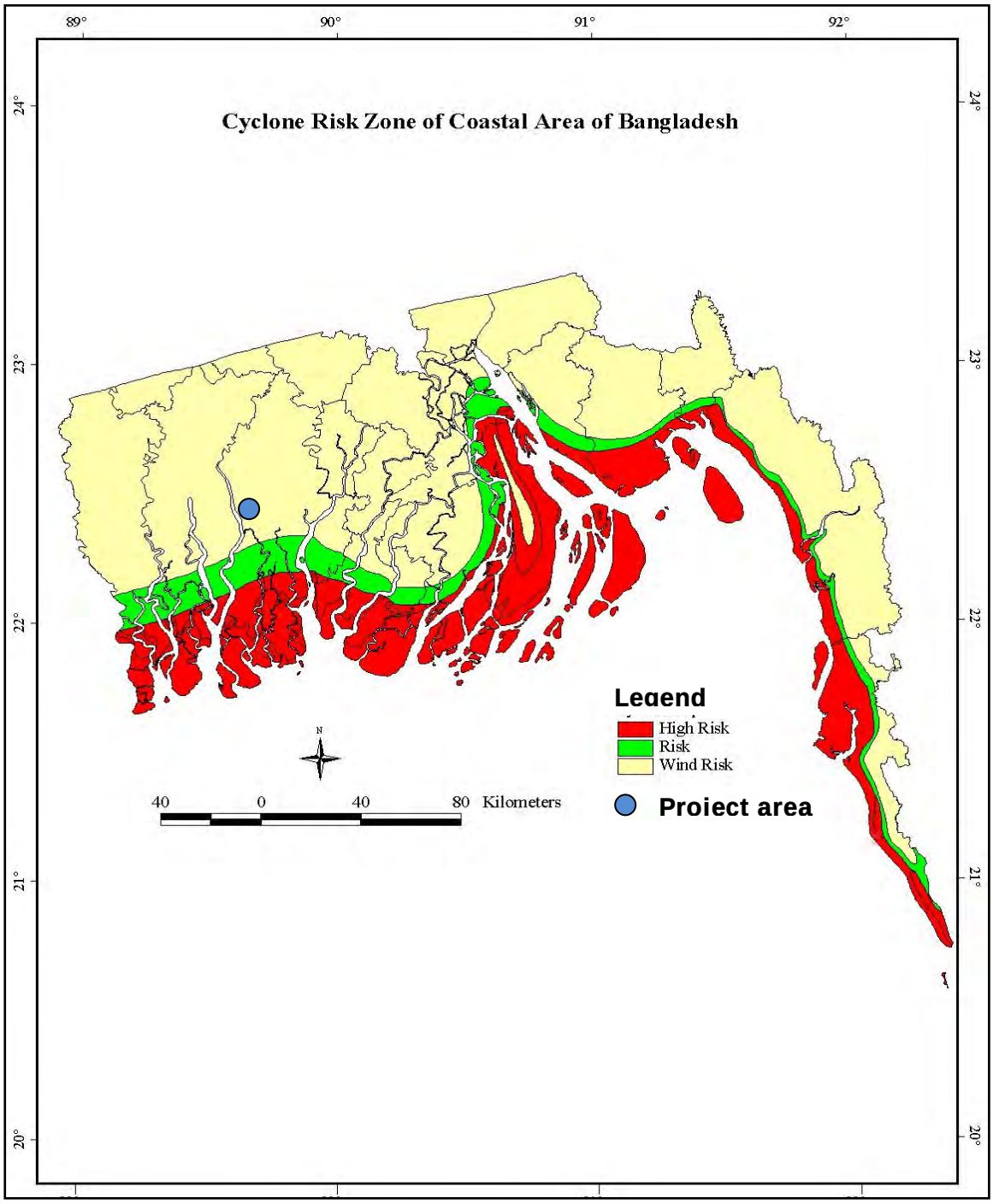
Date		Maximum Wind speed (km/hr)	Storm Surge height (Meter)
30 October	1960	211	4.6-6.1
30 May	1961	160	6.1-8.8
28 May	1963	203	4.2-5.2
11 May	1965	160	6.1-7.6
15 December	1965	211	4.6-6.1
1 November	1966	146	4.6-9.1
23 October	1970	163	3.0-4.9
12 November	1970	224	6.1-9.1
25 May	1985	154	3.0-4.9
29 November	1988	160	3.0-4.0
29 April	1991	225	6.0-7.5
2 May	1994	210	2.0-3.0
25 November	1995	140	2.0-3.0
19 May	1997	220	3.1-4.2
15 November (Sidr)	2007	240	up to 10
25 May (Aila)	2009	120	3.0

Source: MCSP, 1993; Bangladesh Meteorological Department and field survey, 2010



Map 6.14: Map of previous cyclonic storm tracks

(Source: MCSP, 1993)



Source: National Water Resources Data base, WARPO

Map 6.15: Cyclone prone areas of Bangladesh

6.11 Maximum Historical Surge considered for Site Development

Considering importance to the climate change issues, design condition for site development and plant erection has been defined considering historical maximum surge height (during Aila, 5.5 meter surge height as per local perception) occurred in the area. Hence, design condition is inclusive of sea level rise issue.

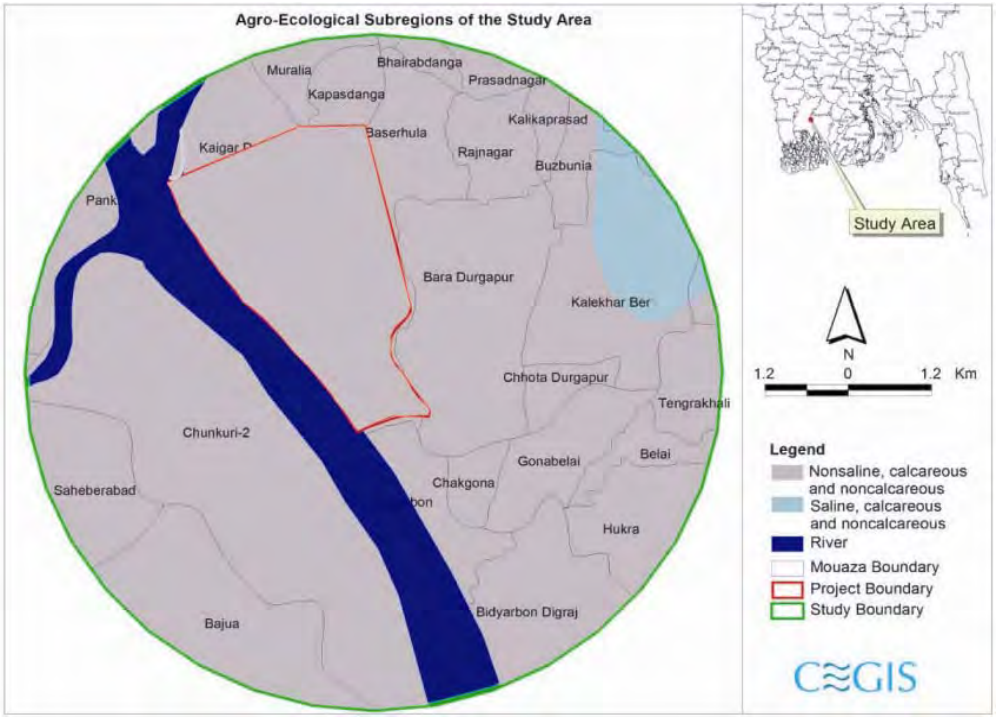
6.12 Land Resources

6.12.1 Agro ecological region

There are 30 (thirty) Agro-ecological regions in Bangladesh. The study area comprises of the Ganges Tidal Floodplain, which has 2 (two) sub-regions: A) Non-saline, calcareous and non-calcareous and B) Saline, calcareous and non-calcareous. The first sub-region occupies the major part of the study area, but the second one occurs in minor areas (Map 6.16).

Non-saline, calcareous and non-calcareous sub-region

This sub-region occupies the North Eastern part of the study area where grey or dark grey, calcareous, silt loams to silty clays occupy river banks and basin margins and grey to dark grey, non-calcareous, heavy silty clays occupy basin centers. Some basin soils overlie a peaty layer within 1 meter. These soils are mainly non-saline. Most of the soils are shallowly flooded during high tide, except where embanked. Some basin centers are more deeply flooded and stay wet for most or the entire dry season.



Map 6.16: Agro-Ecological sub-regions of the study area

Saline, calcareous and non-calcareous sub-region

The soil of this sub-region is mainly saline in the dry season. Calcareous silt loams to silty clays occupy riverbanks and basin margins, and non-calcareous silty clays occupy river basin centers. The proportion of calcareous soils and the proportion of soils with peaty substratum are higher than the former sub-region. Tidal flooding is mainly shallow (outside of the embanked areas), but some basin centers are more deeply flooded and stay wet round the year.

6.12.2 Land Type

Land type classification is based on depth of inundation during monsoon season due to normal flooding in an average year. According to SRDI, there are five land type classes: High land (Above flood level), Medium highland (Flooding depth 0-90 cm), Medium lowland (Flooding depth 90-180 cm), Lowland (Flooding depth 90-270 cm) and very lowland (Flooding depth >270 cm). Detail land type classification based on flooding during monsoon season is presented in Table 6.14.

Table 6.14: Land type classification based on flooding during monsoon season

Land Type	Description	Flooding depth	Flooding characteristics
F_0	Highland	0-30 cm	Non flooded to intermittent
F_1	Medium Highland	30-90 cm.	Seasonal
F_2	Medium Lowland	90-180 cm	Seasonal
F_3	Lowland	180-270 cm	Seasonal, but remains wet in early dry season
F_4	Very Lowland	> 270 cm	Seasonal but remains wet in most of the dry season

The land type characteristics are almost uniform within the study area. Most of the cultivable land is medium highland (> 94%) where maximum flooding depth is below 90 cm during the monsoon period.

6.12.3 Soil Texture

The percentage distribution of sand, silt and clay in a soil particle is called soil texture. The soil scientists have classified soil texture into twelve classes such as sandy, sandy loam, loam, silt loam, clay etc. The soil texture is very important for tillage operation. The loamy soil is very favorable for dry land crops whereas clay soil is very suitable for wet land crops (rice). The silty soil is very much rich for providing nutrient elements to the crops. The top soil texture of the project area along with data on topsoil, subsoil and substratum texture presented in Table 6.15.

Table 6.15: Soil texture of the study area

Soil Texture	Project Area (% of NCA)			Study Area (% of NCA)		
	Topsoil (0-15 cm)	Subsoil (15-60 cm)	Substratum (60-100 cm)	Topsoil (0-15 cm)	Subsoil (15-60 cm)	Substratum (60-100 cm)
Clay	56	56	56	63	59	61
Clay Loam	44	0	44	35	14	37
Loam	-	44	-	2	25	2
Muck	-	-	-	-	2	-
Total	**100**	**100**	**100**	**100**	**100**	**100**

Source: SRDI Note: NCA- Net Cultivable Area

6.12.4 Soil quality

Soils of the study area show acidic in nature due to high salinity in water and practice of shrimp cultivation. Table 6.16 presents soil quality of the project area. Three samples were collected from project site and analyzed in the laboratory.

Table 6.16 Chemical properties of soil of the study area

Sl. No.	Parameters	Sample No. 7	Sample No. 8	Sample No. 9
1.	pH	8.10 at 20.50C	8.09 at 20.60C	8.87 at 20.60C
2.	Chloride	0.058%	0.082%	0.09%
3.	Sulphate	0.025%	0.032%	0.045%

Source: Laboratory Test, 2011

6.12.5 Land use

The total study area was considered at 10 km radius from the stack location of the proposed coal based thermal power plant. The gross study area is about 34,955 ha, of which 26,344 ha is available for cultivation. The net cultivable area (NCA) is about 75.4% of the gross area. The other major distributions are: 0.5% intertidal, 0.2% mangrove, 0.1% water bodies, 9.3% rivers, 0.41% roads and 14.1% settlements. In the project area, all the lands are used as mono-cropped. In the study area, about 63.3%, 32.8% and 3.9% lands are being utilized for single, double and triple cropped respectively. Detail land use of both project and study area is presented in Map 6.17 and Table 6.17 and Figure 6.10.

Table 6.17: Land use of both project and study area

Land use	Project area		Study area	
	Area (ha)	%	Area (ha)	%
Gross area	742.2		34955	
Agriculture land	706	95.1	26344	75.4
Single crop	706	100	16676	63.3
Double crop	-		8641	32.8
Triple crop	-		1027	3.9
Intertidal area	8.4	1.1	192	0.5
Mangrove	3.2	0.4	60	0.2
Water bodies	15	2	41	0.1
River	3	0.4	3241	9.3
Road	1.1	0.2	137	0.4
Settlement	5.5	0.8	4940	14.1

(Source: Satellite image analysis)

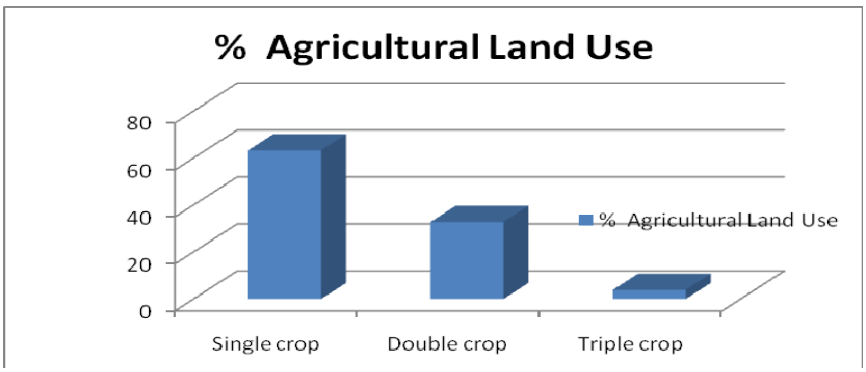
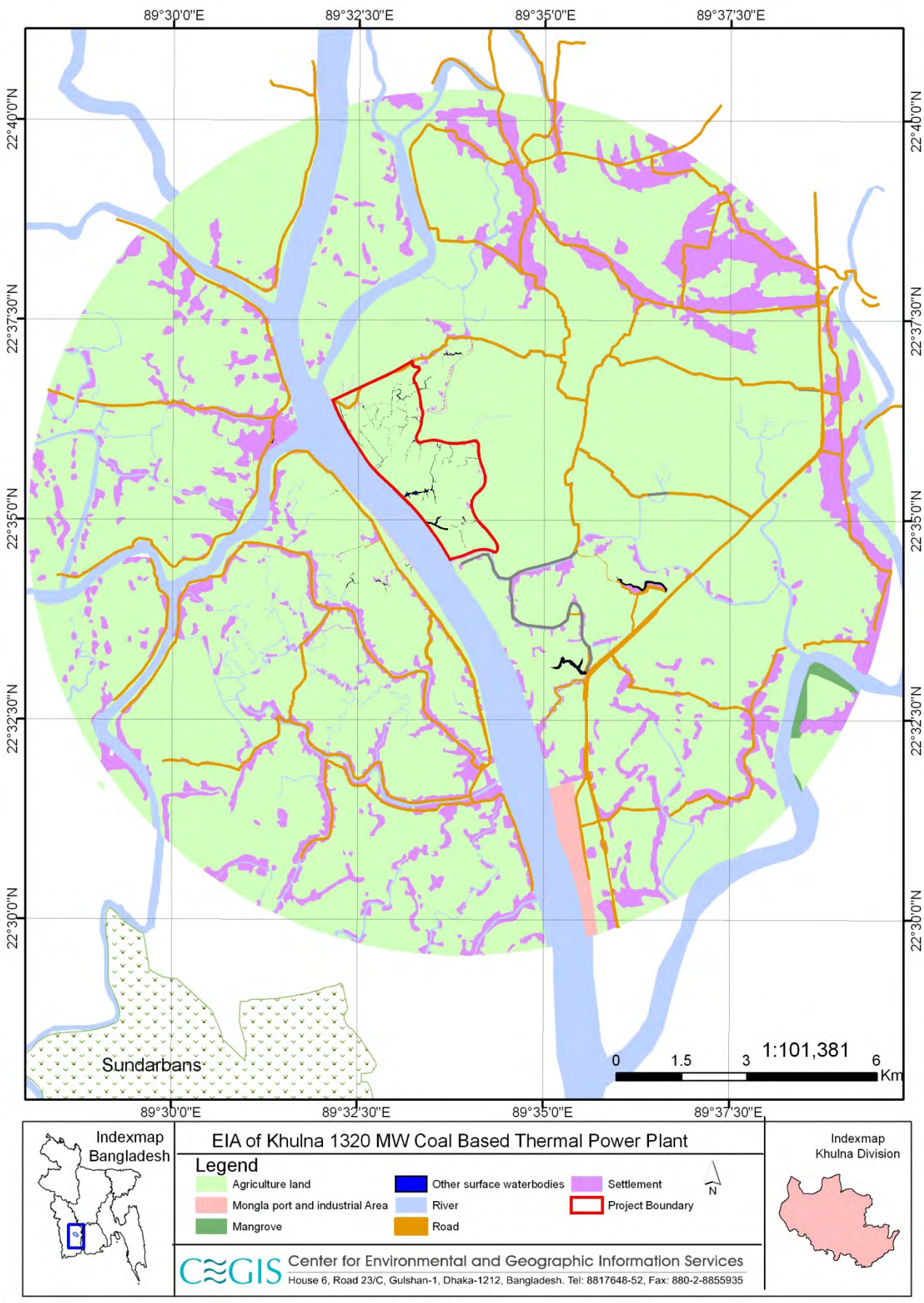


Figure 6.10: Agricultural Land Use in the Study Area



Map 6.17: Land use map of the study area

6.13 Agriculture

The gross area of the study area is about 34,955 ha of which 26,344 ha are being used for agriculture. The percentage of net cultivable land is about 75.4% against the total gross area. The net cultivable area (NCA) has been divided into two parts, one project site where NCA is about 706 ha and the study area where the NCA is about 25,638 ha. Both the project and the study areas have been considered for evaluation of baseline on various agriculture parameters for EIA/SIA of the proposed 1320 MW Khulna Coal Based Thermal Power Station.

6.13.1 Cropping Pattern

In project site, Fallow- T.Aman (Local)-Fallow is the only cropping pattern. This pattern covers about 100% of the net cultivable area (NCA). In the Rabi and Kharif-I season, the lands remains as fallow.

In the study area, the major cropping pattern is Fallow- T.Aman (Local)- Fallow which covers about 63.3% of the NCA. Fallow- T, Aman (Local)-Fruits (Water Melon/ Bangi) and B.Aus-T.Aman (Local)-Fallow cover about 8.8% and 7.0% respectively. Detailed cropping patterns are shown in Table 6.18.

In Kharif-I season, B.Aus, Jute and vegetables cover about 10.9 %, 3.5% and 6.0% respectively. The rest 86.6% remain as fallow.

In Kharif-II season, about 94.7% lands are covered with T.Aman (Local). The rest 5.3% lands remain as fallow.

In Rabi season, Boro (HYV), Vegetables, Fruits and Pulses cover about 5.1%, 6.0%, 12.7% and 2.4% respectively. In this season, about 73.8% lands remained fallow.

Table 6.18: Existing Major Cropping Pattern

Kharif-I (Mar-Jun)	Kharif-II (Jul-Oct)	Rabi (Nov-Feb)	Project Area (ha)		Study Area(ha)	
			Area (ha)	% NCA	Area (ha)	% NCA
Fallow	T.Aman(Local)	Fallow	706	100	16676	63.3
Vegetables	Fallow	Vegetables	-	-	1581	6.0
Fallow	T.Aman(Local)	Fruits	-	-	2318	8.8
B.Aus	T.Aman(Local)	Fruits	-	-	1027	3.9
Fallow	T.Aman(Local)	Pulses	-	-	632	2.4
Jute	T.Aman(Local)	Fallow	-	-	922	3.5
B.Aus	T.Aman(Local)	Fallow	-	-	1844	7.0
Fallow	T.Aman(Local)	Boro(HYV)	-	-	1344	5.1
		Total	**706**	**100**	**26344**	100.0
Cropping Intensity (%)			**100**		**100**	

Source: DAE, Rampal and Field survey, 2010

The cropping intensity of project and study areas are about 100% and 141% respectively. The overall cropping intensity of the study area is about 129%.

6.13.2 Crop Calendar

The detailed crop calendar of different crops of the project and study area is presented in Table 6.19. It is observed that the raising of seedlings generally starts in early July and end in early August and transplanting starts in mid August and continues up to mid-September depending on rainfall and salinity. Sowing of broadcasting Aus (B.Aus) generally stats from late March and continues untill late April. Boro (HYV) crops are transplanted during late December to late January. The seeds of water melon/Bangi are generally sown in December–January just after recession of water from the field. T.Aman (Local) crops are harvested during December whereas the harvesting of B.Aus is generally done during mid July to mid August. Some vegetables are very sensitive to temperature. Therefore, the time of sowing and harvesting of vegetables vary.

Table 6.19: Crop calendar

Crop name	Seedling		Transplanting/Sowing		Harvesting	
	Start	End	Start	End	Start	End
T.Aman(Local)	Early July	Early Aug.	Early-Aug	Mid-Sep	Early-Dec	Late-Dec
B.Aus	-	-	Late-Mar	Late- Apr	Mid-Jul	Mid-Aug
Boro(HYV)	Mid-Nov	Mid-Dec	Late Dec	Late Jan	Late Aril	Late-May
Vegetables(W)	Early Nov	Dec	Nov	Dec	Jan	May
Vegetables(S)	June	July	-	-	Aug	Oct
W.Melon/Bangi	-	-	Mid-Dec	Mid-Jan	Mar	June
Pulses	-	-	Mid-Nov	Mid-Dec	March	April
Jute			Late –Mar	April	Late-Jul	Mid – Aug

6.13.3 Crop production and damages

In the entire study area (project and 10 km radius from plant location), about a total of 62,353 m tons rice is being produced after the loss of about 9,455 m tons annually. About 140,461 m tons of non-rice crops are also grown in the study area.

In project area, all the agricultural production is coming from rice. Total annual paddy production stands at about 1285 tons after loss of about 467 tons. Transplanted Local Aman is the only crop grown in this area.

In the study area, major agricultural production is coming from the rice crops. The total annual paddy production stands at about 62,353 tons after loss of about 9,455 tons. Among the rice crops, Boro is contributing about 8%, T. Aman (Local) about 83%, and B.Aus about 9% of the total paddy production.

A significant agriculture production is also coming from non-rice crops especially in the Polder areas of Dacope Upazila. The non-paddy crops are Summer Vegetables (about 18,972 tons), Winter Vegetables (22,134 tons), Water Melon/Bangi (about 97,005 tons), Pulses (about 505 tons) and Jute (about 1844 tons). Detail crop production (both project and study area) is presented in Table 6.20.

Table 6.20a: Estimated crop production and damage in project and study area

Study Location	Crop name	Crop Area (ha)	Damage free		Damaged		Total production (ton)	Production lost (ton)
			Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)		
Project area	T Aman (Local)	706	459	2.45	212	0.65	1285	467
	Total						Total	1285
Study Area	B.Aus	2871	2440	2.1	431	1.02	5,564	465
	T.Aman (Local)	24058	19246	2.45	4812	0.75	50762	8180
	Boro (HYV)	1344	1210	3.8	134	1.25	4764	343
	Total paddy	28273	22896	-	5377	-	61,091	8,988
	G. Total paddy	28979	23,355	-	5,588	-	62,353	9,455
	Rabi(pulses)	632		0.8	-	-	506	-
	W.Melon/Bangi	3345		29	-	-	97005	-
	Jute	922	-	2	-	-	1844	-
	Vegetables(S)	1581	-	12	-	-	18972	-
	Vegetables(W)	1581	-	14	-	-	22134	-
	Non-paddy	8061	-	-	-	-	140461	-

Source: CEGIS Estimation from field information, 2010

The crop damage data have been collected from the fields for the last three years from outside and inside embankment, drainage congestion areas, coastal saline areas with consultation of concerned farmers and officials of DAE for both project and study areas. Paddy is the main crop in these areas. Therefore, annual crop damage (paddy production losses) within project and study area has been evaluated. The detail crop area, crop damaged area, yield rate of damaged area, damaged area production and production loss have been shown in Table 6.22.

About 5,588 ha area of B.Aus, T. Aman (Local) and Boro (HYV) are affected due to tidal surge, drainage congestion/water logging, soil and water salinity, natural calamities (like SIDR, Aila) and pest and disease infestation resulting crops damage. Annual production loss of paddy is about 9,455 m. tons (project area 467 tons and study area 8,988 tons).



Plate 6.7: Fallow land in the project area



Plate 6.8: Seedbed in the study area



Plate 6.9: T. Aman rice in the study area



Plate 6.10: Farmer is applying pesticide in T. Aman

6.13.4 *Agricultural input use*

Fertilizer and pesticides application

The rate of use of fertilizer per hectare varies considerably from farmer to farmer depending on soil fertility, cropping pattern and financial ability. The major fertilizers used in this area are Urea, TSP and MP. In most of the cases, farmers use fertilizers in unbalanced way.

Use of pesticides depends on the degree of pest infestation. The major insects as reported by the farmers are Stem borer, Rice Hispa, Leaf rollers and Millibugh etc. Local farmer reported that they are using different types of pesticides such as Dimacron (100L), phosphamidan (100L), Basudin (10G), Furadan (3G), Diazinon (10G) Diazinon (60L) etc. to prevent pest infestation both in Boro and T. Aman (Local) crop lands. Granular pesticides are generally used in Boro (HYV) crops. Farmers generally use pesticides in limited scale in T.Aman (Local) crops for the prevention of white fish from pesticide toxicity. Very few farmers use fungicide as powder for seed treatments. Detail use of fertilizers and pesticides are shown in Table 6.20b. Integrated pest management (IPM) practices were not observed during field visit in the study areas.

Table 6.20b: Estimated fertilizer (M. Ton) and Pesticides use in the project and study Area

Name of Crops	Fertilizer used (Kg/ha)			Pesticides		
	Urea	TSP	MP	No. Application	Liquid (ml/ha)	Granular (kg/ha)
T.Aman(Local)	98	40	20	1-2	400	-
B.Aus	100	40	20	1-2	400	-
Boro(HYV)	150	50	25	1-2	400	7.-8
Vegetables (S)	140	60	20	2-3	500	--
Vegetables (W)	150	60	25	2-3	500	-
Water Melon/Bangi	180	50	50	2-3	500	-
Pulses	-	-	-	-	-	--
Jute	50	-	-	-	-	-

Source: Based on field survey and DAE

6.13.5 Irrigation

In the project area, all cultivable lands are more or less salt affected and are being used as mono-cropped and only T. Aman (Local) is being practiced in Kharif-II under rain-fed condition. In the study area, both T. Aman (Local) and B. Aus are grown under rain-fed condition. However, Boro (HYV) is being practiced under irrigated condition in the study area, which is only 5.2% of the NCA. Irrigation is provided with the help of Shallow Tube Wells (STWs). Most of the irrigation water of STWs is slightly saline (EC 1.5 dSm^{-1}-3.5 dSm^{-1}) in nature. Therefore, the cultivation of Boro (HYV) is affected by salinity. As such the cultivation of Boro (HYV) is limited .

6.14 Livestock and Poultry

Livestock and poultry, being an essential sector of integrated farming system, play an important role in the economy of the study area. Livestock provide significant draft power for cultivation, threshing and crushing of oil seeds. Cow dung is used as a source of manure and fuel. Meat, milk and eggs are used for human consumption and a ready source of funds. Most of the households raise poultry and livestock, a practice that significantly reduce the poverty by generating employment and income. About 61% and 55% of households are rearing cows/bullock, 2% and 2.3% of household are rearing Buffalo; 48% and 47% of household are rearing goat; 1% and 1% of the household are rearing sheep, 66% and 71% of household are rearing duck and 71% and 74% of household are rearing chicken of the project area and study area respectively. The livestock and poultry population per households in the project and study area are estimated to comprise of 4 and 3 cattle, 3 and 2 buffaloes, 4 and 4 goats, 1 and 1 sheep, 5 and 5 duck and 7 and 6 chicken respectively (Table 6.21).

Table 6.21: Percentage of household having livestock and poultry and number of livestock and poultry of the project and study area

Name of Livestock and Poultry	% of HH having Live-stock/Poultry		No. of Livestock/poultry per HH	
	Project Area	Study Area	Project Area	Study Area
Cow/Bullock	61	55	4 (1220)	3 (51,866)
Buffalo	2	2.3	3 (30)	2 (144)
Goat	48	47	4 (960)	4 (59,094)
Sheep	1	1	2 (10)	1(628)
Duck	66	71	5 (1650)	5 (1,11,590)
Chicken	71	74	7 (2484)	6 (1,39,566)

Note: Here, study area considers around 10km radius from the plant location. Numbers in parenthesis indicate total number of livestock/poultry.



Plate 6.11: Cows and ducks in project area



Plate 6.12: Cattle with cattle shed in study area

6.14.1 Feed and Fodder shortage

The owners of the livestock population are facing problems in respect of availability of fodder and feeds during the month from March to December due to shortage of grazing fields. In dry and Kharif-I seasons, the lands are generally submerged with saline water especially in the project area and major portion of the study areas. During Kharif-II season, the fields are covered with T. Aman (Local). Rice straw is the main fodder for cattle. Bran of wheat and rice, oil cakes, powder of cereal crops etc. are the other common fodders, but the availability of these feed in these areas is rare. Shortage of grazing area throughout the year aggravates the feed problem to the animal population. Poultry population at family level survives by scavenging and generally, no feed supplements are provided. However, at times kitchen waste becomes feed to the poultry.

6.14.2 Livestock/Poultry Diseases

Productions of livestock and poultry are mainly constrained due to diseases and death of the population. Outbreak of disease is causing a considerable economic loss in livestock farming. Different diseases like foot and mouth disease (FMD), Anthrax, Diarrhea, PPR etc, affect every year livestock population . The got/cyst in head is common disease of goat. Major poultry diseases are Duck Plague, Paralysis, New Castle, Fowl pox, and Dysentery etc. The most vulnerable period is between July to October (rainy season) months for spreading diseases to livestock and poultry populations. The duck plague generally occurs in summer. During monsoon season, the soggy condition of the animal shelter promotes various kinds of diseases to the bullocks and cows. Moreover, the unhygienic condition of the courtyards during this season may cause the diseases to the poultry birds.

6.15 Fisheries

The fisheries resources of the study area are rich and diversified with mainly brackish water to minor fresh water fish habitats. The area has a close connection with mangrove forest providing support to a number of marine and fresh water fishes. The network of river systems of this region connects the fresh water fish habitats with the brackish water habitats and maintains biological balance of the major fish groups.

6.15.1 *Fisheries diversity (Species composition and biodiversity)*

The species composition of fishes in the study area is still rich in its diversity and is believed to have about 120 species. Among the brackish water fishes; Hilsa, Parsha, Tapashi, Bhetki, Tulardandi, etc. are abundant in the study area. The tapashi, bhola, amadi (bairagi) fishes are presently available in the confluence of the Passur-Maidara, Passur-Chinkura rivers. Golda and Bagda post larvae (PL) are still abundant in the Passur, Chinkura and Maidara River and its tributaries. The puti, kholisha, taki, baila, shing, etc. are the main species of the beels and floodplains of the study area, which are mainly located in the eastern part of the study area namely *Chitra, Khalekar-Ber andKalikaprasad* etc. location. It is also estimated that exotic carp species are available in the culture system in the study area. In addition, species of tilapia are also cultured in the study area.

It has been reported by the local fishermen and evident from the catch that the biodiversity of fishes is declining over the years. Multiple factors affecting the species diversity like over fishing pressure, collection of shrimp and prawn PL results high mortality of other aquatic fauna, obstruction in fish migration routes, changes the geo-morphological processes of rivers and its connectivity, rapid siltation of fish habitats, squeezing of spawning and feeding grounds and high expansion of culture fishery. Fishes occupying the catch composition from different habitats are Indian major carps, catfish, minor carps, eels, perches, shrimps, prawns, and gobids, mugil, etc. A list of indicative fish species of the study area is given in Table 6.22.



a. ESBN catch composition



b. Composition of shrimp farm yield



c. Other fish species



d. Composition of push net

Plate 6.15: Fish and shrimp species composition of catch

Table 6.22: Indicative fish species diversity of different fish habitats within study area and their breeding period

Here, A=Absent and P=Present, VU=vulnerable, EN=Endangered

Sl. No	Scientific name	Local name	Common English name	Status IUCN	Habitat				Breeding period
					River	Khal	Wet land	Pond	
1	*Acanthopagrus berda*	Sada Datina	Sea Bream		P	A	A	A	
2	*Acanthopagrus latus*	Datina	Yellow Sea Bream		P	A	A	A	
3	*Acentrogobius caninus*	Baila	Tropical Sand Goby		P	P	A	A	
4	*Aila coila*	Kajoli	Gangetic Aila		P	P	A	A	
5	*Apocryptes bato*	Chiring	Prawn		P	A	A	A	
6	*Brachygobius nunus*	Nuna baila	Goby		A	A	A	A	
7	*Catla catla*	Catla	Katla		P	P	P	P	
8	*Cirrhinus mrigela*	Mirka	Mrigel		P	P	P	P	
9	*Clupisoma naziri*	Muri Bacha	Indus Garua		P	P	A	A	
10	*Ctenopharyngodon idellus*	Grass carp	Grass carp		A	A	A	P	
11	*Cyprinus carpio*	Carpio	Common carp		A	A	A	P	
12	*Garra gotyla*	Ghor Poia	Gotyla		P	P	A	A	
13	*Hypopthlmichthes molitrix*	Silver carp	Silver carp		A	A	A	P	
14	*Labeo boga*	Bhangon	Boga Labio		P	P	A	A	
15	*Labeo calbasu*	Calbaus	Black Rui	EN	P	P	P	P	
16	*Labeo rohita*	Rui	Rohu		P	P	P	P	April- Aug
17	*Lates calcarifer*	Koral	Sea Bass		P	P	A	A	June-July
18	*Lepidosephalus guntia*	Gutum	Guntia Loach		P	P	P	A	
19	*Liza parsia*	Parse	Gold spot Mullet		P	A	A	A	
20	*M. gulio*	Guillya	Long whiskered cat fish		P	P	P	A	
21	*Macrognathus aculatus*	Baim	Tire-track Spiny eel		P	P	P	P	

Sl. No	Scientific name	Local name	Common English name	Status IUCN	Habitat				Breeding period
					River	Khal	Wet land	Pond	
22	*Mastacembalus armatus*	Sal baim	Tire-track Spiny eel		P	P	P	A	Aug-Sep
23	*Monopterus cuchia*	Kuicha	Cuchia	VU	P	P	P	P	
24	*Mugil cephalus*	Bhangon	Flathead Mullet		P	A	A	A	
25	*Mystus gulio*	Nona-tengra	Catfish		P	P	P	A	
26	*Mystus tengara*	Bajari-tengra	Tengra Mystus		P	P	A	A	
27	*Nandas nandas*	Meni	Mud perch		P	P	P	P	
28	*Oreochromis niloticus*	Tilapia	Tilapia		A	A	P	P	
29	*Plotosus canius*	Gang magur	Canine Catfish	VU	P	A	A	A	
30	*Polynemus paradiseus*	Tapsi	Paradise Threadfin		P	A	A	A	
31	*Pama pama*	Poa	Jew fish		P	P	A	A	
32	*Rhinomugil corsula*	Bata	Mullet		P	A	A	A	
33	*Rita rita*	Rita	Rita	EN	P	A	A	A	
34	*Sillaginopsis panijus*	Tular dandi	Flathead Silage		P	P	A	A	Aug-Sep
35	*Tenualosa ilisha*	Ilish	Hilsha		P	P	A	A	
36	*Thrssa mystex*	Faisha	Anchovy		P	P	A	A	
37	*Trypauchen vagina*	Sada chewa	Burrowing goby		P	P	A	A	

Sources: Red Book of threatened Fishes of Bangladesh, IUCN and fishermen consultation Crab Fishery

Crab is going to be an important species for its market demand worldwide. Both natural harvesting and cultivation (crab fattening) of crab species (mainly *Scylla serrata*) is a growing practice in southwestern part of Bangladesh. The study area is also influenced with these practices particularly the culture of mangrove mud crab, *Scylla serrata*, and harvesting of crabs from nature. The natural crabs are collected from inter-tidal creeks, *khals*, mangrove area and rivers using local traps and Estuarine Set Beg Net (ESBN). Apart from this, some crab fattening practices was also observed along with the shrimp farm (Plate 6.16 and Plate 6.17).



a. Crab fattening pond



b. Natural crab harvesting

Plate 6.16: Crab fattening practices



c. Mud crab- a cultivable species



d. Crab species of ESBN catch

Plate 6.17: Crab fattening practices in the study area

6.15.2 Fish habitat

The fish habitats in the study area are classified into brackish to fresh water rivers, *khals* and Sundarbans creeks, tidal and non-tidal floodplains. Most of the creeks and *wetlands* in this region serve as tidal basins as well as breeding and feeding grounds for brackish water fishes. The lands are mostly occupied by the shrimp gher and the communities are almost habituated with these activities. Fish habitats may be classified into two major groups- capture fish habitat and culture fish habitat.

Capture fish habitat

Capture fish habitats of the study area are classified into brackish to fresh water rivers, *khals* and Sundarbans creeks, *beels*, tidal and non-tidal floodplains. Most of the creeks and *beels* in this region serve as tidal basins as well as breeding and feeding grounds for brackish water fishes. The estimated total capture fish habitat of the study area is about 1,179 ha where around 41 ha is to be found in the in the project area. Rest of the habitat for capture fisheries is found within 5 km from the project site (Table 6.25). About 17% of the area (river 15.6%) falls under capture fishery habitat with respect to total study area whereas 5.6% area covering the capture fishery habitat within the project boundary (Plate 6.13).



a. River habitat- Maidara



b. Passur-Chunkuri confluence



c. Tidal Khal



d. Mangrove supported habitat

Plate 6.13: Different open water fish habitats

Culture fisheries

Culture fish habitats of the study area are classified as closed shrimp gher, which is commercially most important, fishponds, and few semi-closed water bodies (*Khals*). The estimated culture fish habitat area is about 5,816 ha, which is more than 62% of the total fish habitat area. Out of this, around 866 ha are situated in the plant area, which is more than 9 % of the total fish habitat within the project boundary (Plate 6.14). The area of different fish habitats are given in Table 6.23.



a. Shrimp farm



b. Homestead fish pond

Plate 6.14: Different habitats of culture fishery

Table 6.23: Analysis of fish habitat area of the study area

Sl. No.	Type of Habitats	Study Area (ha)	Project Area (ha)
Open water/Capture fish habitat			
1	Intertidal area	192.32	8.46
2	Mangrove	59.86	3.23
3	Other surface water bodies/ *Khals*	41.39	15.07
4	River	3241.79	03.08
	Sub-total	3535.36	29.84
Culture Fish habitat			
5	Shrimp Farm/Fish Pond	5,816.26	705.77
	Total	**9351.62**	**735.39**

Source: CEGIS estimation using Satellite image, 2010

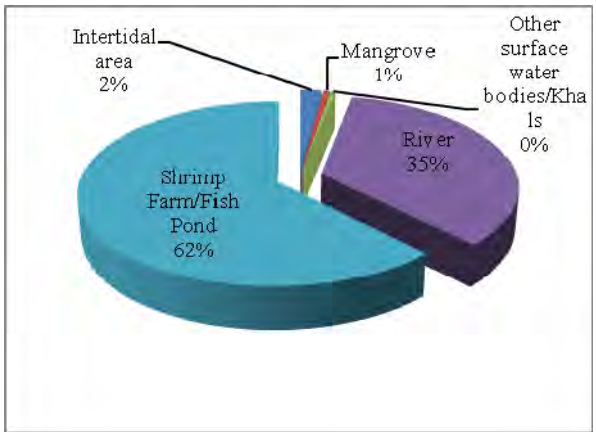


Figure 6.11: Fish habitats classification for total study boundary

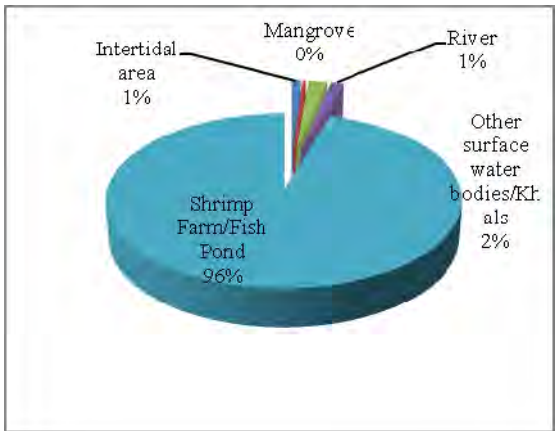


Figure 6.12: Fish habitats classification for project boundary

Overall fish habitat in the study area is about 9351.62 ha, of which 735.39 ha is situated in the project area, which will be acquired for power plant installation. Shrimp/fish farm habitat occupies about 62 % of area followed by rivers and *khals* (35%), and rest 3% includes the intertidal creeks, mangrove area and other surface area. A list of the habitats is given in Table 6.23.

6.15.3 Fish production

The open water fishery (inland and marine coastal) resource in the study area is derived from rivers and *khals*, and inter-tidal areas, including some mangrove area. Rivers and *khals* serve as the main migratory route for different fish species. The culture fishery resource is derived mainly from the shrimp *ghers*, pond fisheries, and brackish and fresh water fish farming. The estimated total fish production of the study area is about 5218.66 M.ton, which comes from both capture fisheries (565.66 M. ton) and culture fisheries (4653. M.ton). On the other hand, the estimated total fish production from the project area (project boundary) is about 569.41 M.ton (capture 4.79 M.ton & culture 564.62 M.ton). The production from different fish habitats and the contribution of different habitats (%) are given in Table 6.24, and Figure 6.13 and 6.14.

Table 6.24: Analysis of the fish production from the study area

Sl. no.	Name of the habitat	Study area		Project area	
		Area (ha)	Production (M.ton)	Area (ha)	Production (M.ton)
1.	a. Aquaculture: Shrimp	5816.26	2326.50	865.53	282.31
	b. Aquaculture: Fish		2326.50		282.31
		sub-total	***4653.00***	***865.53***	***564.62***
2.	Intertidal area	192.32	30.77	8.75	1.35
3.	Mangrove	59.86	9.57	3.23	0.52
4.	Other surface water	41.39	6.62	15.07	2.41
5.	River	3241.79	518.7	12.10	0.5
		sub-total	***565.66***	***41.93***	***4.79***
		Total	**5218.66**	**Total**	**569.41**

Source: CEGIS analysis using FRSS, 2008-09 published data and on-field calculation

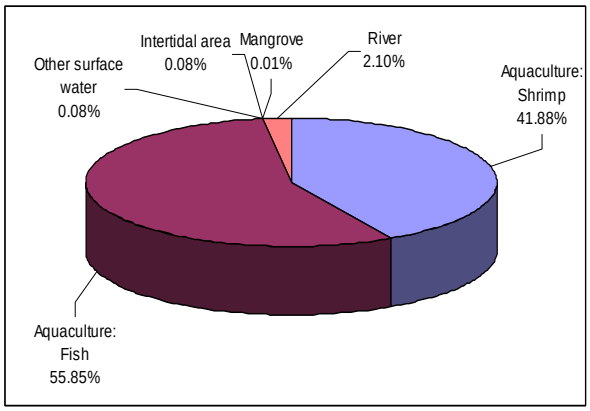


Figure 6.13: Fish and shrimp production status for total study boundary

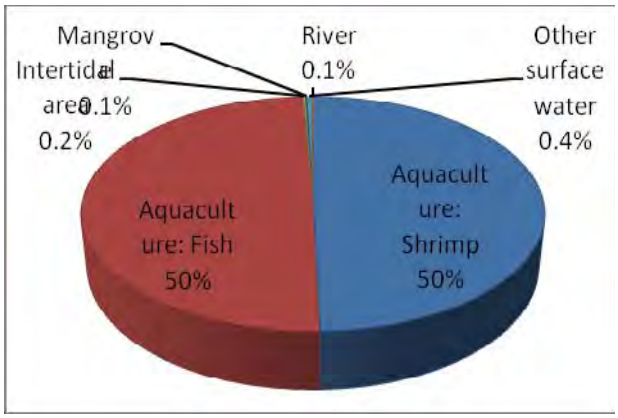


Figure 6.14: Fish and shrimp production status for project (plant) boundary

6.15.4 Fish migration

The Passur-Chikura, Passur-Maidara river system including the inter-tidal creeks is the major migration arteries of the study area. Both anadromous and catadromous fishes migrate through this line for meeting different biological requirements throughout the year.

6.16 Shrimp fry Collection

PL collection is the most common practice in the southern region of Bangladesh as well as in the study area. Near project area, fry collection activities are concentrated at right bank of the Passur River while the project is located at the left bank. Nevertheless, the PL collection practices are occasionally seen at left bank of the river near northern part of the project site. Men, women and children are involved in collection of shrimp fry. Mostly, they come from the poor households of the area. Even in some cases, the female members of affluent households are also involved in fry collection in the area. PL collection has some significant

environmental issues. During collection of one shrimp PL, they destroy about 100 other types of aquatic species resulting loss of fisheries biodiversity rapidly in the region.

6.17 Plankton and Benthos/other microscopic invertebrates

The study areas reach with microscopic invertebrates and benthos communities that play a critical role of the adjacent ecosystems. The information of plankton and other microscopic invertebrates' species has been collected from secondary literature review showing in Table 6.25.

Table 6.25: Phytoplankton and Zooplankton species in the Mongla port area

Phytoplankton		Zooplankton		
Class	**Genus**	**Phylum**	**Class**	**Genus**
Chlorophyceae	*Closterium sp* *Hydrodictyon sp* *Chlorella sp*	Arthropoda	Crustacea	*Merocyclops sp* *Mesocyclops sp.* *Cyclops sp.* *Diaptomus sp.* *Bosmina sp.* *Diaphasomqa sp* *Praunus sp.* *Mysidella sp.* *Epinebalia sp.* *Tigriospus sp.* *Oxyurostylis sp.* *Anatanis sp*
Cyanophyceae	*Lyngbya sp* *Oscillatoria sp* *Schizothrix sp* *Calothrix sp* *Spriulina sp* *Microcolens sp*			
Baillariophyceae	*Gyrsigma sp* *Navicula sp* *Cyclotella sp* *Coscinodiscus sp*			

Source: Amin et al., 2008

6.18 Other Aquatic species

The fish and other aquatic faunal sample collected from the fishermen and indigenous person were identified by standard zoological classification method (Banerjee, 1991). It was found that most of the above species of fish are of deformed size and shape. The deformed shape of the aquatic organism might give the evidence that they might be altered by the influence of changed the environment of the Mongla Port water. However, the fish and other species found in the port area are listed in Table 6.26and Table 6.27.

Table 6.26: The Moluccas fauna found in Mongla port area

Phylum	Local name	Scientific name
Mollusca	Shamuk	*Narita lineata*
		Turbo (Lunella) cinereus
		Luteria elongata
	Zebra s*hamuk (Invasive)*	*Zebra mussel/ Dreissena polymorpha (ESA,1998)*

Source: Amin et al., 2008

Table 6.27: Fish and shrimp species found in catches of different spot of the Passur River

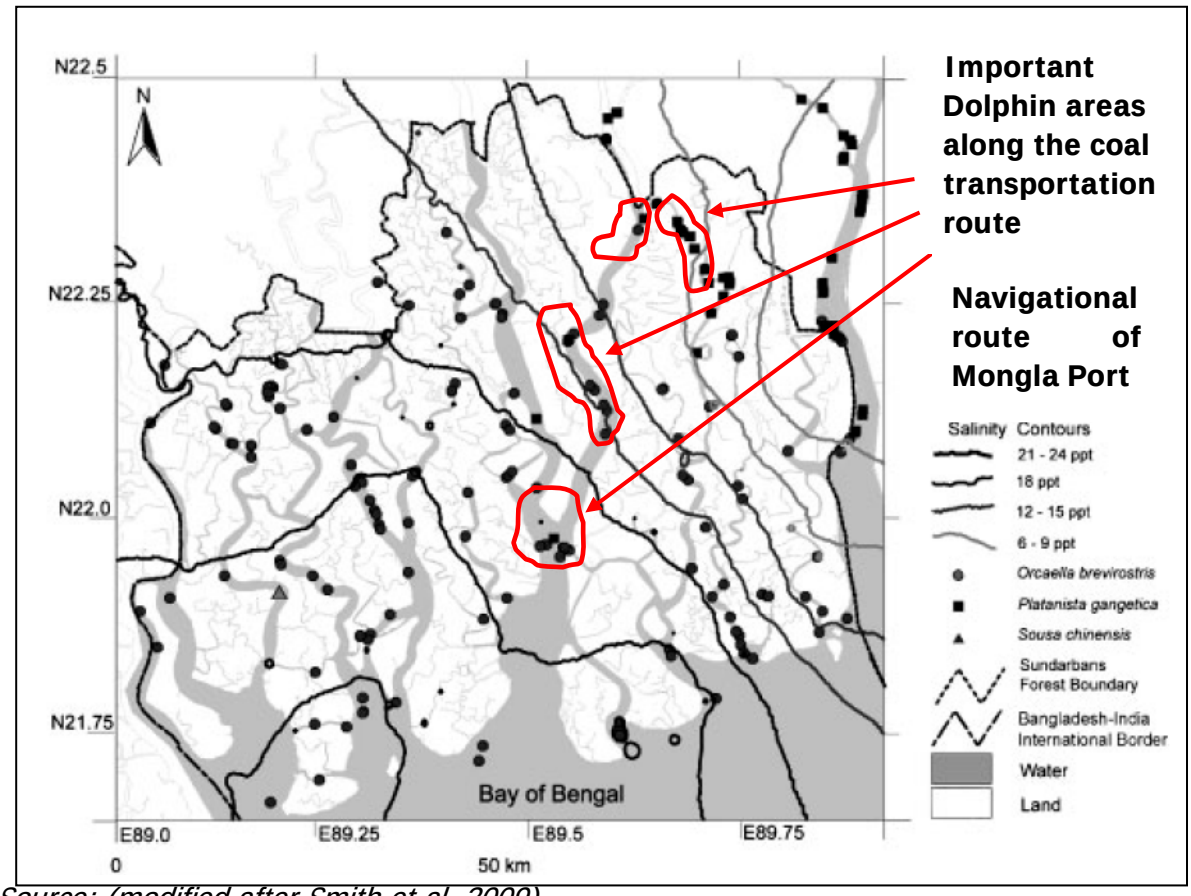
Species	Local name	Scientific name	Remarks
Native	Bagda pona	*Penaeus monodon*	
	Golda pona	*Macrobrachium rosenberii*	
	Paisha	*Liza persia*	
	Taposhi	*Polynemus paradisous*	
	Vatki	*Lates calcarifer*	
	Datina	*Sparus datina*	
	Vhola	*Barilius Bole*	
	Illish	*Hilsa ilisha*	
Invasive	Tilapia	*Tilapia mossambica*	These fish are identified as invasive by Rahman,1997
	Nilotica	*Oreochromis niloticus*	
	Pangus	*Pangasius sutchi*	
	African Magur	*Clarias gariepinus*	

Source: Amin et al., 2008

6.19 Dolphin

The river is also a home for Ganges River Dolphin (*Platanista gangetica*). At least 12 dolphins were observed during the survey. It is to be noted that freshwater dolphins are globally endangered and are protected under the Bangladesh Wildlife Act 2010. During the EIA detailed information on the occurrence of freshwater Dolphins and probable impacts were highlighted. The Passur River is the habitat of good number of fish, Irrawaddy dolphin, Ganges River Dolphin and Estuarine Crocodile.

The existing navigation route for approaching Mongla Port to be followed for coal transportation is also important for the critically endangered mammalian species, freshwater dolphins and Irrawaddy dolphins and saltwater crocodiles and an important bird – the masked fin foot (See Map. 6.18). The Sundarbans is also the last resort for the saltwater crocodiles and hence it is important that utmost care and stringent conditions be laid down for the safety and sustenance of this unique ecosystem and ecological services and natural/biological resources it is providing to support the biodiversity and livelihood of hundreds of thousands of people.



Source: (modified after Smith et al. 2009)

Map 6.18: The shipping route traverses through some of the important habitats of aquatic animals like Gangetic dolphin, Irrawaddy dolphin and saltwater crocodiles

Plate 6.24: Surfacing of Irrawaddy Dolphin in Maidara river





6.20 Ecosystem

The study area is tidal delta and geologically described as Paludal deposits that developed over swamp or marshland. The area is about 14 km northeastwards from the Nalian Range of Sundarbans. Once it was a part of Sundarbans but had been evacuated by the settlers. Tidal flushing is dominant within the entire study area with varied depth due to connectivity of the internal canals and with Passur River through several tidal inlets. Three types of

ecosystem exist in the project site and adjacent area. These are terrestrial, aquatic and mangrove ecosystem.

In general, brackish water ecosystem is dominant in the study area. However, the villages having high elevation, low tidal flushing and low salinity show brackish to fresh water ecosystem. The floristic composition also supports the facts. The transect-walks following the High-low land elevation and low-High tidal flushing brought out the ecological differences within the study area. The villages with high elevation, minimum tidal flushing and low salinity (only during dry season for 4 months): Chitra, Kalikaprashad and Rajnagar resemble the fresh water ecosystem where aquatic plants - red and white Water Lily (*Nymphaea nouchali*), Water Hyacinth (*Echhornia crassipes*), *Pistia stratiotes, Lemna minor* are indicative of the occurrence of fresh water.

6.20.1 Ecosystem habitats and biodiversity

Detailed survey along with the floral and faunal composition of the micro-habitat has been conducted during the EIA. This also helped in establishing some of the indicators for monitoring on a regular basis and also in measuring impact on the environmental conditions, both ecological and biological in the project vicinity. However, based on the field observations, the following seven habitat types were found within the study area's ecosystem (Table 6.28). The dominant habitat was shrimp farms that are inundated with the tidal waters.

Table 6.28: Habitat types found within project area of study area.

Sl. No.	Habitat Types/Ecosystem	Project Area (ha)	Study Area (ha)
1.	Agricultural/Shrimp farm	706	26,344.4
2.	Inter-tidal, mudflats, shoals	8.4	192.33
3.	Mangrove	3.23	*59.86
4.	Other surface water storage	15.0	49.4
5.	River	3.0	3241.79
6.	Roadside ecosystem	1.1	68.92
7.	Settlement/Homestead	5.5	762.69**
TOTAL		**742.0**	**≈7,827**
*NB: not actual, based on image analysis and estimation,** excluding homestead mangrove			

Source: CEGIS Estimation in 2010 from Image Analysis

These habitats are very important for diversified flora and fauna. The detail lists of flora and fauna available in the study area are provided in Annex XI with their status.

6.20.2 Ecosystems of the study area

The mangroves are dominating in the areas (Baserhula, Kapasdanga, Kaigar Daskati, Kalekhar Ber, Durgapur, Sapmari Katakhali, Biddarbon, Chakgona, Gonabelai, Belai, Chunkuri, Bajua and Saheberabad) with medium to low elevation, medium to high tidal flushing and medium to high salinity. The mangrove composition also varies with the land elevation, tidal fluctuation and salinity. Generally, mangroves grow in tidal canals, creeks, tidal inlets and outlets, roadside borrow pits, and tidal flood plains within the study areas.



Plate 6.18: *Gewa* tree at borrow pit along the road side in Kapasdanga



Plate 6.19: Mangrove vegetation along the tidal canal in Chunkuri



Plate 6.20: Patch of Nypa palm in Baserhula



Plate 6.21: Mangrove vegetation in Sapmari along the Passur River

6.20.3 Homestead forestation

Homesteads or settlements though scattered yet found in greater numbers on the eastern side of the study area. Most of the homestead cover consists of timbers plant species, few medicinal plants and some vegetables and fruit trees. These provided roosting area for the local resident birds and nesting sites for the waterfowl like egrets and herons.

6.20.4 Roadside vegetation

The roadside vegetation is mostly planted. Alien species like 'akashmoni' (*Accacia* sp.) is prevalent mostly around the homesteads on the eastern side of the study area. However, in the roadside areas closer to the Maidara river and affected tide water Gewa (*Excoecaria agallocha*) is the dominant species. The species composition of flora changes near by the Passur river such as Keora (*Sonneratia apetala*) and Ura become abundant with respect to rest of the areas. These are to have germinated naturally and grown over the years. Other mangrove species recorded along the river banks and tidal creeks include mostly Hargoza (*Acanthus ilicifolius*), Pakor, Amur (*Amoora cucullata*). Baen (*Avicennia* sp.) are rare. Golpata (*Nypa fruticans*) is seen close to the homesteads where local people planted them and few on the river bank while planted Sundri (*Hereteria fomes*) is also observed along the road side as well as on homestead. The roadside borrow pits also retain freshwater and

some of which are found with water lilies (*Nymphaea nouchali*) and some other aquatic vegetation like Topa pana (*Pistia stratoites*) and water hyacinth (*Eichhornia crassipes*). In some freshwater ponds water lilies are planted for bio-filtration and water from the pond is used for domestic purposes.



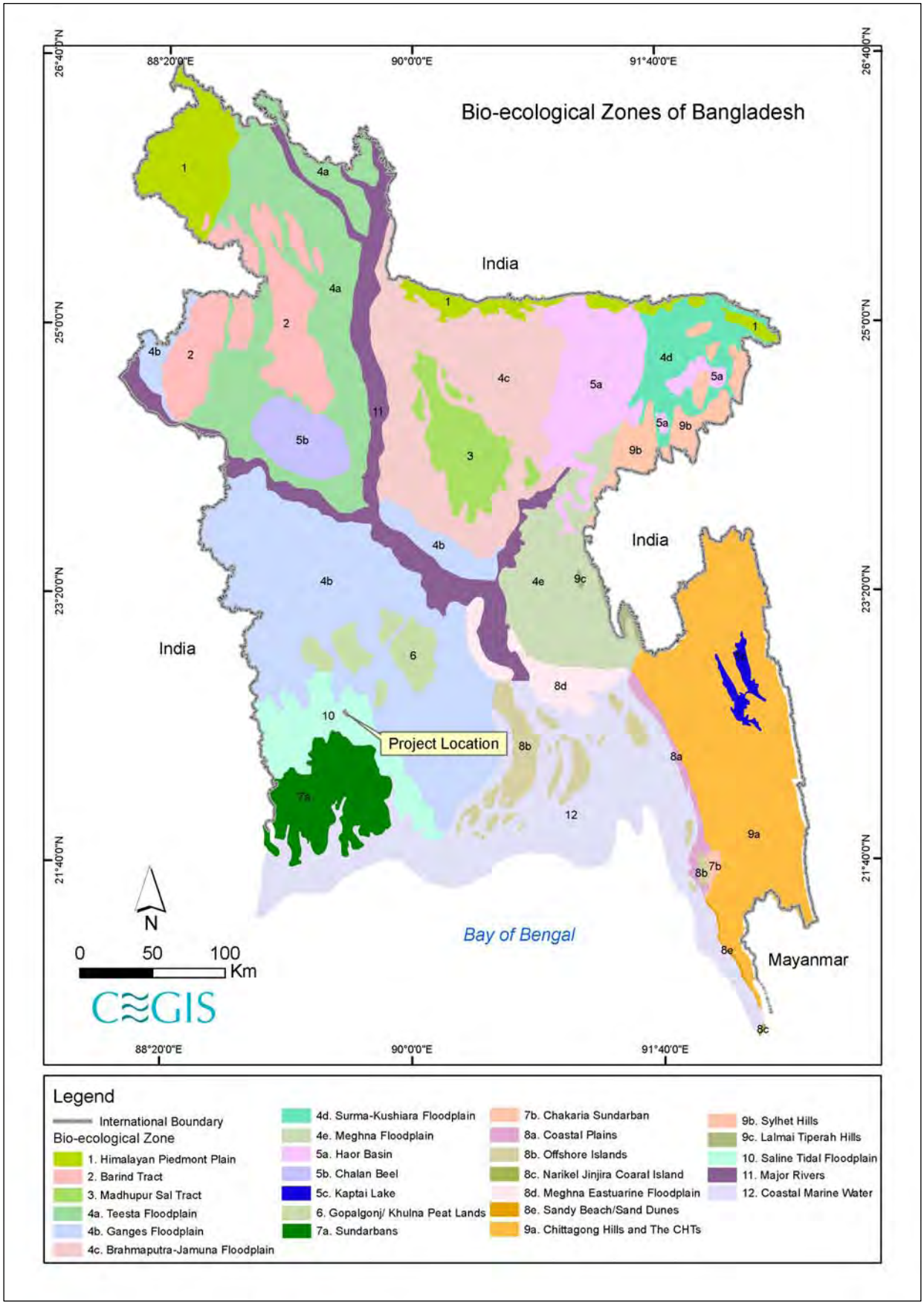
Plate 6.23: Agricultural land providing feeding ground for aquatic birds

6.21 Bio-ecological zone

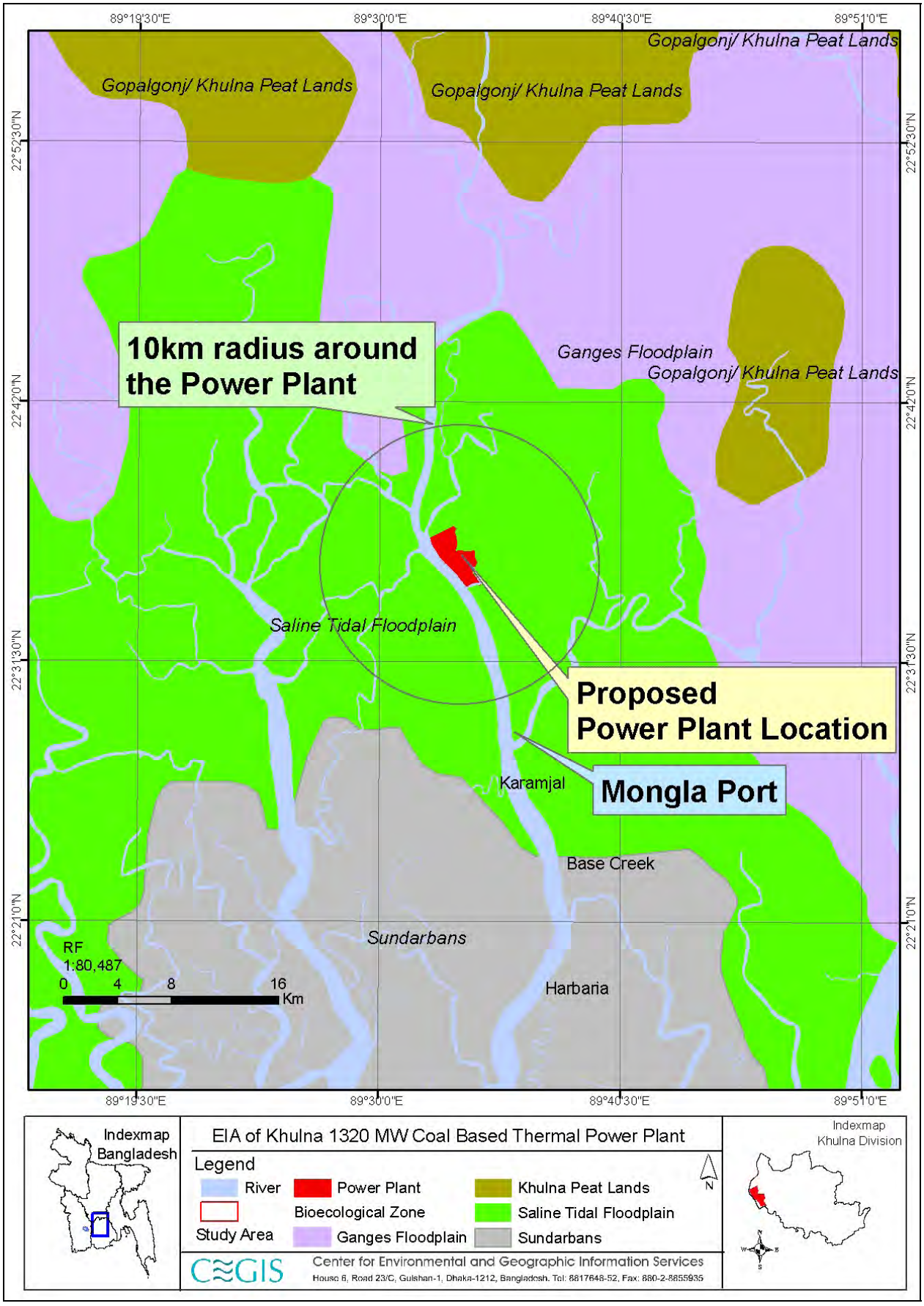
The study area consists of 4 different bio-ecological zones (Nishat *et al.*, 2002), namely

A. The Sundarbans (7a)
B. Saline tidal floodplain (10)
C. Ganges Flood plain (4b)
D. Gopalganj/Khulna Peat Land (6)

The Map 6.19 shows bio-ecological zones of Bangladesh (Nishat *et al.*, 2002) and Map 6.20 presents the bio-ecological zones occurring within the study area.



Map 6.19: Bio ecological zone of Bangladesh



Map 6.20: Bio-ecological zones occurring in the study area

A. The Sundarbans

The Sundarbans mangrove forest is situated in the southwest part of Bangladesh.. Sundarbans is the world's largest Mangrove forest consist of about 330 species of plants, 42 species of mammals, 35 species of reptiles, 400 species of fishes and 270 species of birds. Salinity and tidal influences provide a different type of ecosystem. Plants and wildlife species distribution depend on the salinity. The Sundarbans are divided in 3 ecological zones on different degrees of salinity.

1. Oligohaline zone
2. Mesohaline zone
3. Polyhaline zone

The Sundarbans mangrove forest extends from the Harinbhanga-Raimangal-Kalindi river system in the west and Baleswar river in the east. The Bangladesh Sundarbans now covers an area of about 5,770 km^2, of which 4,016 km^2 are land and the remaining 1,761 km^2 is under water, in the form of rivers, canals and creeks (Hussain and Karim, 1994). About 62% of the forest lies in the administrative districts of Bagerhat, Khulna and Satkhira in Bangladesh. This mangrove tract constitutes 44% of the total forest area in Bangladesh and contributes about 50% of the total revenue derived from the forestry sector (Tamang, 1982). However, the most important value of the Sundarbans stems from the protection it affords to millions of people against the ravages of cyclonic storms, surges and tidal waves, which frequently generate from the Bay of Bengal.

The mangrove of the Sundarbans is unique compared to the non-deltaic coastal mangrove forests. For instance, unlike in the cases of the other mangrove of the world, the Rhizophoraceae is of only minor importance and the dominant species are the Sundri (*Heritiera fomes*) of the Sterculiaceae family, from which the Sundarbans takes its name, and the Gewa (*Exeoeearia agalloeha*) of the Euphorbiaceae family. Other dominant plant species include the Passur (*Xyloearpus mekongensis*), Ohundal (*Xyloearpus granatum*), Kankra (*Bruguiera gymnorrhiza*), Keora (*Sonneratia apetala*), Baen (*Avieennia officinalis*), Golpatta (*Nypa fruticans*) and Goran (*Ceriops decandra*) (BWDB, 2001). This mangrove tract is also both diverse and complex in terms of faunal riches. Moreover, it is now the only refuge left for the national pride of Bangladesh: the Bengal tiger (*Panthera tigris*). In addition, its waterways and canals are richest fish-nurseries in the region. Despite the combination of high tidal flow velocity, heavy silt load and low light penetration, a remarkable diversity of finfish and shellfish exists inside the Sundarbans forest and in the adjacent marine zone of the northern Bay of Bengal. These are mainly of marine origin, but several freshwater species are able to take advantage of low salinity and freshwater conditions in the northern part of the forest.

Physical features

The Sundarbans are part of the world's largest delta, formed from the sediments brought down by three great rivers, the Ganges, Brahmaputra and Meghna, which converge on the Bengal Basin. The forest extends over some 200 islands, separated by 15 major distributaries rivers flowing north-south, and 400 interconnected tidal estuaries, creeks and canals. It forms an impenetrable saltwater swamp reaching 100-130 km inland, which supports the largest tidal mangrove forest in the world, covering 10,200 sq. km. Of this 595, 500 ha (59.3%) are in Bangladesh and 426,200 ha (42.5%) in India, 232,000 ha of which is land. The area is approximately three-fifths of the 16,700 sq.km that existed 200 years ago

having been cleared and converted to agriculture, especially in India (Hussain & Archarya, 1994). The forest swamp extensively embanked with an essential buffer for inland areas against the ravages of frequent cyclones from the Bay of Bengal. The landscape is dynamic, constantly molded and altered by tidal action, with erosion along estuaries and deposition along the banks of inner creeks augmented by the discharge of silt from seawater (Sanyal P, 1986). The wider rivers of this intricate network of waterways are over two kilometers wide, running north south and tend to be long and straight. They are maintained largely by the two diurnal flow tides over a tidal range of 3-5m up to 8m, together with the erosion-resistance of the clay and silt of their banks (Ghosh & Mandal, 1989).

The area has three main hydrological zones: brackish, moderately saline and saline, which influence the types of vegetation, which dominate each. As with the rest of the Bengal Plain, the alluvial deposits are geologically very recent but deep, sediments of just the last few million years being as much as 1,000m thick (Seidensticker & Hai, 1983).

Ecosystem niches of Sundarbans

The Sundarbans lie across the outer deltas of the Ganges, Brahmaputra and Meghna rivers. The forest is composed of small forested islands and mudflats intersected by an intricate network of tidal waterways. The area has a wide range of rare fauna, including the Bengal tiger, estuarine crocodile and many reptiles and birds. These mangroves are slightly elevated, isolated landmasses (like islands) under strong tidal influence. Mangrove plants are specially adapted to survive in saline conditions using pneumatophores. The mangrove root system, along with its buttress, helps to support the trees in the salty clay loam soil under strong water flow. Due to the variation in physical factors, such as topography, salinity, soil condition and tidal variation, vegetation composition within the Sundarbans varies widely. The Sundarbans can be divided into the following ecological niches (Figure 6.15).

a. Mudflats (sloping)
b. Ridges or levees
c. Back-swamps or basins
d. Main river channel
e. Tidal creeks
f. Bays of sandy shores

a. Mudflats

Mudflats or slopes can be defined as the areas exposed during low tides but going underwater during high tide. These are formed on the banks of rivers, canals and creeks. Slope formation is dependent upon hydrological conditions, topographical conditions and sediment particle size. Clay deposits over sandy bed and fine silts make up the mudflat. The angle of the slope and the width of the mudflat play a vital role in the formation of landmass, ultimately composed of vegetation and wildlife profiles.

Crabs of various species inhabit the mudflat. The most dominant and common crab is *Uca spp*. These crabs play an important role in maintaining ecosystem functions. These consumed by mudskippers (a fish, *Boleopthalmus spp*) and shore birds. Most of the avifauna depends on these mudflats for grazing and feeding. Mudflats are also a favorite habitat for estuarine crocodiles (*Crocodylus porosus*); which are commonly seen basking on the mudflats. Snakes like the andha sap and the dog-faced water snake (*Cerberus rhynchops*) prefer mudflats of creeks, as they feed on trapper fishes here during low tide. Germination

of many plant species takes place in the mudflat. Hoda (*Acrostichum aureum*), nol-khagra (*Phragmties karka*), dhanshi (*Myriostachya wightiana*), golpata and hargoza (*Acanthus ilicifolius*) all grow in the mudflats. In this mudflat, the difference between the low tide water level and the upper ridge of the mudflat was nearly 4 meter.

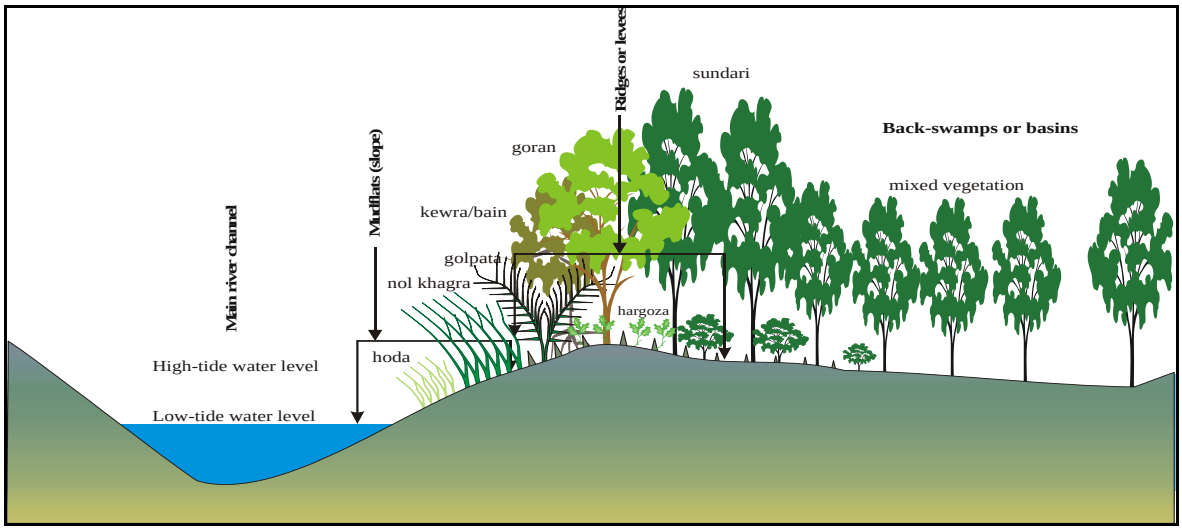


Figure 6.15: Cross section view of the major ecological niches of the Sundarbans ecosystem

b. Ridges or levees

A ridge or levee is the area just behind the mudflat. Most plant succession takes place in these ecological niches. These are the highest elevated lands of the Sundarbans and help in the trapping of seed (floating), providing suitable land for germination, acting as a natural dike to protect the next niche (back swamp) and helping in the natural sedimentation process. The area's tallest trees (sundari or keora) are found in these ecological niches.

Most of the area's terrestrial insects and snails take refuge in these niches during high tide. The lower canopy of these big trees provides a good roosting place for the most commonly seen kingfisher of the mangroves, the black-capped kingfisher (*Halcyon pileata*). The brahmini kite (*Haliaster indus*), prefer the upper canopy, while the white-bellied sea eagle (*Haliaeetus leucogaster*) stays mainly in the upper bole. The levees support primarily marginal vegetation, which is important for wildlife and lends itself to human resourcefulness in the form of commercial extraction of forest products. Marginal vegetation of the Sundarbans ecosystem is much diversified. Common marginal vegetation types that are found throughout the forest include hargoza, golpata, hantal (*Phoenix paludosa*), baen (*Avicennia officinalis*), kakra (*Bruguiera gymnorrhiza*), kewa katta (*Pandonus foetides*), keora (*Sonneratia apetala*) and dhundul (*Xylocarpus mekongensis*). Plant density is highest in these ecological niches.

c. Back swamps

Back swamps or basins are the areas behind the ridges or levees. This ecosystem represents the major area of the Sundarbans and plays a vital role in trapping rainwater in its characteristic saucer-shaped basins. These are the most common and safe grazing lands for spotted deer (*Axis axis*), rhesus macaque (*Macaca mulata*) and wild boar (*Sus scrofa*). These mammals can be seen in the grasslands at the margins of the Sundarbans. Some of

the back swamps have as much as one meter of water (fresh) within their basins. Plant density is moderate in these ecological niches.

d. The main river channel

The main river channel is long with either an eroded bank line or a mudflat margined with *golpata*. These ecological niches occur mainly along the Baleswar, Bhola, Pussur, Marjata, Arpangasia, Shibsa, Jamuna and Raimangol rivers. Main channels are popular for hilsa and shrimp fishing and, as such, are the main routes for navigation. Gangetic dolphin (*Platanista gangetica*) is common in the upper stream of the major rivers. Other dolphins, like the the Irrawaddy dolphin (*Orcaella brevirostris*), are seen downstream of these rivers.

e. Tidal creeks

Tidal creeks are the most dynamic ecological niches of the Sundarbans ecosystem. These can be defined as water channels filled with water during high tide and almost dry during low tide. Minimal human disturbance, diversified vegetation coverage and water level fluctuation result in a wide variety of wild species in these areas. Most of the climbers of the Sundarbans are seen in these areas. These climbers include chanda lota (*Dalbergia spinosa*), gila (*Derris trifoliata*), abeta (*Flagellaria indica*) and bowali lata (*Sarcolobus globisus*). Tidal creek habitats are preferred by the ring monitor lizard (*Varanus salvator*), the largest lizard of Bangladesh.

f. Bays or sandy shores

Bay or sandy shore is found along the southern face of the Sundarbans. These are mainly gentle slopes of sand deposition from the sea. Logs of various plants are seen scattered along these areas, offering breeding sites for terns (*Sterna* spp) and pratincle (*Glareola lactea*).

B. The saline tidal floodplain

The Saline tidal floodplain is located in the administrative districts of Satkhira, Khulna, Bagerhat, Jhalakathi and Borguna. It has a low ridge and basin relief, crossed by innumerable tidal rivers and creeks. Local differences in elevations are less than 1 m. The sediments are mainly composed of non-calcareous clays, although in the riverbanks, they are silty and slightly calcareous. The soils are non-saline throughout the year over substantial amount of areas in the north and east, but they become saline to varying degrees in the dry season in the Southwest and are saline for much of the year in the Sundarbans. The rivers carry fresh water throughout the year to the east and northeast, but saline water penetrates increasingly further inland towards the west mainly in the dry season, and for most or all of the monsoon season in the Southwest. In the Northeast, there is moderately deep flooding during the monsoon season, mainly due to accumulation of rainwater on the land when the Ganges distributaries and the lower Meghna are at high flood levels. Elsewhere, there is mainly shallow flooding at high tide, either throughout the year or only in the monsoon season, except where tidal flooding is prevented by embankments. Within embankments, seasonal flooding only occurs through accumulation of rainwater (Brammer, 1996).

Except Sundarbans, the floral diversity of this zone is similar to those of the adjoining zones. Innumerable indigenous weeds grow in *bee* (wetland) areas. Several types of palms and bamboo clumps grow in almost all the villages. The Mango (*Mangifera indica*) and Jackfruit

(*Artocarpus heterophyllus*) trees supply the commonest timber and are used for making doors, windows, boxes, etc. This zone affords a very lucrative place to game bird watchers. At the advent of winter season, numerous game birds which include wild goose, wild duck, cranes, spine, jungle fowl and various other waterfowl, begin to flock both in the Sundarbans, and the *beel* and char areas of this zone. Moreover, the network of rivers and expanse of *beels* of this zone teem with different species of fish (Bari, 1978).

C. Ganges Flood plain

The Ganges floodplain is basically consisted of the active floodplain of the Ganges river and the adjoining meandering floodplains, and is mostly situated in the Greater Jessore, Kushtia, Faridpur and Barisal districts. These floodplains comprise of ridges, basins and old channels. The Gangetic alluvium is readily distinguished from the old Brahmaputra, Jamuna and Meghna sediments by its high lime contents. Ganges channel is constantly shifting within its active floodplain, eroding and depositing large areas of new char lands in each flooding season, but it is less braided than that of the Brahmaputra- Jamuna. Both plants and animals are adapted with the pattern of flooding. The floodplains are characterized by mixed vegetation. Huge number of stagnant water bodies, channels, rivers and tributaries support a habitat of rich biodiversity. Free-floating aquatic vegetation is commonly found in most of the wetlands. Both cultivated and wild plant species are found in homestead forest. Major groups of the oriental birds are represented in this zone by many species. A large number of migratory birds are observed in winter. Different species of tortoises and turtles are found in perennial water bodies.

D. Gopalgonj-Khulna peat land

Gopalgonj-Khulna peat land occupies a number of low-lying areas between the Ganges river floodplains and the Ganges tidal floodplains in the south of Faridpur region and the adjoining part of Khulna and Jessore districts. Thick deposits of peat occupy perennially wet basins but are covered with clay around the edges. The soil in this zone is potentially strong acidic and low in essential plant nutrients. Basins are deeply flooded by rainwater monsoon; however, water is brackish to some degrees near Khulna. The floral diversity in this zone is quite limited. Due to lack of diversity in vegetation, the variety in faunal species and their population size in this zone are also less than enviable, where as the diversity of bird species is relatively better in this zone (Brammer, 2000).

6.22 Biodiversity of Sundarbans

The Sundarbans is the largest contiguous block of mangrove forest remaining in the present day world and a large unique mangrove ecosystem, recognized as a site of national and international importance for conservation of biodiversity. This forest is an independent "Biome", enriched with different biodiversities along with a great variety of wild life. Besides dolphins and porpoises, Sundarbans mangroves are habitats of many rare and endangered animals (*Batagur baska*, *Pelochelys bibroni, Chelonia mydas*), especially it is the unique natural habitat of the world famous Royal Bengal Tiger (*Panthera tigris*), spectacular spotted deer (*Axix axix*), jungle fowl (*Gallus* sp.) and rhesus monkey (*Macaca mulata*). Ecologically, the forest is particularly important as a barrier to cyclones, tidal upsurges, etc. It is also acting as a huge sink of unlimited capacity for absorbing CO_2 and other pollutants from air

and water that makes the surrounding environment free from pollution. The Sundarbans is the only remaining habitat in the lower Bengal Basin for a variety of faunal species.

a. Distribution of fauna

The Sundarbans is the only remaining habitat in the lower Bengal Basin with a great variety of fauna. Besides the spectacular Royal Bengal Tiger, the other notable mammalian fauna are Spotted deer (*Cervus axis*), Barking deer (*Muntiacus muntjak*), Rhesus macaque (*Macaca mulatta*), Jungle cat (*Felis chaus*), Leopard cat (*Prionailurus bengalensis*), the Indian porcupine (*Hystrix indica*), Otter (*Lutra perspicillata*), and wild boar (*Sus scrofa*). The Sundarbans support one of the subcontinent's largest populations of tiger, the Bengal tiger (*Panthera tigris tigris),* (EN). The only primate is rhesus macaque considered to number about 68,200, and based on a survey by Khan (1986). The smooth-coated otter, *Lutrogale perspicillata* (VU) which may number 20,000 (Hendrichs, 1975), is domesticated by fishermen to drive fish into their nets (Seidensticker & Hai, 1983). Other mammals include leopard cat, *Prionailurus bengalensis* and jungle cat, *Felis chaus*. Indian spotted deer, *Cervus axis*, estimates of which vary between 52,600 (Khan, 1986) and 80,000 (Rahman, 2000.), and wild boar, *Sus scrofa*, estimated at 20,000 (Hendrichs, 1975), are the principal prey of the tiger, together with macaques, crabs and fish. Aquatic mammals include the Ganges river dolphin, *Platanista gangetica* (EN), Indo-Pacific hump-backed dolphin, *Sousa chinensis*, Irrawaddy dolphin,*Orcaella brevirostris* (VU) and finless porpoise, *Neophocaena phocaenoides* (VU) (Mukherjee, 1975). Several of the larger species are now locally extinct due to agricultural reclamation and the increase in soil salinity during the 20th century.

The ecological diversity of the Sundarbans supports a large variety of birds. Among the total number of species recorded, most are resident. The egrets, storks, herons, bitterns, sandpipers, curlew, and numerous other waders are seen along the muddy banks. There are many species of gulls and terns, especially along the seacoast and the larger waterways. The bird-life of the Sundarbans waterways is varied and colourful.. About four of the rarer species are the greater and lesser adjutant storks, *Leptoptilos dubius* (EN) and *L. javanicus* (VU), and Masked Finfoot, *Heliopais personata* (EN). There are many other water birds, including Asian open-bill stork, *Anastomus oscitans*, collared and black-capped kingfishers, *Todiramphus chloris* and *Halcyon pileata*, brown-winged and stork-billed kingfishers, *Pelargopsis amauroptera* and *P. capensis*. Waders include the Asian dowitcher, *Limnodromus semipalmatus*, a rare winter migrant, sandpipers, whimbrel, curlew and numerous others are seen on the muddy banks and sandbanks exposed during the dry season. Marsh birds in the reclaimed areas include great, little and intermediate egrets, *Casmerodius albus*, *Egretta garzetta* and *Mesophoyx intermedia*, purple heron *Ardea purpurea*, a rare vagrant from Africa, and green-backed heron Butorides striata. Raptors include osprey *Pandion haliaetus*, white-bellied sea-eagle H*. leucogaster*, the rarer grey-headed fishing eagle (*Ichthyophaga ichthyaetus)*, short-toed snakeeagle (*Circaetus gallicus)*, peregrine falcon (*Falco peregrines*), oriential hobby (*F. severus*), northern eagle owl (*Bubo bubo*) and brown fish owl- *Ketupa zeylonensis* (Sarker,1985). There are many species of gulls and terns along the coast and larger waterways. There is also a considerable variety of forest birds such as woodpeckers, barbets, shrikes, drongos, mynahs, minivets and babblers. Further details of the avifauna are given in Scott (1989).

A total of 53 reptile species and 8 amphibians are recorded (Hussain & Acharya, 1994). The eighteen recorded species of snake include king cobra- *Ophiophagus hannah* (VU) and spectacled cobra- *Naja naja*, Asiatic rock python- *Python molurus*, Russell's Viper (*Vipera*

russellii), Banded Krait (*Bungarus fasciatus*) and several species of sea snakes are notable. Estuarine crocodile - *Crocodylus porosus* (100 individuals) still survives, its numbers greatly depleted by hunting and trapping for skins. There are also three species of monitor lizards, Bengal, yellow and water *Varanus bengalensis, V. flavescens and V. salvator*. River terrapin Batagur baska (CR), Indian flap-shelled turtle- *Lissemys punctata* and Indian peacock soft-shelled turtle -*Nilssonia hurum* (VU) are present. Four species of marine turtle have been seen, olive ridley -*Lepidochelys olivacea* (VU) being the most abundant. Green turtle-*Chelonia mydas* (EN) is rare due to excessive fishing. Hawksbill-*Eretmochelys imbricata* (CR) are caught by fishermen and loggerhead-*Caretta caretta* (EN) have been reported on the beaches (Hussain & Acharya, 1994). The green frog (*Euphlyctis hexadactylus*) is mostly observed in Chandpai area of the mangrove forest. The other forest amphibians include the Skipper frog (*E. cyanophlyctis*), Cricket frog (*Limnonectes limnocharis*), Tree frog (*Polypedates maculatus*), and the common toad. A rare species of shark, the Ganges river shark Glyphis gangeticus (CR) swims the estuaries. Mud-skippers or gobys, the walking and even tree-climbing fish characteristic of mangrove swamps occur in large numbers. There are 48 species of crabs and a large variety of molluscs. The crustacea form by far the largest proportion of the animal biomass, with an estimated 40 million kilograms of fiddler crabs and 100 million kilograms of mud crabs (Hendrichs, 1975). The area supports a varied insect population including 300 species of spider (Pasha & Siddiqui, 2003) and large numbers of honey-bees, but other insect life has been little studied. Note that figures quoted above before 1987 may refer to the Indian side only and those references may not distinguish between that section and the whole area.

b. Distribution of flora

The dominant species are sundari (*Heritiera fomes)*, gewa (*Exoecaria agallocha)*, goran (*Ceriops decandra*) and keora (*Sonneratia apetala). Excoecaria agallocha* dominates the zone of moderately saline soils; and *Ceriops decandra*, the saline soils. Other mangrove species include garjan or red mangrove *Rhizophora mangle*, *R. mucronata* and *R. apiculata*, kankra (*Bruguiera gymnorhiza*), and baen or (*Avicennia officinalis*). Wild rice (*Oryza coarctata*), Nypa and speargrass (*Imperata cylindrica*) are prevalent on mud flats (Khan, 1986) The large stands of Sonneratia, which colonises new mudbanks, provide important wildlife habitat (Salter and Perscomm, 1987). All four types of tidal forest are found here. Sundarbans West is in the salt-water zone, which supports a dense understory of *Ceriops*, with sparse *Exoecaria* and intermittent patches of hantal palm (*Phoenix paludosa*) on drier ground, riverbanks and levees. *Carapa obovata*, *Bruguiera* and passur (*Xylocarpus mekongensis*) grow sporadically throughout the area. Sundarbans South where there is the greatest seasonal variation in salinity levels has relatively longer periods of moderate salinity where *Exoecaria* is the dominant tree, often mixed with *Heritiera*, frequently associated with a dense understory of *Ceriops* and some *Xylocarpus*. Sundarbans East where freshwater and sundari predominate, has some *Exoecaria* and *Xylocarpus*, with *Bruguiera* in areas of more frequent flooding. The *Nypa fruticans* palm growing along the creeks on wet mud-banks is widespread along drainage lines. There is an understory of shingra (*Cynometra ramiflora*) where soils are drier, amur (*Amoora cucullata)* in wetter areas and *Ceriops* in saline soils.

Sundari (*Heritiera fomes*) trees dominate the Chandpai range at its northern end. The remaining area is a mixture of sundari and gewa (*Excoecaria agallocha*). Virtually, the entire Sarankhola range is covered by mixed sundari and gewa. Gewa grows at the peripheral region and the sundari in the inner part of each forest cluster. Sundari trees dominate most

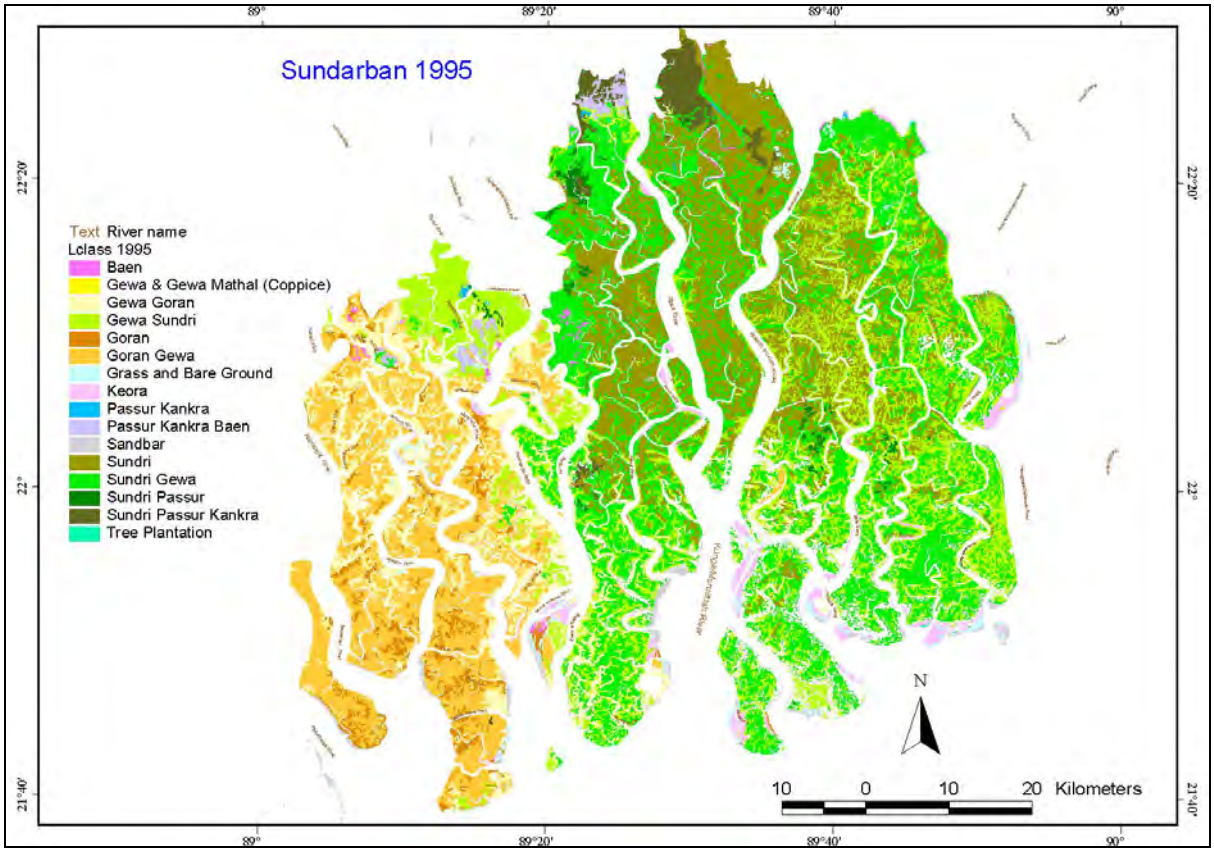
of these areas from north to south of the Khulna range. Lower part of these ranges (Khulna) is composed of sundari and gewa. The northeastern part of the Burigoalini range, under Satkhira district is mainly gewa, but goran (*Ceriops decandra*) dominates the remaining area. There are trees of different species in the area surrounding of the Sarankhola range and the northernmost part of the Khulna range.

The natural vegetation of the Sundarbans is composed mainly of halophytic tree species. The forest canopy is seldom more than 10 m above ground level and is more or less open, permitting some direct sunlight to reach the forest floor. Much of the forest is two-storied with scattered emergent attaining a height of up to 20 m. Stem diameters are generally less than 30-40 cm at breast height, although one or two species attain diameters up to about one meter. Epiphytes are common, so too are woody species parasitic on tree crowns (Hussain and Gayatri, 1994). The trees of the Sundarbans exhibit hydro-phytic and halophytic adaptations, which facilitate survival in waterlogged and saline conditions. Three ecological zones within the Sundarbans, differentiated according to salinity and species composition are: (1) the freshwater zone, (2) the saltwater zone and (3) the saltwater zone. Although the boundaries of these zones are not static, in general, *Heritiera fomes is* characteristic of the freshwater zone, *Excoecaria agallocha* of the moderately saltwater zone, and *Ceriops decandra* of the saltwater zone. The forest is dominated by *H. fomes* and *E. agallocha,* and there are about 25 other tree species, which are common but considerably less frequent in their occurrence (Hussain and Gayatri, 1994).

Five other families are also representing in the Sundarbans. These are the Combretaceae, Euphorbiaceae, Meliaceae, Myrsinaceae and Plumbaginaceae. Certain tree species such as *Ficus spp., Eugenia fruticosa* and *Diospyros peregrina* occur in places of lower salinity, usually on raised areas and are more commonly found as components of dry-land forest and are only marginally salt-tolerant (Hussain and Gayatri, 1994).

6.23 Historical changes in Sundarbans vegetation

Geological evidences suggest that the Bengal Basin tilted eastward during the 12th Century because of the neo-tectonic movement (Morgan and Mc Intire, 1959). The rising of the western part of the delta separated the ancient branches of the river Ganges from the area, which today comprises the Indian and western part of Bangladesh. This alteration in the course of the main river resulted in a reduction of freshwater flowing into the western part of the delta. This in turn, led to accretion at the river mouth and an increase in saline water intruding into the western part of the delta. The lack of freshwater to the western part has had significant effects on the floristic composition of the forests. For instance, according to some studies of fossil pollen, *Heritiera fomes* was a dominant arborescent species in the Calcutta region about 5000 years ago (Blasco, 1975). However, the Indian Sundarbans as well as the western part of the Bangladesh Sundarbans no longer support a healthy population of this species, which requires fresh or slightly saline water. It is dominant only in the eastern part of the Bangladesh Sundarbans. On the other hand, more saline tolerant species are dominant in the western part of the Sundarbans forest.



Map 6.21: Sundarbans with different forest species

Change of vegetation in between 1985 and 1995.

The pattern of vegetation succession in the Sundarbans depends upon the development stages of the land building process under particular sets of the fluvial regime. Salinity gradients, which in turn depends on the quantity of freshwater flushing from the upstream, also play an important role in shaping the vegetation development. The Sundarbans vegetation consists of recurrent patches of vegetation types. Overall, the mosaic formed by these patches represents the equilibrium for the whole ecosystem. However it is argued that the mosaic of forest types represents the serial stages towards an equilibrium condition of vegetation development (Karim, 1988). Depending on the stresses, both biotic and abiotic including management conditions there are a number of self maintaining terminal stage of vegetation development which differ from the traditional concept of climax. The most favorable development of vegetation occurs in the freshwater dominating area where the Sundari is the dominant plant. The Goran dominates another extreme condition under the high salinity terminal community , which is a thicket of scrub. In both cases, grasses and/or trees dominate the initiating and pioneer stage of vegetation development.

The floristic composition of different successions depends upon the species niche and the physical conditions of each specific site. At the present level of information, potential changes in hydrology due to the changing flow of freshwater from upstream could best be understood by a comparison of salinity of the eastern region with that of the western region and its significance on the structural characteristics of vegetation. An attempt is made here to detect the changes in the floristic composition occurring between 1985 and 1995, when the freshwater flow into the Sundarbans was gradually decreasing. The data source for calculation was obtained from the forest department and a Map 6.21 represents the

vegetation coverage of Sundarbans in 1995. Changes of vegetation has been detected by overlying the two maps, are provided in Table 6.29..

Table 6.29: Change of area from 1985 to 1995

Vegetation communities	1995	1985	Difference	% area of 85 remaining unchanged in 95	% area of 95 remaining unchanged from 85
Water	4.46		4.46		
Sundari	750.30	836.50	-86.20	72.70	81.05
Sundari-Gewa	1061.70	1208.29	-146.59	66.70	75.91
Sundari-Passur	24.71	21.84	2.88	77.40	68.39
Sundari-Passur-Kankra	73.94	67.32	6.63	85.18	77.54
Gewa and Gewa-Mathal (Coppice)	213.86	193.40	20.46	56.05	50.69
Gewa-Goran	348.96	373.70	-24.74	73.52	78.74
Gewa-Sundari	764.83	597.97	166.86	70.44	55.07
Goran	83.34	85.50	-2.16	65.35	67.04
Goran-Gewa	563.70	571.87	-8.17	86.87	88.13
Passur-Kankra	2.86	9.55	-6.70	15.65	52.36
Passur-Kankra-Baen	25.85	16.77	9.08	78.29	50.80
Baen	11.47	9.28	2.19	32.48	26.28
Keora	79.32	36.61	42.71	75.62	34.91
Grass and Bare Ground	58.91	43.68	15.23	38.63	28.64
Tree Plantation	2.10	3.52	-1.42	31.20	52.26
Sandbar	9.45	3.97	5.49	26.54	11.14

Source: Forestry Department

During this period, major changes have occurred in the Sundari and Gewa dominated areas, as Gewa is gradually replacing Sundari as the dominant tree species. Pure Sundari dominated areas reduced by about 86 km^2 or about 11 percent of their previous extent, most of which are converted into the Sundari-Gewa and Sundari-Passur-Kankra community. The Sundari-Gewa community also followed a decreasing trend, as it lost 146 km^2 or more than 10 percent of its land to the Gewa-Sundari and Gewa-Mathal community. So the overall shift is from Sundari to Gewa and from Gewa to other more saline tolerant species. A similar trend is also visible even in the higher saline zone where the high saline loving Goran is replacing the Gewa and Sundari. Keora dominated areas have also increased from 37 km^2 to 79 km^2 resulting in an expansion of 43 km^2 or 110 percent. Grass and Bare Ground areas have also increased by about 15 km^2.

The general trend during this ten-year period indicate the reduction of commercially valuable species like the Sundari and Gewa and increase of less valued smaller tree species. It is evident that the changes that occurred during this period are mostly concentrated in the eastern part of the Sundarbans. This might be because of the changed scenario of the salinity regime in the eastern belt due to decreasing freshwater influx from the Gorai River. The vegetation community in the western region seems to be more stable as the hydrological regime in this area remained stable during the period.

6.24 Fisheries Resources of Sundarbans

The Sundarbans mangrove forest (including the world heritage site) is situated in South West of Bangladesh and extends across the international boundary with India. The Sundarbans (Bangladesh part) covers an area of about 5770 sq km of which 4016 sq km is land and remaining 1761 sq.km is under water, in the form of river, cricks, and canals.

The fish habitats in the Sundarbans area are mostly brackish in nature. The fisheries resources in this area are rich and diversified. This is the largest shrimp producing area of Bangladesh and is established as an important sector for earning foreign currency for the nation. The mangrove forest provides support to a large number of marine and fresh water fish species, which contributes towards sustainable regeneration of the fish stocks of the country. The dynamic network of river systems of this area connects fresh water fish habitats with brackish water habitats and maintains biological balance of the major groups of fishes. Continual hydro-morphological alteration has made most of the river systems to become declining in nature.

The largest fishing ground in the Bay of Bengal is close to the Sundarbans. Large number of commercial fishers depends on this fisheries resource.

The water bodies of Sundarbans are rich in fish biodiversity as well as aquatic creators. However, the number of some major fish species is declining due to loss of natural habitat and indiscriminate fishing. Most of the brackish water migratory species follow the routes of interconnected rivers, canals and tidal floodplain with changing time and space to meet up their biological demand e.g. breeding and feeding. Shrimp fry collection is quite popular in the area. However, shrimp fry collectors collect a considerable number of shrimp fry that they sell to the *Bapari(trader).*

6.24.1 Distribution of fisheries

The Sundarbans Mangrove Forest contains the most diverse and rich natural resources of Bangladesh dominated by fisheries and other aquatic resources. It is located in the great delta of the Ganges, the Brahmaputra and the Meghna rivers at the edge of the Bay of Bengal and constitutes the largest adjoining single-tract mangrove ecosystem in the world. The rich ecosystem of the forest supports a wide variety of fin and shellfish species and also serves as an important nursing and breeding and feeding ground for many species of shrimp, crab and other fishes along with providing the habitat for diverse aquatic wildlife.

The fish habitats of the Sundarbans play an important role for both fresh water and saline water fishes. The fishes use the Sundarbans as a nursery, breeding and feeding ground and return to the sea or freshwater. Fishes like *Khorsula (Mugil corsula)*, Gulsha Tengra, Rui, Catla, Shol, Taki, Pungus Tengra, Shing, Magur, Koi, Puti, Datina *(Pomadasys spp.)*, Bagda *(Penaeus monodon)* etc are very common in these areas. A number of fish species spend most of their life stages outside the Sundarbans but come to breed here. These types of fishes are Gulsha Tengra, Poma, Phesa *(Setipinna spp.)*, Pungus, Golda, Topshi *(Polynemus paradiseus)*, Parsha, Chamua Chingri, etc. depending on ichthyoplankton concentration due to reduced salinity. Marine fishes like Ghagot *(Tachysurus jella)*, Apula *(Osteogeneisus militaris)*, Lakhya *(Polynemus indicus)* and Tailla *(Polynemus Tetradactylus)* are also present in this area.

Fishes that use the Sundarbans as both nursery and spawning ground are Gulsha Tengra, and some other species. Many marine fishes come to the Sundarbans only for feeding as this area is rich in food organisms. This type of fishes are Chaka Chingri, Chali Chingri, Motka Chingri, Tiger Chingri, Gura Chingri *(Leander stylifera)*, Begi Ilish *(Tenualosa ilisha)*, Rupchanda, Gang Thurina, Boiragi, Potka, Shapla Pata, Kamot, Tulardati *(Silago domina)*, Pokki, Pankha, Baim, Churi *(Lepturacunthas savale)*, Lottya *(Harpadon neherius)*, Kaldi, Korina, etc. The juveniles of many marine species of prawns and fishes e.g. Chaka Chingri *(Penaeus indicus)*, Gura Chingri (*Leander stylifera*) and various sciaenid and ribbon fish (Churi Mach) migrate into the lower zone of the estuary during the winter and summer months to feed and then return to the sea with the onset of the monsoon.

Some other fishes like Koral *(Lates calcarifer)*, Jaba, Kawn, Chitra, Chapli Chela, Tarial, Borial, Crab, Renua (mus skeeper- *Boleophthalmus spp*), etc. spend most of their life stages in the Sundarbans. Thus it appears that the Sundarbans plays a vital role in the life cycle of freshwater, brackish water and marine fish forms during their different life stages. Many threatened and endangered species also live in these area e.g. Khorsula (critically endangered), Pungus (endangered) etc.

It is assumed that in future the spawning grounds for aquatic creatures of Sundarbans would be shifted to an unsuitable physical environment due to shift of the salinity frontier, resulting in low production of commercial species and species of ecological importance as well. Sundarbans is the spawning and breeding ground of many aquatic marine, brackish and fresh water creatures like shrimps, muscles, fishes etc. These spawning grounds are preferred and selected by individual species considering the physical aspects like substratum, salinity, water velocity, tide regime, temperature, seasonality, etc.

Once salinity is changed, the breeding place of these creatures would be shifted to the upper reach. However, the breeding success depends on other physical factors, which would not change with the change of salinity alone. As a result, a creature might move upstream but it will not be able to breed due to insufficient supports from other physical factors. The degradation of the aquatic condition of the Sundarbans as nursery ground for number of marine fishes would be severe. The marine fishes usually breed in salinity less than 26 ppt. So therefore, it is expected that the low saline dominant species would be replaced by medium to high salinity dominant species in this area. Fishes like pungus, bhetki and golda may be invaded by datina, poa and sharks species. This would reduce the production of fishes in Sundarbans area and impact on fishers' community.

However, in spite of species change, which has tremendous biological and ecological importance, the total production would not change but long term negative impact would be on marine and brackish fish species that depend on Sundarbans for at least a part of its life stages.

6.24.2 Sundarbans as a fish habitat

There are two common fish habitats in Sundarbans- i) rivers and canals, ii) tidal flood plain. Tidal flood plain habitat is dominant habitat in Sundarbans in terms of area. The Sundarbans occupies an extensive area of tidal floodplain e.g. 177,700 ha (FRSS 2009-2010). It is crisscrossed by innumerable tidal rivers and canals where the banks generally stand less than a meter from the adjoining basins. The rivers are more or less saline throughout the

year. Under the natural conditions, this Sundarbans is flooded every day at high and low tides around the year.

6.24.3 Fish production

According to the FRSS (2009-2010), the total fish production of the Sundarbans is 8,109 MT. This production comes from the shrimp farms, rivers, estuaries, mangroves, ponds etc. There are different fishing methods and gear used by the fishermen inside the Sundarbans to catch the fishes. These may be clustered into three major groups based on target species and fishing gear. Shrimp fry collection is particularly considered a very destructive activity.

6.24.4 Fish composition

The mangrove ecosystem provides food, nesting and nursery ground for diversified fauna in general. As a result, there is a good number of fish species in Sundarbans area. There are 291 species exist in Sundarbans areas. Out of these 210 are whitefish, 24 Shrimps, 14 crabs and 43 mollusks. Brackish water fish are dominating in the Sundarbans area and the adjoining tidal floodplains. List of some available fish species are given in the following Table 6.30.

Table 6.30: Indicative fish species diversity of different fish habitats in Sundarbans

Scientific Name	Local Name	Habitat type		
		River, estuary and canal	Tidal Floodplain	Shrimp/ Prawn Gher
Lates calcarifer	Bhetki	P	A	P
Liza parsia	Parsha	P	A	P
Polynemous paradiseous	Topsha	P	A	A
Silago domina	Tular danti	P	A	A
Raiamas bola	Bhol	P	A	A
Mystus cavasius	Gulsha Tengra	P	A	P
Glossogobius giuris	Baila	P	P	P
Setipinna phasa	Phesa	P	A	A
Gudusia chapra	Chapila	P	P	A
Trypauchen vagina	Lal cheua	P	P	A
Aorichthyes aor	Ayir	P	P	A
Penaeus indicus	Chaka chingri	P	A	P
Tenualosa ilisha	Hilsha	P	P	A
Metapenaeus monoceros	Harina chingri	P	P	P
Penaeus monodon	Bagda	P	P	P
Macrobrachium rosenbergii	Golda	P	P	P
Puntius gonionotus	Sharpunti	A	A	P
Puntius ticto	Tit puti	P	A	P
Puntius chola	Chola punti	P	A	P
Channa punctatus	Taki	P	A	P

Scientific Name	Local Name	Habitat type		
		River, estuary and canal	Tidal Floodplain	Shrimp/ Prawn Gher
Channa striatus	Shole	A	A	A
Wallago attu	Boal	P	A	A
Heteropneustes fossilis	Shing	A	A	P
Clupisoma gharua	Gharua	P	A	A
Eutropichthyes vacha	Bacha	P	A	A
Rita rita	Rita	P	A	A
Mystus tengara	Tengra	P	P	P
Mystus vittatus	Bujuri	P	A	A
Mastacembelus pancalus	Chirka baim	P	P	P
Mastacembelus armatus	Shail baim	P	P	P
Mastacembelus aculeatus	Tara baim	A	P	P
Lepidocephalus guntea	Gutum	P	A	P
Leander styliferus	Icha	P	P	P
Anabas testudineus	Koi	A	P	P
Colisa fasciatus	Kholisha	A	P	P
Colisa sota	Boicha	A	P	A
Chanda nama	Nama Chanda	P	A	P
Chanda baculis	Chanda	P	A	P
Glossogobius giuris	Baila	P	A	P
Pangasius sutchi	Pangus	A	A	A
Labeo gonius	Ghoinya	A	A	P
Labeo rohita	Rui	P	A	P
Catla catla	Catla	A	A	P
Cirrhinus mrigala	Mrigal	P	A	P
Hypophthalmichthys molitrix	Silver Carp	A	A	P
Ctenopharyngodon idella	Grass Carp	A	A	P
Cyprinus carpio	Carpio	A	A	P
Puntius gonionotus	Sharpunti	A	A	P
Telapia mossambica	Telapia	A	A	P

Source: GRRP environmental monitoring report by - CEGIS Here, A=Absent and P=Present

Fish species of marine and brackish water that are available in the adjacent water area include eels, clupeids, siluroides, lophiformes, sygnaths, perces, mugiloid, sharks, and rays. In addition, crabs, mussels, snails, and turtles are also found in the study area. Topsha chewa etc. are available during high tide. During low tide loittay, bata, poa, chewa, chingri, pangus etc. are abundant. In the mudflats icha, poa, gulla and other juvenile and small fishes are available. When an area is silted up or becomes shallow, chewa fish becomes more available. A good number of people are involved in collecting crabs, shrimp PL and other natural resources in the Sundarbans area.

6.24.5 Sundarbans wild life sanctuary

The study area is tidal delta and geologically described as Paludal deposits that developed over swamp or marshland. The area is about *14 km north*-eastwards from the Nalian Range

of Sundarbans and is located 4 km beyond the boundary of the declared Ecological Critical Area of Sundarbans which extends up to 10km landwards from the forest boundary (Map 6.22). The world heritage site of the Sundarbans of located 69.6 km south-west and Hiron point is located 84.4 km southward from the project location.

In order to protect the forest biodiversity of the Sundarbans, three wild life sanctuaries were established in 1977 under the Bangladesh Wildlife (Preservation) Order 1973. They were declared as World Heritage Site by UNESCO on 6th December, 1997 – extending over a total area of about 1, 400 sq km. This measure has resulted into greater interest in taking steps to protect and preserve the fragile and complex ecosystem of the Sundarbans. Map 6.22 depicts the wild life sanctuary where the list of the relative abundance of birds are identify in Table 6.31.

Table 6.31: List of Birds found in the Sundarbans wildlife sanctuaries (East and South)

Species (English and Scientific Name)	Relative abundance	Status	IUCN Global Status
BLUE-BREASTED QUAIL *Coturnix chinensis*	UC	R	Least Concern(LC)
RED JUNGLEFOWL *Gallus gallus*	VC	R	LC
LESSER WHISTLING-DUCK *Dendrocygna javanica*	R	R	LC
COTTON PYGMY-GOOSE *Nettapus coromandelianus*	R	R	LC
GADWALL *Anas strepera*	UC	M	LC
SPOT-BILLED DUCK *Anas poecilorhyncha*	R	R	LC
RED-CRESTED POCHARD *Netta rufina*	R	M	LC
TUFTED DUCK *Aythya fuligula*	UC	M	LC
EURASIAN WRYNECK *Jynx torquilla*	R	M	LC
SPECKLED PICULET *Picumnus innominatus*	UC	R	LC
GREY-CAPPED PYGMY WOODPECKER *Dendrocopos canicapillus*	C	R	LC
FULVOUS-BREASTED WOODPECKER *Dendrocopos macei*	VC	R	LC
RUFOUS WOODPECKER *Celeus brachyurus*	C	R	LC
GREATER YELLOWNAPE *Picus flavinucha*	UC	R	LC
STREAK-BREASTED WOODPECKER *Picus viridanus*	R	R	LC
STREAK-THROATED WOODPECKER *Picus xanthopygaeus*	UC	R	LC
GREY-HEADED WOODPECKER *Picus canus*	UC	R	LC
COMMON FLAMEBACK *Dinopium javanense*	UC	R	LC
BLACK-RUMPED FLAMEBACK *Dinopium benghalense*	VC	R	LC
GREATER FLAMEBACK *Chrysocolaptes lucidus*	VC	R	LC
LINEATED BARBET *Megalaima lineata*	C	R	LC
COPPERSMITH BARBET *Megalaima haemacephala*	UC	R	LC
COMMON HOOPOE *Upupa epops*	C	R	LC
INDIAN ROLLER *Coracias benghalensis*	UC	RM	LC
DOLLARBIRD *Eurystomus orientalis*	R	RM	LC
COMMON KINGFISHER *Alcedo atthis*	VC	R	LC
BLUE-EARED KINGFISHER *Alcedo meninting*	UC	R	LC
BROWN-WINGED KINGFISHER *Pelargopsis amauroptera*	VC	R	Near Threatened
RUDDY KINGFISHER *Halcyon coromanda*	UC	R	LC
WHITE-THROATED KINGFISHER *Halcyon smyrnensis*	VC	R	LC
BLACK-CAPPED KINGFISHER *Halcyon pileata*	VC	R	LC
COLLARED KINGFISHER *Todiramphus chloris*	VC	R	LC
PIED KINGFISHER *Ceryle rudis*	R	R	LC

Species (English and Scientific Name)	Relative abundance	Status	IUCN Global Status
GREEN BEE-EATER *Merops orientalis*	VC	RM	LC
BLUE-TAILED BEE-EATER *Merops philippinus*	VC	RM	LC
CHESTNUT-HEADED BEE-EATER *Merops leschenaulti*	C	RM	LC
CHESTNUT-WINGED CUCKOO *Clamator coromandus*	R	RM	
COMMON HAWK CUCKOO *Hierococcyx varius*	VC	R	LC
INDIAN CUCKOO *Cuculus micropterus*	VC	RM	LC
EURASIAN CUCKOO *Cuculus canorus*	UC	RM	LC
PLAINTIVE CUCKOO *Cacomantis merulinus*	C	RM	LC
ASIAN KOEL *Eudynamys scolopaceus*	VC	R	LC
GREEN-BILLED MALKOHA *Phaenicophaeus tristis*	VC	R	LC
GREATER COUCAL *Centropus sinensis*	VC	R	LC
ROSE-RINGED PARAKEET *Psittacula krameri*	C	R	LC
ASIAN PALM SWIFT *Cypsiurus balasiensis*	VC	R	LC
EURASIAN EAGLE OWL *Bubo bubo*	UC	R	LC
BROWN FISH OWL *Ketupa zeylonensis*	UC	R	LC
BUFFY FISH OWL *Ketupa ketupu*	UC	R	LC
BROWN WOOD OWL *Strix leptogrammica*	R	R	LC
LARGE-TAILED NIGHTJAR *Caprimulgus macrurus*	VC	RM	LC
INDIAN NIGHTJAR *Caprimulgus asiaticus*	R	RM	LC
ORIENTAL TURTLE DOVE *Streptopelia orientalis*	R	RM (M)	LC
SPOTTED DOVE *Streptopelia chinensis*	VC	R	LC
EURASIAN COLLARED DOVE *Streptopelia decaocto*	VC	R	LC
EMERALD DOVE *Chalcophaps indica*	UC	R	LC
ORANGE-BREASTED GREEN PIGEON *Treron bicincta*	C	RM	LC
POMPADOUR GREEN PIGEON *Treron pompadora*	C	R	LC
YELLOW-FOOTED GREEN PIGEON *Treron phoenicoptera*	UC	R	LC
MASKED FINFOOT *Heliopais personatus*	UC	R	Endangered
SLATY-BREASTED RAIL *Gallirallus striatus*	R	R	LC
WHITE-BREASTED WATERHEN *Amaurornis phoenicurus*	R	R	LC
RUDDY-BREASTED CRAKE *Porzana fusca*	R	R	LC
PINTAIL SNIPE *Gallinago stenura*	UC	M	LC
COMMON SNIPE *Gallinago gallinago*	C	M	LC
BLACK-TAILED GODWIT *Limosa limosa*	UC	M	Near Threatened
WHIMBREL *Numenius phaeopus*	VC	M	LC
EURASIAN CURLEW *Numenius arquata*	C	M	Near Threatened
COMMON REDSHANK *Tringa totanus*	VC	M	LC
MARSH SANDPIPER *Tringa stagnatilis*	VC	M	LC
COMMON GREENSHANK *Tringa nebularia*	VC	M	LC
WOOD SANDPIPER *Tringa glareola*	C	M	LC
TEREK SANDPIPER *Xenus cinereus*	R	M	LC
COMMON SANDPIPER *Actitis hypoleucos*	VC	M	LC
RUDDY TURNSTONE *Arenaria interpres*	R	M	LC
SANDERLING *Calidris alba*	UC	M	LC
PHEASANT-TAILED JACANA *Hydrophasianus chirurgus*	R	R	LC
GREAT THICK-KNEE *Esacus recurvirostris*	UC	R	LC
BLACK-WINGED STILT *Himantopus himantopus*	R	M	LC
PIED AVOCET *Recurvirostra avosetta*	R	M	LC
PACIFIC GOLDEN PLOVER *Pluvialis fulva*	R	M	LC
KENTISH PLOVER *Charadrius alexandrinus*	UC	M	LC
LESSER SAND PLOVER *Charadrius mongolus*	VC	M	LC

Species (English and Scientific Name)	Relative abundance	Status	IUCN Global Status
GREATER SAND PLOVER *Charadrius leschenaultii*	C	M	LC
GREY-HEADED LAPWING *Vanellus cinereus*	R	M	LC
RED-WATTLED LAPWING *Vanellus indicus*	VC	R	LC
SMALL PRATINCOLE *Glareola lactea*	R	R	LC
PALLAS'S GULL *Larus ichthyaetus*	R	M	LC
BROWN-HEADED GULL *Larus brunnicephalus*	VC	M	LC
BLACK-HEADED GULL *Larus ridibundus*	UC	M	LC
GULL-BILLED TERN *Gelochelidon nilotica*	VC	M	LC
CASPIAN TERN *Sterna caspia*	R	M	LC
GREAT CRESTED TERN *Sterna bergii*	R	M	LC
COMMON TERN *Sterna hirundo*	UC	M	LC
LITTLE TERN *Sterna albifrons*	VC	M	LC
WHISKERED TERN *Chlidonias hybrida*	VC	M	LC
OSPREY *Pandion haliaetus*	R	M	LC
BLACK-SHOULDERED KITE *Elanus caeruleus*	UC	R	LC
BLACK KITE *Milvus migrans*	UC	R	LC
BRAHMINY KITE *Haliastur indus*	VC	R	LC
WHITE-RUMPED VULTURE *Gyps bengalensis*	R	R	Critically Endangered
WHITE-BELLIED SEA EAGLE *Haliaeetus leucogaster*	VC	R	LC
CRESTED SERPENT EAGLE *Spilornis cheela*	VC	R	LC
EURASIAN MARSH HARRIER *Circus aeruginosus*	R	M	LC
PIED HARRIER *Circus melanoleucos*	R	M	LC
SHIKRA *Accipiter badius*	VC	R	LC
GREATER SPOTTED EAGLE *Aquila clanga*	R	M	Vulnerable
CHANGEABLE HAWK EAGLE *Nisaetus cirrhatus*	UC	R	LC
COMMON KESTREL *Falco tinnunculus*	UC	M	LC
PEREGRINE FALCON *Falco peregrinus*	R	M	LC
LITTLE CORMORANT *Phalacrocorax niger*	R	R	LC
LITTLE EGRET *Egretta garzetta*	VC	R	LC
GREY HERON *Ardea cinerea*	R	R	LC
GREAT EGRET *Casmerodius albus*	VC	R	LC
INTERMEDIATE EGRET *Mesophoyx intermedia*	C	R	LC
CATTLE EGRET *Bubulcus ibis*	R	R	LC
INDIAN POND HERON *Ardeola grayii*	C	R	LC
LITTLE HERON *Butorides striatus*	VC	R	LC
BLACK-CROWNED NIGHT HERON *Nycticorax nycticorax*	R	R	LC
MALAYAN NIGHT HERON *Gorsachius melanolophus*	R	RM	LC
CINNAMON BITTERN *Ixobrychus cinnamomeus*	R	R	LC
BLACK-HEADED IBIS *Threskiornis melanocephalus*	R	R	Near Threatened
LESSER ADJUTANT *Leptoptilos javanicus*	C	R	Vulnerable
INDIAN PITTA *Pitta brachyura*	R	R	LC
MANGROVE PITTA *Pitta megarhyncha*	R	R	Near Threatened
GOLDEN-FRONTED LEAFBIRD *Chloropsis aurifrons*	UC	R	LC
BROWN SHRIKE *Lanius cristatus*	UC	M	LC
LONG-TAILED SHRIKE *Lanius schach*	C	R	LC
GREY-BACKED SHRIKE *Lanius tephronotus*	R	M	LC
RUFOUS TREEPIE *Dendrocitta vagabunda*	C	R	LC
HOUSE CROW *Corvus splendens*	C	R	LC
LARGE-BILLED CROW *Corvus macrorhynchos*	UC	R	LC
ASHY WOODSWALLOW *Artamus fuscus*	VC	R	LC

Species (English and Scientific Name)	Relative abundance	Status	IUCN Global Status
BLACK-NAPED ORIOLE *Oriolus chinensis*	R	M	LC
BLACK-HOODED ORIOLE *Oriolus xanthornus*	C	R	LC
LARGE CUCKOOSHRIKE *Coracina macei*	VC	R	LC
BLACK-WINGED CUCKOOSHRIKE *Coracina melaschistos*	R	M	LC
SMALL MINIVET *Pericrocotus cinnamomeus*	VC	R	LC
SCARLET MINIVET *Pericrocotus flammeus*	C	R	LC
BAR-WINGED FLYCATCHER-SHRIKE *Hemipus picatus*	UC	R	LC
WHITE-THROATED FANTAIL *Rhipidura albicollis*	C	R	LC
BLACK DRONGO *Dicrurus macrocercus*	VC	R	LC
ASHY DRONGO *Dicrurus leucophaeus*	C	M	LC
BRONZED DRONGO *Dicrurus aeneus*	VC	R	LC
LESSER RACKET-TAILED DRONGO *Dicrurus remifer*	R	M	LC
SPANGLED DRONGO *Dicrurus hottentottus*	UC	R	LC
GREATER RACKET-TAILED DRONGO *Dicrurus paradiseus*	C	R	LC
BLACK-NAPED MONARCH *Hypothymis azurea*	C	R	LC
COMMON IORA *Aegithina tiphia*	C	R	LC
BLUE ROCK THRUSH *Monticola solitarius*	UC	M	LC
ORANGE-HEADED THRUSH *Zoothera citrina*	R	R	LC
SCALY THRUSH *Zoothera dauma*	R	M	LC
DARK-SIDED FLYCATCHER *Muscicapa sibirica*	R	M	LC
RED-THROATED FLYCATCHER *Ficedula parva*	C	M	LC
VERDITER FLYCATCHER *Eumyias thalassinus*	UC	M	LC
BLUE-THROATED FLYCATCHER *Cyornis rubeculoides*	R	M	LC
ORIENTAL MAGPIE ROBIN *Copsychus saularis*	C	R	LC
BLACK REDSTART *Phoenicurus ochruros*	R	M	LC
COMMON STONECHAT *Saxicola torquata*	UC	M	LC
CHESTNUT-TAILED STARLING *Sturnus malabaricus*	C	R	LC
ASIAN PIED STARLING *Sturnus contra*	C	R	LC
COMMON MYNA *Acridotheres tristis*	UC	R	LC
BANK MYNA *Acridotheres ginginianus*	C	R	LC
JUNGLE MYNA *Acridotheres fuscus*	VC	R	LC
VELVET-FRONTED NUTHATCH *Sitta frontalis*	C	R	LC
GREAT TIT *Parus major*	VC	R	LC
BARN SWALLOW *Hirundo rustica*	VC	M	LC
RED-WHISKERED BULBUL *Pycnonotus jocosus*	C	R	LC
RED-VENTED BULBUL *Pycnonotus cafer*	VC	R	LC
ZITTING CISTICOLA *Cisticola juncidis*	VC	R	LC
YELLOW-BELLIED PRINIA *Prinia flaviventris*	R	R	LC
PLAIN PRINIA *Prinia inornata*	R	R	LC
ORIENTAL WHITE-EYE *Zosterops palpebrosus*	UC	R	LC
BLYTH'S REED WARBLER *Acrocephalus dumetorum*	UC	M	LC
CLAMOROUS REED WARBLER *Acrocephalus stentoreus*	R	M	LC
COMMON TAILORBIRD *Orthotomus sutorius*	C	R	LC
COMMON CHIFFCHAFF *Phylloscopus collybita*	UC	M	LC
GREENISH WARBLER *Phylloscopus trochiloides*	UC	M	LC
ABBOTT'S BABBLER *Malacocincla abbotti*	C	R	LC
PIN STRIPED TIT BABBLER *Macronous gularis*	C	R	LC
YELLOW-EYED BABBLER *Chrysomma sinense*	R	R	LC
STRIATED BABBLER *Turdoides earlei*	C	R	LC
RUFOUS-WINGED BUSHLARK *Mirafra assamica*	C	R	LC
PALE-BILLED FLOWERPECKER *Dicaeum erythrorhynchos*	UC	R	LC
RUBY-CHEEKED SUNBIRD *Anthreptes singalensis*	UC	RM	LC
PURPLE-RUMPED SUNBIRD *Nectarinia zeylonica*	R	R	LC

Species (English and Scientific Name)	Relative abundance	Status	IUCN Global Status
PURPLE SUNBIRD *Nectarinia asiatica*	VC	R	LC
CRIMSON SUNBIRD *Aethopyga siparaja*	UC	R	LC
FOREST WAGTAIL *Dendronanthus indicus*	C	M	LC
WHITE WAGTAIL *Motacilla alba*	VC	M	LC
WHITE-BROWED WAGTAIL *Motacilla madaraspatensis*	R	R	LC
CITRINE WAGTAIL *Motacilla citreola*	UC	M	LC
YELLOW WAGTAIL *Motacilla flava*	R	M	LC
GREY WAGTAIL *Motacilla cinerea*	C	M	LC
PADDYFIELD PIPIT *Anthus rufulus*	C	R	LC
OLIVE-BACKED PIPIT *Anthus hodgsoni*	UC	M	LC
BAYA WEAVER *Ploceus philippinus*	VC	R	LC
SCALY-BREASTED MUNIA *Lonchura punctulata*	C	R	LC

(Source: Khan, MAR, 2010; Khan, MMH, 2005; Rashid & Scott 1990; Rashid et al. 1994)

(NB: The navigational route of Mongla Port from the Bay through the Passur river is between these two nationally important forest protected areas, classified as Wildlife Sanctuary, with the highest level of protection under the Bangladesh Wildlife Act 2010. The navigation route will also be followed for coal transportation)

Relative abundance: VC = very common; C = common; UC = uncommon; R = rare. Status: R = resident; RM = resident but local movements observed; M = migrant.

6.24.6 *Sundarbans conservation projects*

Sundarbans mangrove forest particularly the three wildlife sanctuaries act as good nurseries and potential breeding ground for shrimps, prawns and many edible fishes. To alleviate the situation and protect the biodiversity of the Sundarbans, the Forest Department Bangladesh had taken many projects and doing many programs to conserve the forest. A number project activity listed below.

a) List of some completed Projects:

- Management Support Project for Sundarbans Reserve Forest (2005-06 to 2009-2010).
- Nishorgo Support Project at Sundarbans (1999-2000 to 2008-09).

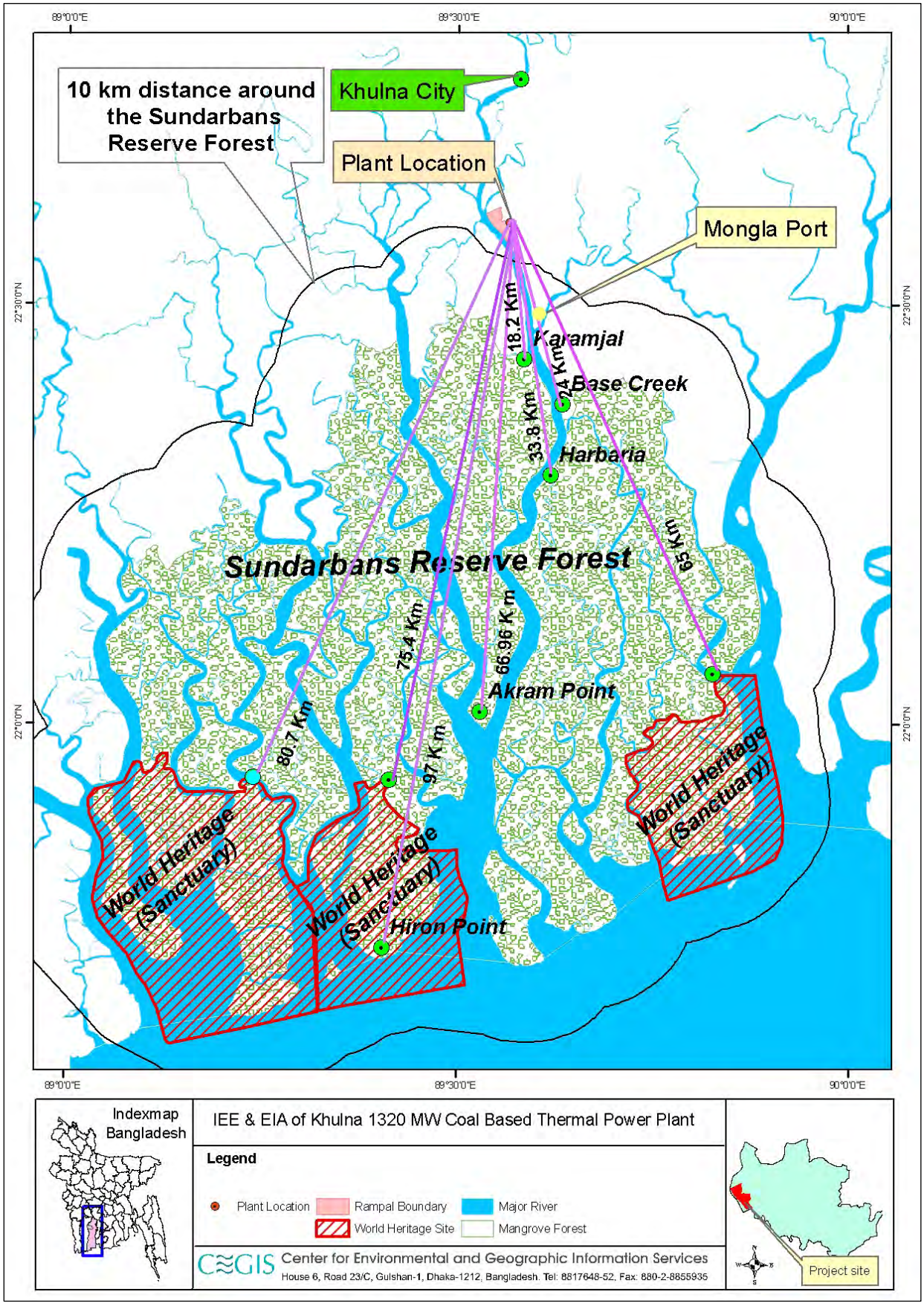
b) Recently Completed Projects/Program:

- Rehabilitation and Development of Infrastructures and communication system in the Sundarbans
- Support to Essential Management Capacity in the Sundarbans World Heritage Site following the passage of cyclone *Sidr*; Phase - 1
- Support to Essential Management Capacity in the Sundarbans World Heritage Site following the passage of Cyclone *Sidr;* Phage-2.
- Support to Sundarbans Reserve Forest Management project

c) List of on-going projects:

- Integrated Protected Area Co-Management (IPAC)-Nishorgo (July,2010 to June,2013)

- Sundarbans Environmental and Livelihood Security (SEALS) (July,2010 to December,2014)
- Community Based Adaptation to Climate Change through Coastal Afforestation in Bangladesh (July,2009 to November,2012)
- Conservation of Sundarbans and to elect as New Natural Seven Wonders of the World
- Forest Information Generation and Networking System (January,2011 to December,2012)
- Coastal Area Afforestation to Combat Negative Impact of Climate Change (November-2010 to June,2013)
- Rehabilitation and development of infrastructure in the Sundarbans (2009-10 - 2011-12)
- Rehabilitation and development of communication in the Sundarbans.(2009-10 - 2011-12).
- Biodiversity Conservation and Ecotourism Development in Bangladesh(Sundarbans is one of the
- Strengthening Regional Cooperation for Wildlife Protection at Sundarbans



Map 6.22: Map showing location of the power plant with respect to Sundarbans

6.25 Socio-economic condition

The baseline study was designed to grasp the inherent notion about the socio-economic condition of Rampal and Dacope Upazila for the Environmental Impact Assessment (EIA) of the proposed 1320MW Coal Based Thermal Power Plant project at Rampal in Bagerhat district. The study area includes 10 Unions and 29 Mauzas. Twenty percent of the Mauzas was selected for smooth completion of the study within short duration of the study period. The socio-economic baseline situation of these Mauzas is depicted afterward.

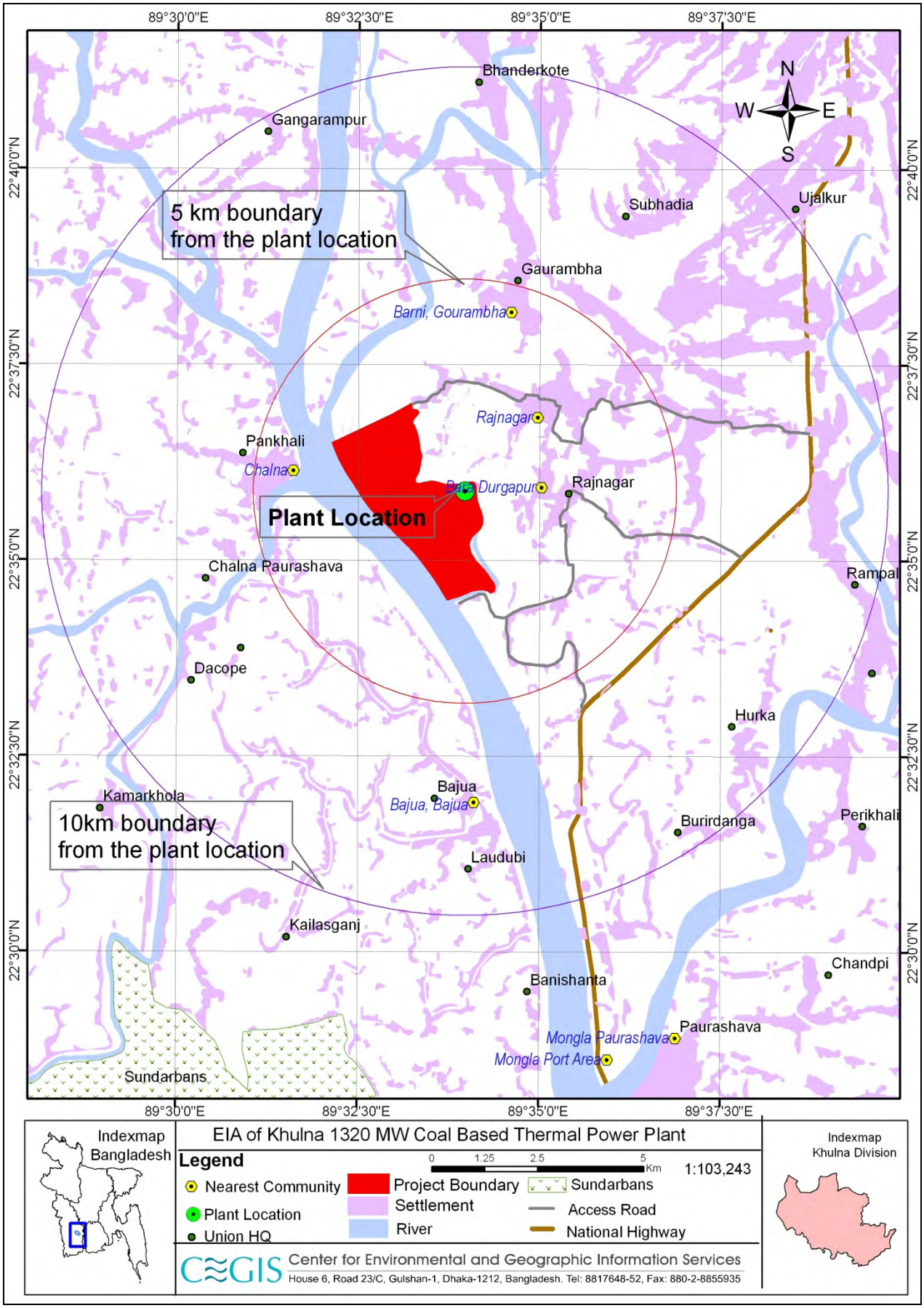
6.25.1 Settlement of urban and rural community

The proposed project site is located at a safe distance from community settlements. Rajnagar and Kalekarber villages are the nearest dense settlements. Map 6.23 shows the community settlements around the project area. The name and distances of the nearest the community settlements are shown in Table 6.32.

Table 6.32: Community settlements nearest to the plant location

Village / Mauza	Union / Pourashava / Upazila	Location and distance from plant
Rajnagar	Rajnagar	2 km east-northward
Durgapuir	Rajnagar	2 km eastward
Barni	Gaurambha	4 km north-eastward
Chalna	Pankhali	4 km north-westward
Bajua	Najua	7.3 km south-westward
Rampal Upazila HQ	Rampal Upazila	11 km eastward
Mongla Port Area	Mongla Pourashava	14 km southward
Mongla Pourashava	Mongla Pourashava	14 km south-eastward
Khulna City	Khulna City Corporation	23.33 km northeastward

Source: Spatial analysis using GIS



Map 6.23: Settlements surrounding the project area

6.25.2 *Demographic profile*

There are 3, 378 households in the study area consisting of 16,585 people. The average size of household is 4.9. However, the population density in the project area (in Sapmari Katakhali) is relatively low, as most of the land in Sapmari Katakhali is occupied by the shrimp farms. Most of the landowners of the project area live in Gaurambha union but each of them has a farmhouse to look after their farm in Sapmari Katakhali. Guards of the shrimp farms usually reside in these farmhouses. The labors of shrimp farms are the major inhabitants of this area. Population distribution of the study area is presented in the Table 6.33 below:

Table 6.33: Population distribution of the study area by Union and Mauza

Union	Mauza name	Area (acre)	Households	Population				
				Total	Male	% Male	Female	% Female
Pankhali	Pankhali	5436	4755	22973	11779	51	11194	49
Bajua	Chunkuri-2	4507	1712	8408	4435	53	3973	47
Bajua	Bajua	3084	1859	9014	4659	52	4356	48
Gaurambha	Kapasdanga	455	430	2112	1041	49	1072	51
Rajnagar	Baserhula	763	153	753	422	56	331	44
Rajnagar	Rajnagar	397	447	2192	1129	51	1064	49
Rajnagar	Sapmari Katakhali	1834	150	708	527	74	181	26
Rajnagar	Bara Durgapur	1565	491	2412	1296	54	1116	46
Total		**18041**	**9997**	**48572**	**25287**	**52**	**23287**	**48**

Note: Above mentioned data depicts total area, households & population distribution around the 10 km boundary from the plant location

Source: Census Report 2001, BBS data adjusted with the growth rate 1.16 for the year of 2010

6.25.3 *Polarization in land ownership*

In the study area, polarization in land ownership exists severely. Although, the number of landowners is satisfactory but most of the landowners have smaller size of land. Maximum people possessed up to 49 decimal of land. In the project site, Sapmari Katakhali, few people engaged in shrimp farming own most of the lands. They own more than 750 decimal of land in most of the cases. The centralization of land ownership in a few people's hand is making the land scarcity more alarming for the poor people. The number of landless households, therefore, is growing rapidly; the enhancing poverty and unemployment compel people to sell their land which is further accelerating the poverty status. The scenario of polarization in land ownership based on different land size is presented in the Table 6.34 below:

Table 6.34: Land Ownership Categories in the Study Area

Mauza Name	% of HHs with different land size				
	Land less (0- decimal)	Marginal (up to 49 dec)	Small (50-249 dec)	Medium (250-749 dec)	Large (750+ dec)
Kapasdanga	30	20	40	9	1
Baserhula	30	20	40	8	2
Sapmari Katakhali	30	10	10	20	30
Rajnagar	5	68	15	10	2
Bara Durgapur	10	35	47	7	1
Chunkuri-2	50	33	10	5	2

Source: RRA, 2010.

6.25.4 *Employment opportunity and availability of manpower*

According to the BBS census report (2001), the largest portion of population of the country within the age range between 18-34 years and this statistics is similar to the study area. This group of young people in the study area is engaged in shrimp cultivation. They rarely have any other option of employment. The data collected from the project sites shows that the laborer availability is very high but the employment opportunity is very low (Table 6.35 depicts that most of the households are concentrated on fishery as their main employment) and the rate of wage is also not satisfactory. The number of female youth engaged in employment in the study area is not mentionable. The labors get the chance to work only for 4-5 days in a week. In shrimp farming they never have the opportunity to work for more than 5 to 6 hours in a day. The workless situation is making them frustrated and reducing their skills, which are eventually influencing the regional economy. Some of the RRA participants informed that the youths are drug addicted because of the lack of proper jobs.

Table 6.35: Different types of employment opportunity in the study area

Mauza name	% of HHs having different types of employments								
	Not working	Looking for work	Fishery	Industry	Water, Electricity & Gas	Construction	Salt farming	Work abroad	Others (specify)
Kapasdanga	0	0	95	0	0	20	0	2	0
Baserhula	2	2	90	0	0	20	0	2	0
Sapmari Katakhali	0	0	100	0	0	0	0	0	0
Rajnagar	2	2	95	0	0	15	0	0	0
Bara Durgapur	10	40	90	0	0	0	0	0	0
Chunkuri-2	5	5	80	0	0	0	0	0	0

Source: RRA, 2010



Plate 6.25: NGO intervention



Plate 6.26: Sources of drinking water



Plate 6.27: Sanitation facility



Plate 6.28: Housing pattern



Plate 6.29: Local vehicle



Plate 6.30: A local primary school



Plate 6.31: Shrimp: source of livelihood



Plate 6.32: A local temple



Plate 6.33: Solar panel



Plate 6.34: Local mosque



Plate 6.35: Local road network



Plate 6.36: Communicative infrastructure

6.25.5 Education

As per Bangladesh constitution, education is the fundamental right for every citizen. However, this right is not reflected in the life of poor people of the study area. Poor people are busy to earn livelihood for their survival; there is no chance of thinking about education. There are few primary schools in the Mauzas of study area (Table 6.36). After completing the primary education most of the students drop out from the school, they do not get

admission at the secondary level, as high schools are situated either in union or Upazila level. Students lose their interest in going to the union or Upazila level for bad communication network.

Table 6.36: Literacy rate of the study area by Union and Mauza

Union	Mauza	Literacy rate		
		Total	Male	Female
Bajua	Chunkuri-2	50.17	57.41	42.19
Gaurambha	Kapasdanga	45.76	46.36	45.2
Rajnagar	Baserhula	58.45	60.77	55.51
Rajnagar	Rajnagar	63.03	67	59.02
Rajnagar	Sapmari Katakhali	18.29	21.91	6.72
Rajnagar	Bara Durgapur	67.22	72.25	61.31

Source: Census Report 2001, BBS.

In addition, the crisis of good teacher is severe here. Because of the bad communication network the educated persons from urban locale not interested to teach in such areas. The BBS census reported in Table 6.37 delineates that despite those several types of problems mentioned earlier the average rate of literacy of the study area, except the literacy rate of Sapmari Katakhali, is not so lower than the national rate of literacy. The lower rate of Sapmari Katakhali showed that education is not fundamental where shrimp cultivation offers opportunity of livelihood. Thus the growing poverty, bad communication network represents education as secondary option in life.

Table 6.37: Number of academic institutions in the study area

Mauza	Number of Academic Institutions			
	Primary School	High School	College	Madrasa
Kapasdanga	1	0	0	0
Baserhula	1	0	0	0
Sapmari Katakhali	0	0	0	0
Rajnagar	1	0	0	0
Bara Durgapur	3	0	0	0
Chunkuri-2	1	1	2	1

Source: RRA, 2010

6.25.6 Occupational pattern

Although the data from secondary source (BBS census report 2001) does not show the dominance of fishery (especially shrimp cultivation) in the life of the people residing in the study areas but the direct observation (tabular presentation in Table 6.38) of study team revealed that shrimp cultivation is the only means of livelihood. People are bound to do shrimp cultivation because of salinity in soil. Shrimp cultivation is no more beneficial to all types of people. It may be beneficial to the owners of large shrimp farm but not for shrimp farm laborers. Moreover, because of virus infestation shrimp cultivation becomes a loss project for income now-a-days. However, people cannot give up the shrimp cultivation because of the salinity contamination in soil, which hampers crop cultivation. People,

therefore, cannot grow crops although they want to do so. Bad communication network, remote location, lack of literacy, and traditional expertise are some other obstacles for alternative options of income opportunity.

Table 6.38: Main occupation in the study area

Mauza	Main occupation by % of HHs								
	Agri / Forestry /Livestock	Service	Industry	Business	Agri labor	Non-agri labor	Fishery	Salt farming	Work abroad
Kapasdanga	100	20	0	0	100	0	95	0	0
Baserhula	80	10	0	0	80	0	95	0	2
Sapmari Katakhali	100	0	0	0	0	0	100	0	0
Rajnagar	5	2	0	1	0	0	95	0	0
Bara Durgapur	0	2	0	2	0	0	90	0	0
Chunkuri-2	20	5	0	2	20	20	80	0	0

Source: RRA, 2010

6.25.7 *Demand of electricity*

The people of the study area always desire to have electricity connection in all of their dwelling places. They always feel that they are poor, they are unemployed, and they remain detached because they do not have electricity. If electricity is available in their area there will be possibility for growing industry, business, education, entertainment, and employment opportunity. They accused the lack of electricity as the main obstacle to their development. Only the area up to the union level has electricity connection. The following Table 6.39 shows the solar panel provided by different NGOs as the main source of their (5-25% households) electricity at Mauza level of the study area. This nature-based solar panel is out of reach of poor people because of its high cost. The power of solar panel is used only for lighting purpose in the households. For industrial development and other development works, people want electricity connection.

Table 6.39: Status of electricity facility in the study area

Mauza	% of HHs having electricity	Sources of electricity	Purposes of electricity
Kapasdanga	20	Solar panel	Lighting, Charging, Fan, TV
Baserhula	15	Solar panel	Lighting, Charging, Fan, TV
Sapmari Katakhali	20	Solar panel	Lighting, Charging, Fan, TV
Rajnagar	25	Solar panel	Lighting, Charging, Fan, TV
Bara Durgapur	5	Solar panel	Lighting, Charging, Fan, TV
Chunkuri-2	1/2 HH (Nos.)	Solar panel	Lighting, Charging, Fan, TV

Source: RRA, 2010.

6.25.8 *Population migration*

Because of the dearth of work during a particular season, people of study area usually migrate-out to other places in search of work; while some other people also migrate-in to their locale from outside. As per supply and demand law of economics, the available labor causes lower rate of wages. People from Bara Durgapur out of six Mauzas emigrate permanently in the neighboring country India. The current migration status of the study area is presented in the Table 6.40 below:

Table 6.40: Migration status in the study area

Mauza Name	Seasonal migration		Permanent migration	
	Out (% of HHs)	In (% of HHs)	Out (No of HHs)	In (No of HHs)
Kapasdanga	20	20	0	0
Baserhula	25	20	0	0
Sapmari Katakhali	30	50	0	0
Rajnagar	25	0	0	0
Bara Durgapur	10	0	20-30	0
Chunkuri-2	25/30 people	100/150 people	0	1/2

Source: RRA, 2010.

6.25.9 *Communal diversity*

All the people of the study areas belong to the same ethnicity “Bangali” but they are mainly divided into two religious communities Muslim and Hindu community. Both the communities are living with intimacy in the study area over the years. This picture resembles the religious liberalism of our country. Out of six within the study areas, only one village of Bara Durgapur is the habitat of Hindu community. The rest of the villages enjoy glorious unity of two religious beliefs. Table 6.41 shows that there are more or less similar number of mosques and shrines, graveyards and cremation grounds in these villages.

Table 6.41: Number of common property resources in the study area

Mauza Name	Number of Common Property Resources			
	Mosque	Shrine	Graveyard	Cremation ground
Kapasdanga	6	1	0	0
Baserhula	3	2	Nil	1
Sapmari Katakhali	Nil	Nil	Nil	Nil
Rajnagar	4	1	0	1
Bara Durgapur	1	5	0	0
Chunkuri-2	8	6	0	1

Source: RRA, 2010.

6.25.10 *Vulnerability to natural disaster*

The proximity to coast makes the study area most vulnerable to the natural disasters. As depicted in Table 6.42 very high frequency cyclones, storms, tidal floods and salinity are the common phenomena of this area. As most of the houses are made of natural resources (Golpata) and as shrimp cultivation is the main source of livelihood, the people have to depend solely on the nature to survive. They are also very vulnerable to natural disaster. White fish, Aman paddy, shrimp, vegetables, other crops and homesteads are the main resources usually damaged by these disasters. The study team observed during fieldwork that there was a cyclone shelter in Chunkuri Mauza only and rest of the villages have no cyclone shelter. Hence, insufficient cyclone shelter, poor infrastructure and poverty make them more vulnerable to natural hazards.

Table 6.42: Disaster severity in the study area

Mauza	Major Disasters	Major Damaged Resources	Frequency	No. of Cyclone Shelter
Kapasdanga	Tidal Flood, Cyclone, Storm, Salinity	White fish, Aman, Crops	Very high	Nil
Baserhula	Tidal Flood, Cyclone, Storm, Salinity	White fish, Paddy (Aman), Homestead	Very high	Nil
Sapmari Katakhali	Tidal Flood, Cyclone, Storm, Salinity, Erosion	White fish, shrimp, Aman	Very high	Nil
Rajnagar	Tidal Flood, Cyclone, Salinity	Cattle, Shrimp, Fish, Paddy, Vegetable	Very high	Nil
Bara Durgapur	Tidal Flood, Cyclone, Salinity	Cattle, Shrimp, Fish, Paddy, Vegetable	Very high	Nil
Chunkuri-2	Tidal Flood, Cyclone, Storm, Salinity	Aman, Crops, Watermelon	Very high	1

Source: RRA, 2010

6.25.11 *Communication infrastructure*

This is easily assumable that bad communication is one of the main obstacles to the development of the study area. The local people urged for the development of communication system to the Member of Parliament (MP), local leaders and district government officials over the years but they never responded to their demands. Because of the proximity to the coast and rivers this area can be the exciting tourism spot but lack of communication network made it impossible. GO and NGO interventions are not also addressed up to the desired level in this area and thus the poverty reduction measures are not promoted properly for this bad or lack of communication infrastructures.

6.25.12 *Social solidarity*

It is well known that all types of social resistance are born from social unity. The social movements in rural area are always born in public gathering places. Although the number is few but there are some public gathering places in the study area. The evidences gathered from the field visit by the study team presented in Table 6.43 shows that these gathering places include rural shops, turning points of roads, school yards or shrimp farms. In these places older people of the villages gather together, gossip and discuss about the problems of villages and try to solve it socially. This gathering gives fuel to their combined resistance

against any kind of activities that may harm their social stability. The study team found that they may be unknown to the phrase but they feel it “united we stand, divided we fall”.

Table 6.43: Important public gathering places in the study area

Mauza	Name of public gathering places
Kapasdanga	Kheya Ghat
Baserhula	Kheya Ghat
Sapmari Katakhali	Shops at Charer Gora
Rajnagar	Kacharibari Bazar, Kheya Ghat
Bara Durgapur	Dighir Par
Chunkuri-2	Bajua Bazar

Source: RRA, 2010

6.25.13 Safety nets

At present, the social safety nets of a rural remote area are dependent on the NGO interventions. Although the government interventions are limited to some extent, but the government interventions are more or less in a satisfactory level in this place. At least it does not differ so much compared to other regions of Bangladesh. But the scenario of NGO intervention is not satisfactory in the study area. It is observed from the following table that the NGO activities are limited to their credit programs in most cases. There are only handful programs run by the NGOs on education, health and women empowerment while program on forestry, fishery, livestock rearing, disaster and human rights are nearly absent. It is true that the lack of good communication system made the study area detached from the urban locale but the credit program of all the NGOs worked there reflects their big business mentality which could not contribute to any development in ensuring the fundamental rights (health, education, etc.) of the people. Thus the GO and NGO interventions failed to conduct poverty reduction measures simultaneously, and hence, the safety net programs remain low in these areas (Table 6.44).

Table 6.44: NGO intervention according to the activity in the study area

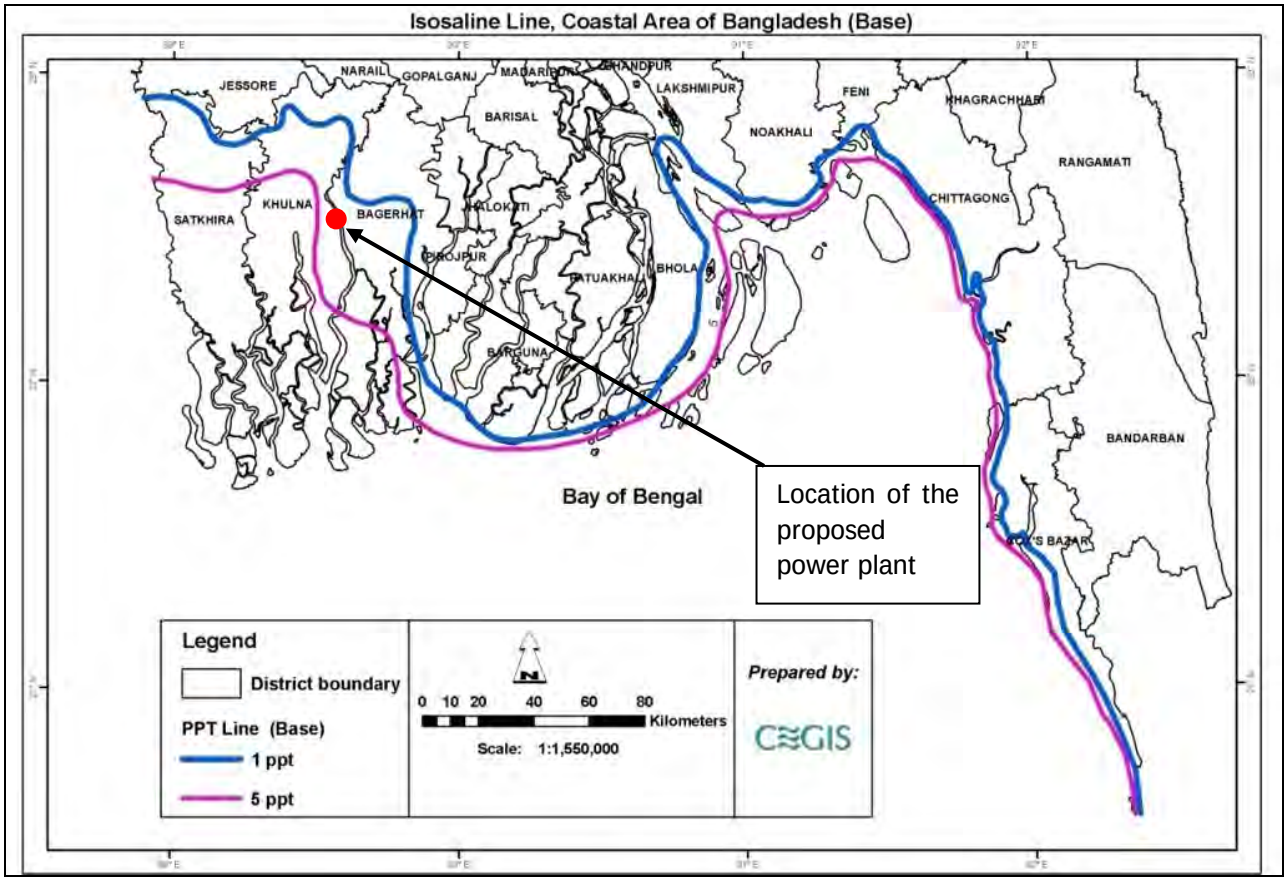
Mauza Name	% of HHs coverage	Name of NGOs by activity							
		Credit	Education	Health	Forestry	Fishery	Livestock	Women Empowerment	Human Rights
Kapasdanga	50	Karitas, ASA, Grameen Bank, BRAC	No intervention	BRAC	No intervention	No intervention	No intervention	Nari Bikash	BRAC
Baserhula	60	Karitas, ASA, Grameen Bank, BRAC	No intervention	BRAC	No intervention	No intervention	No intervention	Nari Bikash	No intervention
Sapmari Katakhali	40	ASA, BRAC, Grameen Bank	No intervention	BRAC	No intervention	No intervention	No intervention	Nari Bikash	No intervention
Rajnagar	70	Karitas, ASA, Grameen Bank, BRAC, Agriculture Bank, Sonali & Janata Bank	BRAC	CSS	BRAC	No intervention	No intervention	RICK	No intervention
Bara Durgapur	65	Karitas, ASA, Grameen Bank, BRAC, BRIDGE, Agriculture Bank	RICK	BRAC	No intervention	No intervention	No intervention	Rupantor	No intervention
Chunkuri-2	65	Karitas, ASA, Grameen Bank, BRAC	No intervention	World Mission	No intervention	No intervention	No intervention	Nari Bikash	

Source: RRA, 2010.

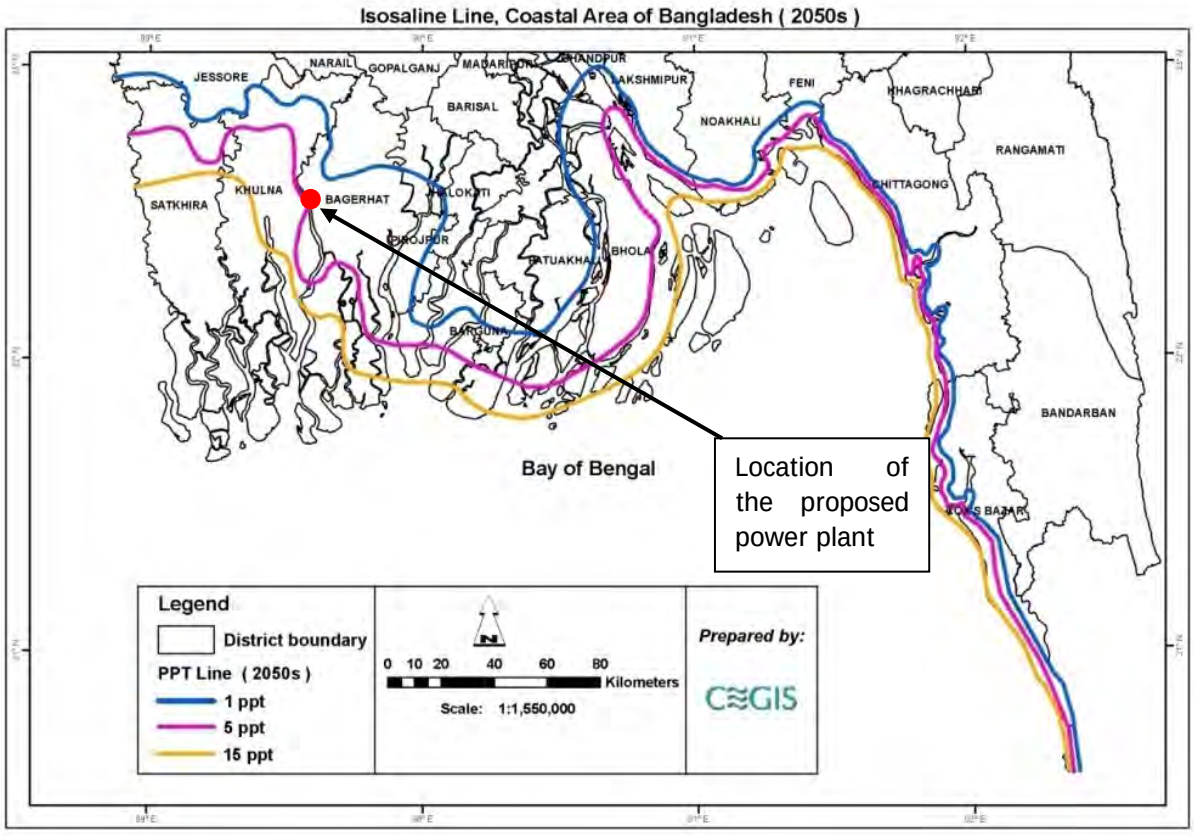
6.26 Climate Change Scenario

It is seen through analyses that climate change has an exaggerating effect on the natural hazards like sea level rise, cyclonic storm surge, salinity intrusion, erratic rainfall behavior, anomalies in temperature trends etc. Hence understanding the anticipated future climatic condition of the study area is of utmost importance for any development project. Coastal zones are particularly vulnerable to climate change effects. Over the last century, sea level rose on average by 10–12 cm per decade and did so at much higher rates in some coastal areas due to land subsidence (Bhuiyan & Dutta, 2012). This recent study also applies a newly developed salinity flux model integrated with an existing hydrodynamic model in order to simulate flood and salinity in the complex waterways in the coastal zone of Gorai river basin. The results obtained indicate that due to sea level rise, the salinity has increased in the river and salinity intrusion length has increased. Sea level rise of 59 cm produced a change of 0.9 ppt at a distance of 80 km upstream of river mouth, corresponding to a climatic effect of 1.5 ppt per meter sea level rise.

The changes in salinity in the coastal area of Bangladesh have been assessed in the study on "Investigating the Impact of Relative Sea-Level Rise on Coastal Communities and their Livelihoods in Bangladesh" (IWM & CEGIS, 2007). Based on the study results, the isohaline lines of 1, 5 and 15 ppt have been drawn for base and 2050 conditions. Maps 6.24 and 6.25 present these isohalines. These figures indicate that in base condition about 10% area is under 1 ppt salinity and 16% under 5 ppt salinity and this area will increase to 17.5% (1 ppt) and 24% (5 ppt) by 2050. Therefore, there will be around 7% increases in area under 5 ppt salinity levels (CEGIS, 2011).



Map 6.24: Salinity condition in coastal area (for base condition)



Map 6.25: Salinity condition in coastal area (for 2050)

A calibrated hydrodynamic model was used to simulate surge wave propagation through the rivers and overland flooding. This analysis of this model result showed that for a storm surge under 2°C SST rise and 0.3 m SLR, flood risk area would be 15.3% greater than the present risk area and depth of flooding would increase by as much as 22.7% within 20 km from the coastline. Within the risk area, the study identified 5690 km^2 land (22% of exposed coast) as a high-risk zone (HRZ) where flooding of depth 1 m or more might occur, and people should move to nearby cyclone shelters during extreme cyclonic events. Predicted area of HRZ is 1.26 times the currently demarcated HRZ. It was estimated that 320 additional shelters are required to accommodate people in the newly identified HRZ (Karim & Mimura, 2008).

Several attempts have been made in climate scenario development in Bangladesh over the period using GCMs and RCMs (CEGIS, 2011). Most of these exercises have used GCM results and only a few have incorporated results of RCMs. In summary, a general consent was found among the studies about drier dry season, wetter wet season and overall increase in temperature. In general, change in annual temperature might be around 1^0C by 2030 and 2^0C by 2050; change in annual rainfall is expected in the range of 0 to 2% by 2030 and 2 to 4% by 2050 with a greater variation in seasonal rainfall. Winter (December-February) rainfall is expected to decrease in most of the study results while monsoon (June-August) rainfall might increase in the future (CEGIS, 2011). Table 6.45 and 6.46 represents the changes in temperature and rainfall under A2 and B1 scenarios for the projected year.

Table 6.45a: Temperature change (^{O}C) in Khulna Region: A2 scenario

Season	DJF		MAM		JJA		SON		Annual	
Division	2030s	2050s	2030s	2050s	2030s	2050s	2030s	2050s	2030s	2050s
Khulna	1.09	1.83	0.72	1.31	0.36	0.74	0.54	0.99	0.68	1.21
National	1.16	1.96	0.76	1.41	0.42	0.84	0.59	1.09	0.73	1.32

Source: Hassan et. al. 2010

Table 6.45b: Temperature change (^{O}C) in Khulna Region: B1 scenario

Season	DJF		MAM		JJA		SON		Annual	
Division	2030s	2050s	2030s	2050s	2030s	2050s	2030s	2050s	2030s	2050s
Khulna	1.23	2.07	0.84	1.68	0.24	0.93	0.53	1.25	0.71	1.48
National	1.32	2.20	0.91	1.85	0.30	1.04	0.60	1.40	0.78	1.62

Source: Hassan et al. 2010

Table 6.46a: Precipitation change (%) in Khulna Region: A2 scenario

Season	DJF		MAM		JJA		SON		Annual	
Division	2030s	2050s	2030s	2050s	2030s	2050s	2030s	2050s	2030s	2050s
Khulna	-28.73	-39.12	30.01	40.30	8.73	11.76	-0.87	2.17	4.47	7.51
National	-27.68	-37.67	24.00	32.61	9.47	13.29	-2.81	-1.18	4.92	8.10

Source: Hassan et al. 2010

Table 6.46b: Precipitation change (%) in Khulna Region: B1 scenario

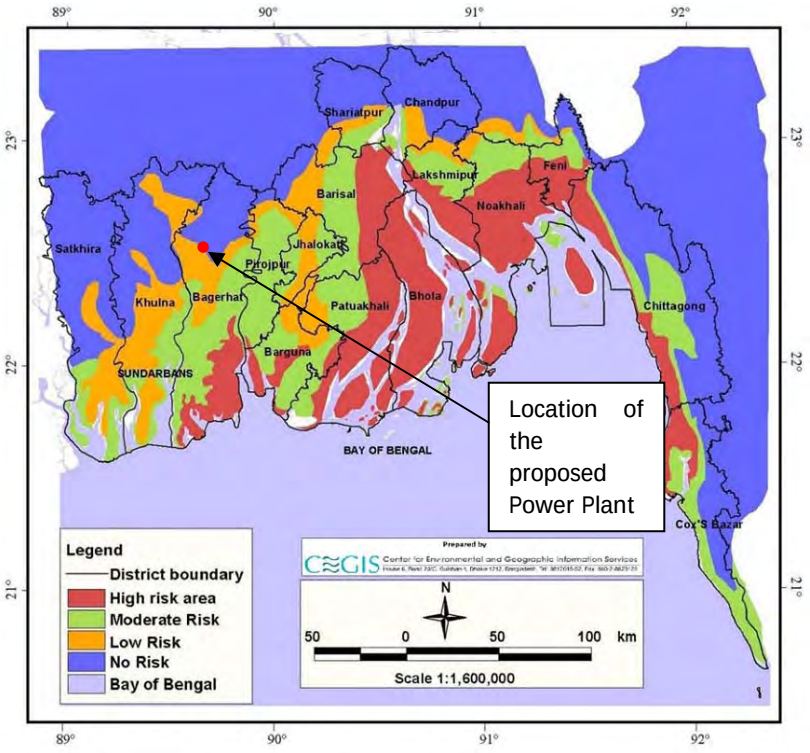
Season	DJF		MAM		JJA		SON		Annual	
Division	2030s	2050s	2030s	2050s	2030s	2050s	2030s	2050s	2030s	2050s
Khulna	-63.25	-62.71	23.22	6.44	13.17	11.99	-0.46	6.92	6.02	8.47
National	-58.40	-56.56	19.52	7.34	13.05	12.51	-2.26	3.88	6.30	8.41

Source: Hassan et al. 2010

According to Tanner et. al. (2007), the cyclone High Risk Areas (HRAs) of 8,900 sq km will increase by 35% and 40% in the 2020s and 2050s, respectively. On the other hand, total population exposed to cyclone High Risk Areas is likely to increase. The total coastal area is 39,400 km^2 and population density is about 930 people per km^2. Currently about 8.3 million people live in cyclone HRAs and, based on projections of future population density, this will increase to 14.6 million in the 2020s and 20.3 million in the 2050s (Tanner *et al*., 2007).

Developments and climate change induced moisture stress in the upstream areas of the river basin will result in an increase of the rate of water withdrawal for agricultural, domestic and industrial activities. This might lead to even lesser availability of water flow in the cross-boundary rivers in Bangladesh during the winter months. This is also a concern for Passur river as Passur, though a tidal river, is a distributaries of the Ganges as it is first known as *Gorai*, then further down as *Rupsha* and before meeting the Bay of Bengal, *Passur*.

Cyclonic storm surges can also be a major hazard in the study area. The cyclone prone area of Bangladesh is shown in Map 6.26. The 'risk areas' have been identified based on storm surge inundation depths collected from a study entitled 'Use of existing data on available digital elevation models to prepare useable tsunami and storm surge inundation risk maps for the entire coastal region' (IWM, 2008). Based on the storm surge inundation risk maps for cyclone the coastal area has been divided into four risk zones. These are, Wind/No risk (no inundation), Low risk (inundation 0-1 m), Moderate risk (inundation 1-3 m) and High risk (inundation > 3 m).



Map 6.26: Storm Surge Risk Areas

Singh *et. al*. (2000) has shown that both sea surface temperature (SST) and the intensity of cyclone in the Bay of Bengal during May and November have been increasing. An increase in SST is likely to cause greater convective instability, leading to an increase in the wind speed of a cyclone. It is observed that though the frequency of tropical cyclones in the Bay of Bengal is not changing much, the number of intense tropical cyclones hitting Bangladesh have increased in recent years. In another study it is seen that with no sea level rise, surge height increases by 21% and 49% respectively for SST rise of 2^{o}C and 4^{o}C respectively for a cyclone like that of 1991 (Ali, 1996).

SLR may also cause an increase in the destructive effect of cyclones in Bangladesh. The SLR will force the shoreline to retreat. As a result, the path distance of the cyclone will increase and the cyclone will have more time in the sea to acquire energy to increase its intensity. The convergence of the Bay will also increase through SLR, thus making the surge height to amplify further (CEGIS, 2011).

Chapter 7: Important Environmental and Social Components

Environmental impact assessment has been carried out considering the impacts of proposed interventions with associated activities on important components of the environment and society. Firstly, all of the environmental components sensitive to proposed activities were identified during reconnaissance field visit based on expert observation, local people's perception and worldwide practice of EIA. The scoping process, followed to select IESCs, included professional judgments of the multi-disciplinary EIA team members and village scoping sessions where local communities identified environmental and social components likely to be impacted by the proposed power plant project. The preliminarily identified IESCs were presented to the BPDB with inception report for their comments and suggestion. Incorporating the expert opinion and suggestion of the BPDB professionals, the preliminarily identified IESCs were screened and considered for EIA study. At the end, the IESCs were finalized incorporating the experience of IEE study.

IESCs, selected for the Power Plant Project at Sapmari in Bagerhat district along with the rationale of their selection under physical environment, water resources, land resources, agriculture, fisheries, ecosystem and socio-economic condition, are pointed out in the following sections.

7.1 Physical environment

7.1.1 Landscape and scenic beauty

Any kind of industrial activities especially in the rural area could be an aspect of landscape change and impact (negative or positive) on scenic beauty. The zone of visual intrusion might be changed due to introduction of any construction activities. Hence, it has been considered as an IEC.

7.1.2 Heat radiation

Heat radiation may change the local air temperature as well as be responsible for global warming. Thence, heat radiation has been considered as an Important Environmental Component for this EIA.

7.1.3 Air quality

Air quality is very important component in EIA. SOx, NOx, SPM, greenhouse gases, etc may cause air pollution. The fate of the air pollutants and impacts of these has been considered in EIA study.

7.1.4 Acid rain

Excess SOx and NOx in air may cause acid rain. Acid rain is very harmful for ecosystem, agriculture, fisheries and human health. The possibility of acid rain and its associated impacts have been considered in the EIA study.

7.1.5 *Noise*

Noise from any construction activities, industrial activities, and mechanical engine may have impact on existing acoustic environment. The noise is also with a correspondence for health hazards in workplace and to local people. To identify the noise sources and to assess impact, it has been considered as an IEC in this EIA.

7.1.6 *Solid waste*

Disposal of solid waste may deteriorate ecosystem habitat, fish habitat and also may cause annoyance to local people. The potential sources of waste generation are construction, coal handling, plant processing, domestic activities, and its impact on environment need to be identified and properly addressed.

7.2 Water Resources

7.2.1 *Tidal inundation*

Tidal inundation pattern and extent play importation role in tidal flooding in the surrounding area. Site establishment, construction of civil structures and mechanical development may change the tidal penetration and inundation status if these activities obstruct tidal creeks and tidal flood plain. Hence, the 'Tidal Inundation' has been taken as an IEC.

7.2.2 *Drainage congestion*

For the power plant, an area of 1834 acres has to be raised above the highest surge height by filling dredging material. Hence, drainage congestion has been selected as an IEC to examine the role of the land area to be developed for site establishment in drainage of the surrounding area and to identify impacts of land filling on drainage congestion of the surrounding area.

7.2.3 *Water logging*

There are some low-lying *beel* and Gher (shrimp aquaculture farmland) areas outside the project area where water remains most of the year. The IEC has been selected to identify and examine whether there would be any impact of the site establishment on the water logging of the surrounding area.

7.2.4 *Salinity intrusion*

Salinity intrusion is an important hydrological issue in southwestern region of the country. Change in river flow condition may also shift the salinity front. Water abstraction from tidal river may have impact on the flow condition (subject to abstraction rate). Hence, the IEC has been selected to examine the impact of water abstraction from Passur River on salinity intrusion.

7.2.5 *Erosion*

Erosion is the most acute problem, which causes losses of human life, property and makes the life vulnerable. Hence, erosion has been considered as IEC to identify the impacts of project related activities on erosion pattern.

7.2.6 Accretion

Similar to erosion, accretion is also an important hydro-morphological characteristic of river that might be changed due to dredging, jetty construction, and other activities on river or along the riverbank. Hence, accretion has been selected as IEC to assess the impacts of project related activities on accretion.

7.2.7 Surface water quality

Water quality is an important factor for ecosystem as well as human system dependent on the surface water system. Surface water quality may be changed due to dumping of waste, wastewater, pollution from ships, dredging, and other pollution causing activities. Hence, water quality has been selected as an IEC to examine the impact of the project related activities on surface water quality.

7.2.8 Ground water level and quality

The people of the study area are largely dependent on ground water for drinking purpose. Usually, water abstraction may lead to increase the drawdown of ground water level. Ground water quality may be changed due to infiltration of leachate from any waste disposal system of coal stockyard. Hence, it has been selected as an IEC to identify and assess impacts of project activities on ground water level and quality.

7.3 Transportation system

7.3.1 Communication

The road as well as the waterway communication status may be changed in the study area and its surrounding area after completion of the project. There is a possibility of development of communication through telephone, internet, postal service etc. The jetty facility may also change the waterway communication in the area. The maintenance quality of present local and regional roads may be further improved for the power plant. Therefore, communication has been selected as an IESC.

7.3.2 Traffic load on roads

The traffic load on Khulna – Mongla road may change due to implementation of the project. As such, this has been selected as an IEC.

7.3.3 Navigation/ River Traffic

Jetty will be constructed in Passur River for loading and unloading of coal and other production materials. Therefore navigation in Passur River may become an important factor for this project. Therefore, it has been selected as an IEC.

7.4 Land Resources

7.4.1 Land Type

Platform of the power plant will be raised up to maximum surge height, which may cause various changes in the area. As such, land type is selected as an IEC.

7.4.2 *Land Use*

The construction of coal based thermal power plant may change the land use in the project area. Hence, land use has been selected as an IEC.

7.4.3 *Soil nutrient status*

Coal fired power plant generates several byproducts like fly ash, bottom ash, etc. During operation and storage a part of these may be deposited over the products in the surrounding area due to wind action, therefore, it has been selected as an IEC.

7.4.4 *Heavy metal*

Heavy metal contamination of soil is toxic to agricultural as well as ecosystem. Coal may contain light concentration of heavy metal. Hence, heavy metal has been selected as IEC to identify possible contamination and to assess its impacts.

7.5 Agriculture

7.5.1 *Loss of agricultural land*

Agricultural land is limiting day by day due to expansion of settlement and other development activities. The economy of the country largely depends on agricultural activities and production, Hence, loss of agricultural land is an important component that needs to consider in EIA.

7.5.2 *Crop production*

Acquisition of agricultural land may reduce crop production of the local area. Thence, it has been considered as an IEC to assess the impact.

7.5.3 *Crop damage*

Byproduct of the power plant may contaminate the soils of the surrounding areas and may cause unfavorable condition for plant growth. Therefore, it is considered as an IEC.

7.6 Livestock

7.6.1 *Fodder and disease*

The power plant area may restrict grazing and the waste products/drained water of power plant to be released in the surrounding area may also harm livestock health. Hence, livestock fodder and diseases have been included as an IEC.

7.7 Fisheries

7.7.1 *Fish Habitat*

Habitat health and productivity is the prime factor of fish diversity and production. Habitat health and quality depend on quality of the surrounding environment. Fish habitat has been

considered as IEC to identify and assess impacts of proposed project on fish habitat as the project activities include dredging, navigation, site establishment, coal transportation etc.

7.7.2 Fish Migration

The project site is located near the coast having a number of rivers and canal networks. All the estuarine fish species and Hilsa used to migrate through these river and channels. Therefore, fish migration has been selected as an IEC to identify and assess the impact of project on fish migration.

7.7.3 Fish Biodiversity/Species Composition

The of fish habitat, feeding and breeding ground, obstacles or changing migration route may induce change in the status of fish biodiversity. Therefore, this has been considered as IEC to examine whether any project activities have any chances to affect fish biodiversity.

7.7.4 Fish Production

The study area as well as the project area is dominated by fish aquaculture practice. The proposed project also acquires area used for shrimp farming. Fish production has been selected as IEC to assess the impacts of project on fish production and to identify which project activities have potential for affecting fish production.

7.8 Ecology

7.8.1 Habitat

Habitat health and diversity are very important for ecosystem. Different construction activities may have impact on habitat due to disposal of waste and waste water, alteration of existing landscape, increase of anthropogenic activities, etc. Emissions of greenhouse gases, Sox, NOx, Heat, etc from power plant may have impact on surrounding ecosystem habitat, which depend on the emission rate and nature. Hence, the ecosystem habitat has been selected as an IEC to identify and examine all potential impacts of the proposed power plant.

7.8.2 Terrestrial flora

The potential impact on terrestrial flora including riverside, roadside, homestead and agricultural land are related to the site clearance activities, construction activities during implementation phase, open-air coal storage facilities, management of coal dust, fly ash. Smaller plants (herbs, shrubs) are sensitive to change their surroundings. Hence, this has been selected as IEC to identify each impact of project activities on terrestrial flora.

7.8.3 Terrestrial fauna

Different species of frog, amphibians, reptiles, mammals, are found within the project area. Hence, terrestrial fauna has been selected as IEC to identify and to assess impact of proposed project on the terrestrial fauna of the surrounding.

7.8.4 *Aquatic flora*

Aquatic flora including planktonic community is a good indicator of ecological health. The aquatic flora and planktonic community of the river and adjoining freshwater sources may be affected due to changes in water quality. Hence, aquatic flora has been considered as IEC to examine all potential impacts of proposed project on aquatic flora.

7.8.5 *Aquatic fauna*

The proposed coal-fired plant is located close to the major river Passur. This river is notified as regular roaming ground of endangered aquatic mammal – the Ganges River dolphin (*Platanista gangetica*) and Estuarine Crocodile. The river also serves as the migratory route for many anadromous species. Hilsa is a well know anadromous fish species. Among reptiles like Dog-faced water snake (Cerberus rhynchops), White-bellied snake (Fordonia leucobalia), critically endangered Estuarine River Terrapin (Batagur baska) are few of the known anadromous animals. In general the aquatic mammals choose the thalweg (the deeper channel) as migratory habitat while some animals prefer near-surface water for migration. Thus, aquatic fauna has been considered as IEC to identify and to assess potential impacts of the proposed project and its relevant activities.

7.8.6 *Benthic community*

Generally, benthic communities are very sensitive to waste water discharge, thermal plume, dredging operation, pollution from ships etc. Species composition of the river may be changed any change in river water quality, heat gradient, etc. Hence, the benthic community has been selected as an IEC to assess the potential impact of proposed power plant on benthic community as well as ecosystem.

7.8.7 *Sundarbans Ecosystem*

The proposed power plant is 14 km away from the Sundarbans Mangrove Ecosystem. Sundarbans ecosystem represents a good number of flora and fauna with many threatened species. The World Heritage Site of Sundarbans is 70 km away from the proposed plant location. Providing importance to the Sundarbans, it has been considered as an IEC to examine what would be the impacts of the proposed power plant on Sundarbans ecosystem.

Bengal Tiger and Deer

Bengal tiger is our national animal and only found in Sundarbans mangrove forest. It is a globally threatened species. The spotted deer are the major prey of tiger. The existing navigational route in Passur River shall be used for transporting coal for the proposed power plant. The vessel movement and sound pollution from vessel would be disturbance (feeding/ grazing, breeding, movement etc.). Hence, the “Tiger and Deer” has been considered as an IEC to examine and evaluate the potential impacts of power plants on Bengal Tiger and Deer.

Crocodile

Estuarial crocodile is also found in Sundarbans mangrove forest’s river and estuaries. The existing navigational route in Passur River shall be used for transporting coal for the proposed power plant. The movement, oil spills, and sound from vessel may be disturbance (feeding territory, breeding behavior, roosting and basking habitat) for such aquatic reptiles.

Hence, these have been considered as an IEC to examine and evaluate the potential impacts.

Dolphin community

The Passur River is an important habitat for Dolphin. Bangladesh has established three new wildlife sanctuaries for endangered freshwater dolphins in the world's largest mangrove ecosystem, the Sundarbans. Officially declared on January 29, 2012, the sanctuaries are intended to protect the last two remaining species of freshwater dolphins in Asia - the Ganges River dolphin, Platanista gangetica, and the Irrawaddy dolphin, Orcaella brevirostris. The existing navigational route in Passur river shall be used for transporting coal for the proposed power plant. Hence the “Dolphin Community” has been considered as an IEC to examine and evaluate the potential impacts of power plants on dolphins.

Mangroves Plant

The existing navigational route in Passur River shall be used for transporting coal for the proposed power plant. Oil spills from vessel, disposal of waste may affects the mangrove regeneration and productivity. Hence the “Mangrove Plant” has been considered as an IEC to examine and evaluate the potential impacts of power plants on Mangrove plant.

Invasive species

Invasive species may become very harmful for ecosystem and its community. In general, maritime vessels may carry invasive species. The proposed project includes maritime transportation of coal from different international sources (Australia, Indonesia and South Africa). Thus, invasive species become an important component and considered as an IEC for this EIA.

7.9 Socio-economic condition

7.9.1 Population

Impact on population is an important aspect of EIA that has to be properly addressed. Hence, population has been selected as an IEC to identify and assess the impact of the proposed power plant on population.

7.9.2 Employment and manpower

Employment opportunity is an important indication of identifying economic condition. The development activities may change existing employment pattern. Availability of manpower is also important that has to be explored before initiating project. Hence, employment and manpower is selected as an IEC.

7.9.3 Occupation

Land acquisition, industrial development, infrastructural development, etc are directly and indirectly related with occupational pattern of the locality. Thus, occupation has been selected as an IEC to identify impact of the proposed power plant on occupational pattern of the local people.

7.9.4 Communication

Any kind of industrial development triggers communication system. On the other hand, it sometime creates pressure on existing communication. Hence, it has been selected as an IEC to assess the impact of proposed power plant on communication of the locality.

7.9.5 Health

Health is the most fundamental need in a human's life cycle. In the study area, only a handful people enjoy the access to the recognized health facilities because of the weak communication system and shortage of health institutions in the study area. For implementation of this project, the communication system may be changed and this improvement eventually will touch the health system. This has thus been selected as an IEC to explore the impact of the proposed power plant on community health and health system of the locality.

7.9.6 Water-sanitation

Water and sanitation is an important indicator to assess socio-economic condition. Development activities may improve or deteriorate local water and sanitation system. This has thus been selected as an IEC to examine the impact of the proposed power plant on water and sanitation system of the locality.

7.9.7 Poverty

In Bangladesh, almost 40% people live under upper poverty line. The implementation of the project may change the poverty status through income generation, communication development, and improved health facility. In contrast, land acquisition may change the economic condition of the affected person. Hence, this has been selected as an IEC to assess the potential impact.

7.9.8 Land ownership and land price

The people of the studied area own huge amount of land of the project site. The eviction of settlements because of the project may affect the land ownership composition. The acquisition may change the land price in the project and adjacent areas. Thus it has been considered as an IEC.

7.9.9 Literacy

The poor communication infrastructure, financial insolvency caused a lower rate of literacy of this area. The project would change literacy rate of the area. Literacy is thus been considered as an IEC.

7.9.10 Social safety nets

The social safety nets programs are insufficient than those in other rural areas of adjacent districts. This huge development process may accelerate more NGO interventions in this area. Government initiatives and other development partner interventions may create the possibilities of improving social safety net programs along with the NGOs. Social safety nets are thus considered as an IEC.

7.9.11 *Income and expenditure*

There is always an outsized discrepancy between income and expenditure in the study area. The change of occupation may compel the people to take loan from different NGOs and banks to survive. The pressure of loan interest will create a deteriorated living condition of the people. If the project can ensure employment, it will be a positive scenario.

7.9.12 *Social institution*

The number of social institutions in the study area is a few. The huge gathering of development professionals will change the composition. During the construction period of the project the number of religious institutions (mosques, shrines), economic institutions (markets) and the public gathering places will be influenced.

Chapter 8: Environmental and Social Impacts

8.1 Identification of impacts

Through detail technical analysis and reconciliation with BPDB, NTPC and other experts' opinions, comment and perception of the local people impacts identified during IEE study have been investigated and refined. The predicted impacts have been evaluated as per DoE's guideline and expert opinion of DoE's professionals. The impacts have been evaluated in respect to their nature of impact (i.e. direct or indirect), spatial nature (i.e. local or widespread), temporal nature (i.e. long term or short term), and likelihood of occurrence. Finally, the consequences of these impacts have been categorized into a qualitative scale defined by word scenarios for each category. The following sections describe all the potential impacts (stage wise) on physical environment, physical resources (water resources, land resources, agricultural resources, fisheries resources, ecosystem resources) and socio-economic environment of the surrounding.

8.2 Impacts pre-construction and construction stages

8.2.1 Impact on land form and land type

For this project 1,834 acre lands have been acquired. This will be changed from existing condition but it might not affect land form and land type of the surrounding area. At the initial stage, 420 acre of land shall be developed for site establishment. The existing low to medium high land within the project area will be changed to high land. The rest of the land shall be developed for 2nd phase of the project by dumping of ash slurry to be generated from the power plant.

8.2.2 Impact on land use

Land use of surrounding area might not be affected for construction and pre-construction activities of the project. But in future (post-construction phase) the land use of the surrounding area might be changed for the induced regional and local infrastructure development.

8.2.3 Impact on landscape and scenic beauty

Constructions activities may change the visual landscape of the project area. Site clearance activities, gathering of equipment and construction materials, machinery and camp establishment on green field site may reduce the scenic beauty. Nevertheless, the impact is for a short duration, and reversible as the project plan includes landscape planning, green belt development etc.

8.2.4 Heat radiation

Different diesel engines to be operated for construction related activities and project vehicles are the potential sources of heat, which would be very insignificant to increase local air temperature. Hence, there may be no or negligible impact of heat radiation during pre-construction and construction phase

8.2.5 *Impacts on ambient air*

Generating particulate dust materials

Land filling, site establishment, earth works, construction materials processing, construction activities, vehicle movement, etc. may generate fugitive dust particles. The proposed project involves construction activities like civil construction, mechanical construction, handling and stocking of construction materials, etc. It is necessary to adopt management plan for controlling the fugitive particulate matter during construction activities. However, these ground sourced generation will be limited to the project boundary and the impact might be for short period, only during the construction activities. Moreover, the consequence will not be significant as the closest hamlet of settlement is located 2 km away from the project boundary.

Emission of greenhouse gases

Carbon dioxide and nitrogen oxides may be emitted from combustion of the petroleum products in project related vehicles, machinery, generators, and vessels/barges etc during the construction period. Their impact on air quality will not be significant as the pollutant emission activities (point and area sources) will be limited within the project boundary and the activities will be short term (only for construction period). However, this impact may further be minimized by adopting Environmental Management Plan.

8.2.6 *Impact on ambient noise*

Operation of different machineries and equipments for construction activities, running of heavy load traffic for construction materials transportation, and regular traffic movement may generate noise during construction period. The produced noise may have impact on existing acoustic environment of rural category defined in ECR, 1997. Local inhabitants may feel disturbed due to noise from line sources (traffic movement). However, it is very unlikely that the local people will be affected by the noise which might be produced from point sources (construction activities) as the nearest - hamlet of settlement is located 2 km away from the sources.

8.2.7 *Waste generation and disposal*

Construction activities may generate different categories of solid wastes and might have impact on local environment only if not managed properly. Wastes may be generated from earth works, site establishment, civil construction, stockpile of materials, and domestic household activities. The wastes might be metals, concrete, spoiled construction material, excavated spoils, spilled oil from machinery and vehicles, etc. The construction activities shall be carried out following environmental rules and regulation so that no significant environmental impact would be resulted from the construction activities. The EIA also suggests different management plan as EMP for controlling generation and scattered disposal of wastes. If EMP is properly implemented, there might be only some minor local and short term impact of waste disposal on physical environmental resources i.e. water, land resources and agriculture.

8.2.8 *Impacts on water bodies and water resources*

During pre-construction phase the environmental quality of water resources may not be impacted significantly, as there will be no activities on water resources except some navigation for site visit

The construction activities and installation of power plants may cause changes in the surface water and ground water quality and potential. Some of the predicted changes are pointed out as follows:

Little drawdown of local groundwater table may be noticed in dry season due to withdrawing of groundwater for construction activities. In the project area, lowest ground water table occurs during April-May. Therefore, it is necessary to initiate proper management plan for limiting the use of groundwater during dry season. However, the problem of this phenomenon will be short term and consequences of this problem might not be significant as there is no hand pump tube well within 1km of the project. Therefore, it is very unlikely that withdrawing of ground water for construction activities might affect the surrounding hand pump tube wells.

Impact on Surface Water Quality

Oil spillage from the workshop, water vessel may contaminate surface water near the construction site.

Effluent from workers colony

During construction, large number of labors will work and huge domestic garbage and sanitary waste water will be generated from various facilities such as workers shed units, which shall have to be properly managed.

Impacts of dredging activities (if required)

Dredging operation may increase turbidity of water at dredging locations. If the dredgers cannot be managed properly, water quality of river may be contaminated by spillage of oil, grease and effluent from dumping site. Dumping of dredged material and seepage from dumped dredged material may also increase the turbidity of river water at project site. Nevertheless, the dredging may improve navigability of the Passur River. The implementing agency shall be responsible for taking necessary measures suggested in Chapter 10 for mitigation of impact. Thereby, it is expected that impact during dredging may be minimum.

8.2.9 *Impacts on transportation system and traffic movement*

During pre-construction phase, the Important Environmental Components (IECs) under this sector will not be severely impacted. During construction of the project, vehicles movement in the project and surrounding area will be increased due to transportation of raw materials and construction materials. Therefore, traffic load on the road as well as on the waterway may be increased during construction period, thereby road and waterway accidents might be increased.

8.2.10 *Impact on agriculture resources*

Crop production

1,834 acre land to be acquired for the project including 1745 acre of agricultural land (rice and rice-shrimp cultivation). Thereby, local crop production might be reduced.

Crop damage

The process of land acquisition has already been completed. People of the area should be informed before initiation of the construction work so that affected people get enough time to harvest their crops so that construction activities shall not cause any damage to the standing crops. The construction activities shall be limited within the project area. Hence, the construction activities may not cause any damage of standing crops of the project surrounding area. EPC contractor shall follow the standard practice and EMP to manage construction waste that may prevent damage to surrounding agricultural area from waste disposal.

8.2.11 *Impact on livestock resources*

The land acquired for the proposed power plant provides food, fodder and grazing land for livestock. Acquisition of this land will reduce grazing area for livestock. However, there are also other grazing areas for livestock within 10 km radius of the project that shall be unaffected.

8.2.12 *Impact on fisheries*

Fish Habitat

The only direct impact during pre-construction phase is acquisition of agricultural cum shrimp aquaculture area. There will be no other significant direct impacts on fish resources during pre-construction phase. Acquired land includes shrimp aquaculture farm, mangrove, intertidal area, and tidal creeks which are used as, fish habitat. Acquisition of these lands might cause loss of these habitats. However, the expected benefits of the project overcome these losses.

Construction work including land filling by dredging, sand lifting, site clearance and physical construction of plant setup etc. which may have impacts on open water fish habitats, fish diversity and hence to some extent on capture fisheries production. The project adopts waste management plan, so impact on fish habitat due to waste discharge would be minimum. Open water fisheries habitats like rivers (Passur, Maidara), *khals* and inter-tidal area may be affected due to dredging, traffic movements, and oil and chemical spilling. Dredging activities may also alter the habitat of the bottom feeder fish for short period. Nevertheless, EMP has been suggested to limit the pollution causing activities that shall be duly considered during construction.

Only if the suggested EMP is not followed properly, turbidity of the water column of nearby river may be observed due to discharge of solid load and construction works may change fish habitat as well as production. Feeding and spawning ground of fish are sensitive to high settling on solid load on river bed.

Fish Migration

The Passur, Chunkuri and Maidara rivers are the main channels for open water fish migration. All the migratory fishes move inward and seaward for their biological needs (e.g. spawning, feeding).

Navigational activities for transporting construction materials through existing navigation route and dredging activities may result minor disturbance to fish migration. Only during the dredging operation, fish migration may be disturbed within the dredging operation area. This impact may be very limited due to adoption of Environmental Management Plan during construction activities.

Lateral migration of fish is limited within the project area due to shrimp farming activities. Hence, the proposed site development may not be an issue for obstructing lateral migration of fish. Nevertheless, no construction activities related with the project may result obstruction to fish migration outside the acquired area.

Fish diversity

The EPC contractor shall be obliged by the ECR 1997. All kind of wastes and waste water to be generated from the construction activities shall be managed as per requirement of ECR 1997. Hence, it can be anticipated that the proposed construction activities may not have any impact on fish habitat, and spawning grounds located in the Maidara and Passur River.

Only the dredging activities may cause migration of some bottom feeder fish species from the dredging operation zone. On the other hand, increased turbidity in water column may attract some fish species for food sourcing. In general, there may be a minor change in fish composition only during dredging operation but it would not affect the local fish diversity.

Fish Production

The only direct impact of land acquisition would be loss of culture fish production from the acquired shrimp aquaculture. The loss may stand up to a maximum of 564 tons annually. Compensation may help the shrimp farmers to recover the losses. This impact may be limited only within the project boundary. There may not be any loss of capture fish from the Passur and Maidara River during construction period. Only during dredging operation, local fisher may notice less catch from the dredging operation area and its close proximity.

8.2.13 Impacts on ecosystem

Ecosystem habitat

Site establishment shall not occupy the existing strip of mangrove along the Passur River. Only for jetty construction (540m length) some scattered mangrove tree may have to be cleared. The scattered bushes growing in the agricultural field within site establishment area need to be cleared for site development. These bush habitats are important for a number of common birds, aquatic birds e.g. Heron and Egrets. However, these impacts will be limited within the project boundary.

Suspended particulate matter to be produced from construction activities may be deposited in the surrounding areas and water bodies including river and may change habitat quality of

aquatic and terrestrial ecosystem if no corrective measures are taken. During construction no waste and wastes water shall be discharged directly to the river without treatment, satisfying standard defined in ECR 1997. Hence, impact of waste disposal and waste water discharge would be minimum and limited within the close proximity of the project area.

Terrestrial flora

Site establishment and base stripping activities may require removal of only some weeds, reeds and other vegetation. Scattered mangrove along the Maidara river and Mangrove strip along the Passur river surrounding the project area comprising around 3.23 ha shall remain unchanged. Only some scatter mangroves may need to be removed for jetty construction.

Terrestrial fauna

Initially 420 acre of total acquired land (1,834 acre) will be occupied for site establishment. Alteration of shrimp farming area (gher) and agricultural land for site establishment may cause lose of feeding ground and nesting habitat of different terrestrial common birds like Dove, Eagle, starling etc. Due to high salinity and shrimp farming practices these areas are not abundant with fauna except some reptile (e.g. Ring lizard, Banded sea snake, etc). The faunal community may migrate to nearby agricultural and homestead area.

Aquatic flora

No significant impact on aquatic flora will be resulted for the construction activities of the proposed project. Due to site establishment on 1,834 acre of land, covering mostly shrimp farming pond might require to clear the aquatic weeds, reeds, and floating plants growing in the shrimp farming pond and agricultural pond. However, these impacts will be limited within the project boundary.

Aquatic fauna

Dredging activities in the Passur River and limited navigational activities (in the existing navigation routes) may have minor impact on Dolphin community of the Passur River and Maidara River. EIA suggests Environmental Management Plan to avoid/limit the disturbance on the swimming, surfacing and migration of Dolphin during dredging and navigational activities that shall be followed by the implementing agency. Thence, the impact on dolphin community may be insignificant.

Alteration of existing shrimp farming and agricultural area only within the project boundary may cause loss of feeding ground of different local aquatic birds mostly Heron, Egrets, water fowl etc.

Sundarbans Ecosystem

The project has been located ef14 Km away from the nearest point of Sundarbans. However, the materials and equipment during the construction period would be transported by river to the project site. As such, the frequencies of the vessels will relatively increase. If navigational, spillages, noise, speed, lighting, waste disposal rules regulations are not properly maintained, it may impact the Sundarbans ecosystem especially Royal Bengal Tiger, deer, crocodile, dolphins, mangroves etc.

Benthic community

In case of dredging activities in the Passur River may affect the benthic community of the river only within the dredging area. Dredging activities may cause short term alteration of habitat and death of benthos like some Mollusks and Arthropods, living in the river bed sediments.

8.2.14 *Impacts on socio-economic condition*

Land ownership and land price

Deputy Commissioner, Bagerhat has acquired 1,834 acre land and handed over to BPDB for project. The acquisition plan includes acquisition of 100 to 150 households. Thereby, land ownership pattern especially in the project area will be changed. Land acquisition will have impact on the land price of the surrounding area. These impacts can be twofold – price of the land very close to the project area may decrease owing to the establishment of power plant on the other hand, in the surrounding of the study area, it may increase due to resettlement of the displaced households (about 150), and induced infrastructural development, establishment of shops, markets, etc.

Population displacement

The land acquisition will cause eviction of around 150 households. Most of these displaced households will migrate to nearby villages.

Employment and manpower in pre-construction phase

At present most of the households and the core part of the manpower, the youth, are engaged solely in shrimp farming. People depending on these shrimp farming activities may migrate to other area or may change their livelihood. The immediate impact of this land acquisition would be unemployment of the agricultural labor dependent on the acquired lands. Compensation may help them to find new employment.

Poverty

Land acquisition means permanent loss of capital to land owner. This sudden loss of capital may cause economic recession in the affected families if compensation is not paid properly, which may ultimately lead to poverty. Taking this in high consideration, DC office Bagerhat has already initiated the payment of compensation money to the affected families.

Employment and manpower during construction phase

The proposed project involves huge construction activities that offer employment opportunity to locals. If the labor recruitment policy of the project favors, this manpower may get jobs in non-technical posts. During hiring employees, priority should be given to the affected people and the locals.

Communication

During construction most of the construction materials and heavy equipment shall be transported through river. The existing Bhanga-Kaigar Daskati road (to be upgraded to suitable for heavy cargo by LGED) shall also be used for material and equipment transportation. As such, traffic volume in Bhaga-Kaigar Daskati road and Passur may increase.

Income and expenditure

There will be twofold impacts: affected people may lose their income opportunity; on the other hand, locals to be employed by the project will get income opportunity. If proper compensation is paid and local people get access to project employment, then income level of the locals will increase.

8.3 Impacts during operation (post construction) stage

8.3.1 Impacts on land form and land type

The project will not have any direct impact on land form and land type of the area as it will not alter natural hydrological and hydro-morphological processes in the locality during its operation period.

8.3.2 Impact on land use

Development of this project may induce local and regional infrastructural development. It is very likely, power security along with Mongla Port facility will attract industrial development, and thereafter industrialization would take place. Accordingly, present land use would be changed; more township and industry will be developed on existing agricultural land.

8.3.3 Impact on landscape and scenic beauty

The project includes development of planned landscape, urban facilities, township, and greenbelt to be developed within the project area for project employees. This planned landscape with greenbelt area may enhance the scenic beauty. Installation of this project will not alter the natural scenic beauty of the locality. Rather the power plant along with its landscape, green belt development and township may attract local tourists.

8.3.4 Impacts of heat radiation

The stack of 275 m high will continuously discharge air effluent of 125^0 C temperature. However, this heat will be easily dispersed to the atmosphere, as the stack will be constructed following the ECR 1997. Stack gas will be easily dispersed in to surrounding environment as there is no topographical natural barrier. It is unlikely that the heated stack gas will increase local air temperature. Contribution of this heat to global warming is also very insignificant. As no sensitive receiver of radiated heat, the dense settlement, is located within the 2 km radius from the stack point, there will be no significant impact of this heat radiation on local community.

In case of accidental explosion, local air temperature may rise for short term. However, implementation of suggested world standard and enforcement of MoEF's standard might

reduce the likelihood of accidental explosion and fire hazard. Additionally a Hazard Management Plan has been prepared that may keep the accidental risk very low.

8.3.5 Impacts on ambient air

During operation, major gaseous emission from proposed coal based power plant would be SOx, NOx, H_2O, NO_2, CO_2, CO and particulate matter.

Particulate dust materials

The proposed project will be based on imported coal that will involve handling and storage of large volume of coal while the daily coal requirement is about 12,900 MT per day. Handling and storage facilities of coal shall be equipped with dust suppression system. The conveyor belt shall be covered and the transfer point shall be equipped with dust suppression system. Hence, dust generation from coal handling and storage activities shall be minimum and within the limit of ECR 1997. Nevertheless, sometime, within the close proximity of the handling and storage facilities, SPM of the local air might rise but automatic dust sensor and suppression system shall control the generated dust within limit of ECR 1997. On the other hand, there is no dense settlement within the 2 km radius from the stockyard; hence, dust generation from the power plant may not be a health risk issue for the local community.

The coal combustion process will produce maximum 15% ash from the total coal inflow. Ash residue left from coal combustion process will be managed with efficient ash collecting, conveying and storage system. The total process may include Bottom ash collector, Fly ash collector (filtered by Electrostatic Precipitator with the efficiency of 99.9%), Pneumatic ash conveying system, Ash storage silo and Ash pond. All the setup will be installed to limit the outlet ash emission to 100 µg/Nm^3 in compliance with the Particulate Matter emission standard of Bangladesh (defined in ECR, 1997) which is 100 µg/Nm^3 for sensitive region and 200 µg/Nm^3 for rural & residential settings. The project also plans utilization of generated ash. The ash slurry and bottom ash shall be used for land filling and the fly ash may be sold at plant end. The detail of the ash utilization has been provided in section 11.15.

Despite efficient ash management system, some fugitive ash might be produced and dispersed to the surrounding area but the impact will not be significant as the amount will be too low and no settlement is located within the 2 km vicinity of the plant. On the other hand, accidental release of ash from ash separation and handling system might have impact on surrounding air quality. The accidental release of ash through stack due to failure of ash separation system may be dispersed to the locality and deposited on water bodies, agricultural land, and settlements around the proposed power plant. However, this impact will be short term and reversible and possess less health risk as because the dense settlements are located 2 km away from the stack point. The plant adopts centrally controlled automatic monitoring and controlling system to prevent any accidental event.

Emission of Sulfur Dioxide and Nitrogen Oxides

Major emissions from the coal thermal based power plants will be SO_2 and NOx. Emission depends on coal quantity and quality. The proposed power plant will be relatively cleaner technology in comparison to the conventional coal based thermal power plant. For the proposed power plant, coal to be used will have low Sulfur content (avg. 0.6%, as

mentioned in the Feasibility Study). During pulverized coal combustion, the nitrogen in NOx originates either in the fuel (fuel NOx) or in the air (thermal NOx). Fuel NOx is more important than thermal NOx during coal combustion, making up 60-95% of the total NOx formed in typical coal flames (Pohl and Sarofim 1977; Boardman and Smoot 1993). Nitrogen content is around 1.4% of the selected sources of coal. However, about 1.68% of nitrogen is assumed to be the ultimate composition (e.g. fuel and thermal) to release NOx from the single unit power plant. Therefore, approximately 819 g/s Sulfur Dioxide and 490 g/s NOx might be emitted from combustion of 5,897 ton per day from a single unit for required electricity production (Table 8.1). The estimation of emission rate of SO_2 from coal for each 660 unit is given below:

Coal consumption for each unit	*5,897 ton/day*
Sulfur content in Coal	*0.6% (Average)*
Molecular weight of SO_2	*64*
Equivalent weight of SO_2 after combustion	*0.6% x (Molecular Weight of SO_2/Molecular weight of S)*
Hence, emission rate of SO_2	*0.6 % x 5897 ton /day x (64/32)* *= 70.764 ton/day* *≈ 819 g/s*
Nitrogen content in coal	*1.68% (both for supplied fuel and air)*
Molecular weight of NOx (considering NO_2)	*46.01*
Equivalent weight after combustion	*1.68%x (Molecular Weight of NO_2/Molecular weight of N)*
Efficiency of Low NOx (LNI) Integrated System	*87% (Release only 13% of NOx)*
Hence, emission of NO_2	*1.68% x 5897 ton/day x (46.01/14.01) x 13%* *= 42.3 ton/day* *≈ 490 g/s*

These standards shall be attached with the tender documents, the machinery and equipment will be chosen based on environmental along with other technical criteria. The coal quality prescribed in Chapter 5 (Article: 5.15.1) should be maintained not only for environmental quality control but also well mechanical performances of the plant. Coal quality always varies with origin, marketing process, etc. If inferior quality of coal would use, FGD (Flue gas Desulfurization), Low NOx Integrated system (two stage combustion or low NOx burner) have to be installed suiting to the environmental standard rules and regulation of the country as well as Equator Principle. FGD will relax to intake lower grade of coal (e.g. higher Sulfur content) for running the power plant under worst circumstances. Therefore, there is a provision of installing FGD for functioning in case of having higher Sulfur and Nitrogen content coal and limit the SOx and NOx emission of MoEF's standard (ECR 1997) and World Bank Standard.

Table 8.1: Emission of SO_2 and NOx from proposed coal based supercritical Thermal power plant

Element	Elementary content in Coal, % by wt	Coal flow, Tons/ day	Emission rate from stack	Bangladesh's Standard	World Bank Standard[4]	Remarks
Sulfur Dioxide	0.6 (as Sulfur)	5897 for each unit of 660 MW	819 g/s for each unit (70.76 TPD)[5]	No specific regulation is defined in ECR, 1997 for emission from Coal based power plant. However, Ambient air quality standard, (80 µg/Nm^3)[6] might be applied.	138 TPD for first 660 MW and 198 TPD for another 660 MW unit (0.2 TPD for each MW for first 500 MW and plus 0.10 TPD for each additional MW and the concentration should not to exceed 2,000 µg /Nm^3)	Flue Gas Desulfurization must provide in case of higher sulphur contain (*e.g.* more than 0.6% Sulfur content in Coal), 275 m stack height and specified designed condition of the stack is ensured.
Nitrogen Oxides	1.68 (including fuel and thermal)		490 g/s (and concentration below 750 µg/Nm^3) from each unit		Concentration should be less than 750 µg/Nm^3	The furnace may be provided with low NOx burner

Source: Estimated from BPDB given data; FGD: Flue gas Desulfurization

[4] Draft World Bank Guideline for Thermal Power Plant: World Bank (draft) Environmental and Occupational Health Standards, Thermal Power available at http://www.his.com/~mesas/OccupHealth.htm, accessed on 22 Sept. 2011

[5] TPD- Ton Per Day

[6] The unit is corrected from ECR, 1997. In ECR, it has been written as microgram per cusec meter which is not correct as there is no unit like cusec meter. However, the correction has been made based on EIA report of Meghnaghat Power Station (Mott Ewbank Preece, 1997) accepted by Department of Environment, Bangladesh.

Ground level concentration of SO_2 and NOx

Maximum ground level concentration of SO_2 and NO_x (contribution of each unit of 660 MW to ambient air) were calculated using SCREEN 3.0.0 model. The model is fully approved by the United States Environmental Protection Agency (USEPA) for calculation of maximum short-term concentrations of non-reactive pollutants emitted from a single source. Short-term concentration represents here peak one-hour ground level concentration (which would be the contribution of each unit to ambient air). The SCREEN 3.0.0 model set up has been prepared including buoyancy-induced dispersion (BID), subroutines to estimate shoreline fumigation due to presence of river and sea, rural dispersion, and simple terrain. SCREEN 3.0.0 is an optimized version of the USEPA reference Industrial Source Complex model (ISC). Maximum concentrations are calculated based on a screening set of 54 meteorological conditions for distances downwind of the source. No account has been made on wind direction. The parameters considered for air pollution assessment is presented in Table 8.2

SCREEN 3 assumes that pollutants are conserved (*i.e.* no chemical reactions take place). The combined concentrations of NO and NO_2 are therefore expressed as total NO_X. Emission of NOx from combustion plants generally include 10%-25% NO_2 and 75%-90% NO (Mott Ewbank Preece, 1997).

Table 8.2: Model set up for SCREEN 3.0.0

Parameter	Value[7]
Source type	Point
Dispersion Coefficient	For Rural
Receptor Height Above ground	0 m
Emission Rate (SO_2)	819 g/s
Emission Rate (NOx)	490 g/s
Stack Height	275 m
Stack inside diameter	7.5 m
Velocity	25 m/s
Stack Gas Exit Temperature	125^0 C
Ambient Air Temperature	27^0 C
Terrain	Simple and Flat
Stability Class	A (considering the average wind speed of 1.7 m/s)
Fumigation	Shoreline fumigation, (as the stack is located 1 km away from the Passur river)
Distance of River/Sea from source	1 km

Dispersion of SO_2

The model predicts for each unit that, 1-hour concentration, 24 hour and annual average concentration of SO_2 would be maximum 268.9 µg/m^3 and 107.6 µg/m^3 and 21.5 µg/m^3

[7] These values are for each unit and have been collected from Feasibility Study report and information on climatic condition has collected from Bangladesh Meteorological Department, Mongla

respectively at 1.5 km downwind from the chimney. The dispersion of SOx concentration is much lower than the European Standard (350 µg/m^3 for 1hr and 125 µg/m^3 for 24-hr average) and ECR 1997 standard (120 µg/m^3 for Industrial area) in the air shade of the power plant. Figure 8.1a shows the SO_2 dispersion where distances are given in meter and concentrations are given in µg/m^3. Detail data of the same is given in Table 8.3a and 8.3b.

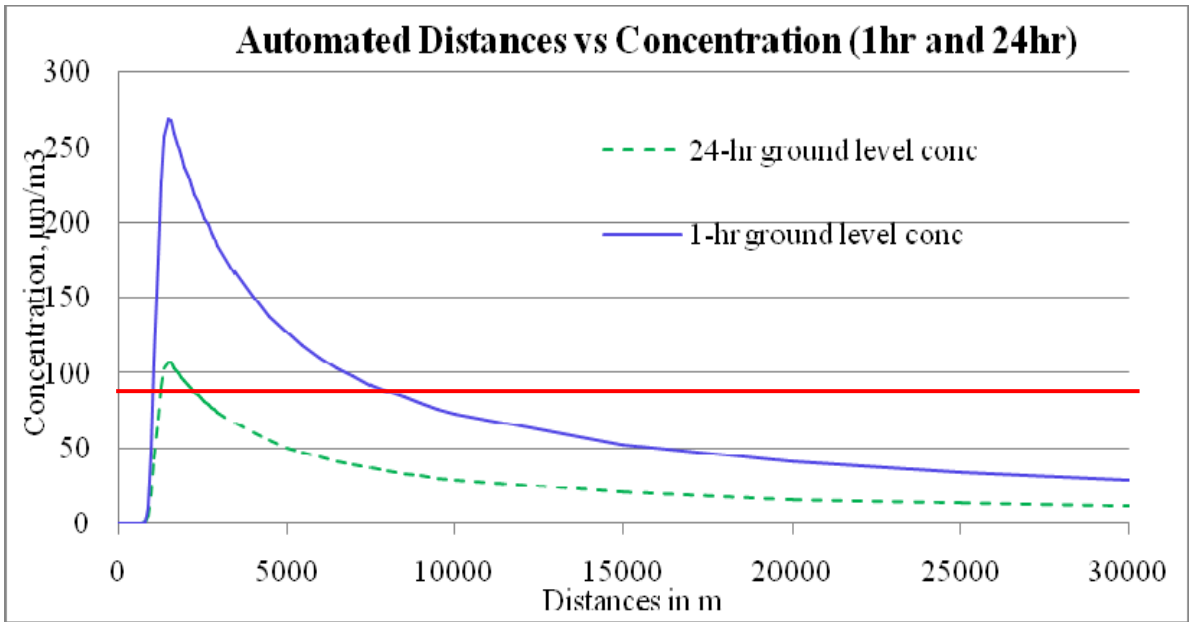


Figure 8.1: Model results on dispersion of SO_2 at downwind direction

Pasquill-Gifford Stability Index the wind stability of the study area falls into very unstable (Class A) to unstable classes (Class-B). The model estimates that the emitted SO_2 will be dispersing easily and will be lowering down below the ambient air quality standard for SO_2 (80 µg/m^3 for residential area as per ECR, 1997) after reaching 2.7 km to the downwind direction which means that the emission outside the project boundary.

Only during November to February, prevailing wind flows towards South and rest of the year it flows mostly towards North. In most of the time of a year, emissions from power plant shall not reach the Sundarbans except November to February.

As per the estimated results, during November to February, stack emissions with low concentration may reach the Sundarbans. The maximum 1-hr and 24-hr SO_2 concentration contribution of the stack gas over the region of Sundarbans, which is 14 km beyond the project area, would be maximum 53 µg/m^3 and 21.2 µg/m^3 respectively. Table 8.3a gives maximum ground level concentration contribution of SO_2 from each unit for 1hr and 24hr average and 8.3b presents the details of the model output.

Table 8.3a: 1hr and 24hr concentration of SO_2 at different distances

Distance (m)	Max. 1hr Conc.	24hr Average conc (±0.7)	Annual Average conc (±0.02)
	(µg/m^3)	(µg/m^3)	(µg/m^3)
1	0	0	0
100	0	0	0

Distance (m)	Max. 1hr Conc.	24hr Average conc (±0.7)	Annual Average conc (±0.02)
	(µg/m^3)	(µg/m^3)	(µg/m^3)
200	0	0	0
300	0	0	0
400	0	0	0
500	1.00E-09	4.01E-10	8E-11
600	1.58E-04	6.3E-05	0.00001264
700	1.71E-01	0.06856	0.01368
800	1.03	0.412	0.0824
900	11.43	4.572	0.9144
1000	47.18	18.872	3.7744
1100	108.3	43.32	8.664
1200	174.6	69.84	13.968
1300	226.6	90.64	18.128
1400	257.1	102.84	20.568
1500	268.3	107.32	21.464
1600	266.8	106.72	21.344
1700	258.8	103.52	20.704
1800	250.1	100.04	20.008
1900	243.5	97.4	19.48
2000	236.9	94.76	18.952
2100	230.5	92.2	18.44
2200	224.4	89.76	17.952
2300	218.6	87.44	17.488
2400	213.1	85.24	17.048
2500	207.8	83.12	16.624
2600	202.7	81.08	16.216
2700	197.9	79.16	15.832
2800	193.3	77.32	15.464
2900	188.8	75.52	15.104
3000	184.6	73.84	14.768
3500	165.9	66.36	13.272
4000	150.7	60.28	12.056
4500	138	55.2	11.04
5000	127.3	50.92	10.184
5500	118.2	47.28	9.456
6000	110.4	44.16	8.832
6500	103.6	41.44	8.288
7000	97.65	39.06	7.812
7500	92.37	36.948	7.3896
8000	87.66	35.064	7.0128
8500	83.44	33.376	6.6752
9000	79.64	31.856	6.3712

Distance (m)	Max. 1hr Conc.	24hr Average conc (±0.7)	Annual Average conc (±0.02)
	(µg/m^3)	(µg/m^3)	(µg/m^3)
9500	76.19	30.476	6.0952
10000	73.05	29.22	5.844
15000	52.25	20.9	4.18
20000	41.16	16.464	3.2928
25000	34.22	13.688	2.7376
30000	29.44	11.776	2.3552

Table 8.3b: Model output for SO_2 dispersion

DIST (M)	CONC (UG/M**3)	U10M STAB	USTK (M/S)	MIX HT (M/S)	PLUME (M)	HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	1	1.7	2.1	1329.6	1307.36	8.32	8.31	NO
100.	0.000	1	1.7	2.1	1329.6	1307.36	51.11	45.67	NO
200.	0.000	1	1.7	2.1	1329.6	1307.36	85.23	75.00	NO
300.	0.000	1	1.7	2.1	1329.6	1307.36	115.47	102.15	NO
400.	0.000	1	1.7	2.1	1329.6	1307.36	143.55	130.67	NO
500.	0.1002E-09	1	1.7	2.1	1329.6	1307.36	170.15	164.69	NO
600.	0.1576E-04	1	1.7	2.1	1329.6	1307.36	195.65	210.52	NO
700.	0.1714E-01	1	1.7	2.1	1329.6	1307.36	220.29	266.15	NO
800.	1.030	1	1.7	2.1	1329.6	1307.36	244.22	332.20	NO
900.	11.43	1	1.7	2.1	1329.6	1307.36	267.55	408.99	NO
1000.	47.18	1	1.7	2.1	1329.6	1307.36	290.36	496.72	NO
1100.	108.3	1	1.7	2.1	1329.6	1307.36	312.73	595.51	NO
1200.	174.6	1	1.7	2.1	1329.6	1307.36	334.70	705.43	NO
1300.	226.6	1	1.7	2.1	1329.6	1307.36	356.31	826.58	NO
1400.	257.1	1	1.7	2.1	1329.6	1307.36	377.59	959.01	NO
1500.	**268.3**	**1**	**1.7**	**2.1**	**1329.6**	**1307.36**	**398.58**	**1102.80**	**NO**
1600.	266.8	1	1.7	2.1	1329.6	1307.36	419.30	1257.99	NO
1700.	258.8	1	1.7	2.1	1329.6	1307.36	439.77	1424.66	NO
1800.	250.1	1	1.7	2.1	1329.6	1307.36	457.58	1602.17	NO
1900.	243.5	1	1.7	2.1	1329.6	1307.36	470.67	1790.19	NO
2000.	236.9	1	1.7	2.1	1329.6	1307.36	483.90	1990.19	NO
2100.	230.5	1	1.7	2.1	1329.6	1307.36	497.26	2202.18	NO
2200.	224.4	1	1.7	2.1	1329.6	1307.36	510.73	2426.15	NO
2300.	218.6	1	1.7	2.1	1329.6	1307.36	524.28	2662.12	NO
2400.	213.1	1	1.7	2.1	1329.6	1307.36	537.92	2910.11	NO
2500.	207.8	1	1.7	2.1	1329.6	1307.36	551.63	3170.15	NO
2600.	202.7	1	1.7	2.1	1329.6	1307.36	565.40	3442.27	NO
2700.	197.9	1	1.7	2.1	1329.6	1307.36	579.22	3726.50	NO
2800.	193.3	1	1.7	2.1	1329.6	1307.36	593.08	4022.89	NO
2900.	188.8	1	1.7	2.1	1329.6	1307.36	606.97	4331.45	NO
3000.	184.6	1	1.7	2.1	1329.6	1307.36	620.90	4652.24	NO
3500.	165.9	1	1.7	2.1	1329.6	1307.36	690.80	5000.00	NO
4000.	150.7	1	1.7	2.1	1329.6	1307.36	760.83	5000.00	NO
4500.	138.0	1	1.7	2.1	1329.6	1307.36	830.70	5000.00	NO
5000.	127.3	1	1.7	2.1	1329.6	1307.36	900.24	5000.00	NO
5500.	118.2	1	1.7	2.1	1329.6	1307.36	969.37	5000.00	NO
6000.	110.4	1	1.7	2.1	1329.6	1307.36	1038.02	5000.00	NO
6500.	103.6	1	1.7	2.1	1329.6	1307.36	1106.17	5000.00	NO
7000.	97.65	1	1.7	2.1	1329.6	1307.36	1173.81	5000.00	NO
7500.	92.37	1	1.7	2.1	1329.6	1307.36	1240.94	5000.00	NO
8000.	87.66	1	1.7	2.1	1329.6	1307.36	1307.56	5000.00	NO

DIST (M)	CONC (UG/M**3)	U10M STAB	USTK (M/S)	MIX HT (M/S)	PLUME (M)	HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
8500.	83.44	1	1.7	2.1	1329.6	1307.36	1373.69	5000.00	NO
9000.	79.64	1	1.7	2.1	1329.6	1307.36	1439.33	5000.00	NO
9500.	76.19	1	1.7	2.1	1329.6	1307.36	1504.49	5000.00	NO
10000.	73.05	1	1.7	2.1	1329.6	1307.36	1569.20	5000.00	NO
15000.	52.25	1	1.7	2.1	1329.6	1307.36	2193.75	5000.00	NO
MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:									
1532.	268.9	1	1.7	2.1	1329.6	1307.36	405.03	1149.68	NO
INVERSION BREAK-UP FUMIGATION CALC.									
CONC (UG/M**3) = 140.6									
DIST TO MAX (M) = 64120.18									
SHORELINE FUMIGATION CALC									
CONC (UG/M**3) = 773.3									
DIST TO MAX (M) = 8333.20									
DIST TO SHORE (M)= 1000.00									
SUMMARY OF SCREEN MODEL RESULTS									
CALCULATION PROCEDURE	**MAX CONC (UG/M**3)**	**DIST TO MAX (M)**	**TERRAIN HT (M)**						
SIMPLE TERRAIN	**268.9**	**1532.**	**0.**						
INV BREAKUP FUMI	**140.6**	**64120**							

Source: Model output

The model also predicts that fumigation due to presence of the Passur River and diurnal nature of sea breeze (during night and day time) would be very negligible.

The resultant impact on Sundarbans

The concentration of SO_2 in the ambient air near Sundarbans region is found 8 to 10 µg/m^3 (field monitoring data, see Table 6.5). Hence, it is found that the resultant concentration (24 hr average after emission contribution and only during November to February) from the power plant) of SO_2 in the ambient air may be maximum 53.4 µg/m^3 (see Table 8.3c) which is much below the MOEF's standard (ECR 1997), 80 µg/m^3 for residential and rural area. Therefore, the concentration of emitted SO_2 is very insignificant to have any impact on Air quality of Sundarbans. However, daily monitoring of emission rate is recommended for protecting Sundarbans from impact of emitted gas.

Table 8.3c: Resultant affects SO_2 concentration in ambient air near Sundarbans

Concentration of SO_2 from each unit (24 hr avg)	Contribution of SO_2 from two units (24 hr avg)	Concentration of SO_2 in ambient air (24 hr avg.) near Sundarbans	Resultant concentration of SO_2 (24 hr avg.) near Sundarbans	MoEF's Standard (ECR 1997)	WB Standard of SO_2 (24 hr avg)	WB Standard of SO_2 (Annual avg)
21.2 µg/m^3	42.4 µg/m^3	8 – 11 µg/m^3	50.4 – 53.4 µg/m^3	80 µg/m^3	150 µg/m^3	80 µg/m^3

Note: concentration in ambient air has been monitored during May 2012 with the facilitation of DoE, Khulna. During the sample collection the day was sunny, and wind was flowing northwestward

Dispersion of NOx

The model predicts for each unit that, 1-hour concentration and 24 hour average concentration of NO_2 would be maximum 160.5 µg/m^3 and 64.26 µg/m^3 respectively at 1.5 km downwind from the chimney which is much lower than the European Standard (350 µg/m^3 for 1hr and 125 µg/m^3 for 24-hr average) and ECR 1997 standard (120 µg/m^3 for 24 hr for Industrial area). Figure 8.2 shows the NO_2 dispersion where distances are given in meter and concentrations are given in µg/m^3. Detail data of the same is given in Table 8.4a and 8.4b.

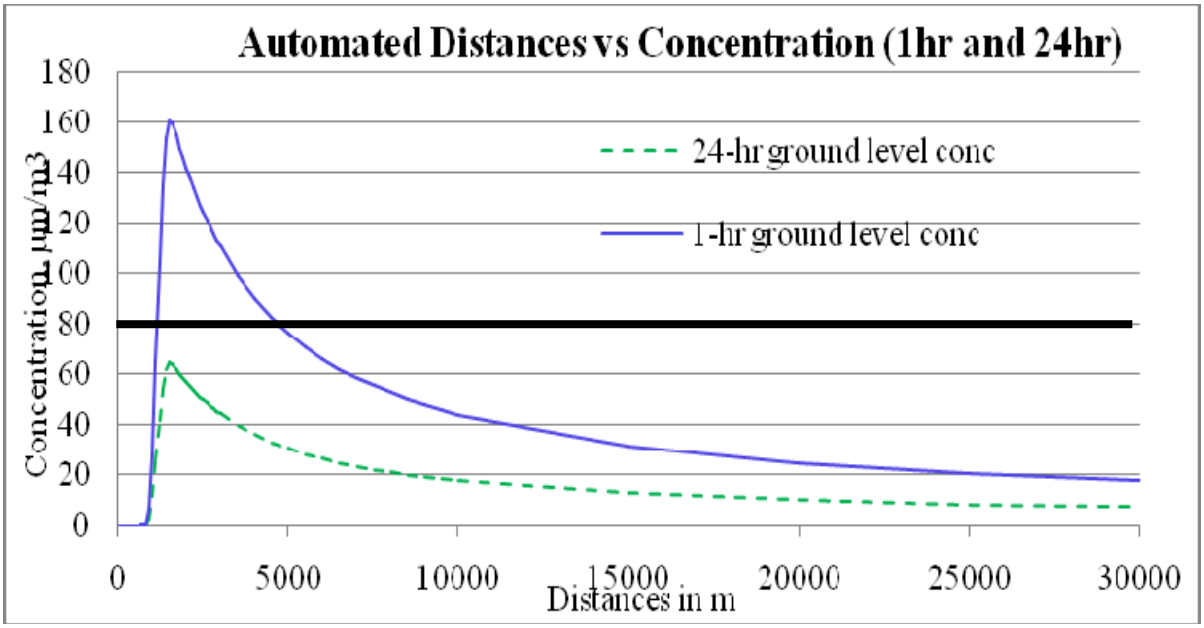


Figure 8.2: Model result on dispersion of NOx

Considering wind stability Class- A (unstable), the model estimates, the emitted NO_2 will be dispersing easily and will always be lower than the ambient air quality standard for NO_2 (120 µg/m^3 for industrial area and 80 µg/m^3 for residential as per ECR, 1997). The prevailing wind flows towards South only in November to February while rest of the year it flows mostly northward. Emissions from power plant shall not reach the Sundarbans in most of the year except November to February.

As per the estimation, stack emissions with low concentration may reach the Sundarbans only during November to February. The maximum 1-hr and 24-hr NO_2 concentration contribution in ambient air of the stack gas over the region of Sundarbans, which is 14 km beyond the project area, would be maximum 39 µg/m^3 and 15.6 µg/m^3 respectively. Table 8.4a gives maximum ground level concentration contribution of NO_2 from each unit for 1hr and 24hr average and 8.4b presents the details of the model output. This concentration of emitted NO_2 is very insignificant to have any impact on Air quality of Sundarbans. However, daily monitoring of emission rate is recommended for protecting Sundarbans from impact of emitted gas.

The model also predicts the shoreline fumigation due to diurnal circulation of sea breeze (daytime and nighttime) to be insignificant to cause fumigation of air pollutants.

Table 8.4a: 1hr and 24hr concentration of NOx at different distances

Distance (m)	Max. 1hr Conc. ($\mu g/m^3$)	24hr Average conc ($\mu g/m^3$)	Annual Max Average conc ($\mu g/m^3$)
1	0	0	0
100	0	0	0
200	0	0	0
300	0	0	0
400	0	0	0
500	6.00E-10	2.4E-10	4.8E-11
600	9.43E-05	3.77E-05	7.54E-06
700	1.03E-01	0.04104	0.00824
800	0.6161	0.24644	0.049288
900	6.839	2.7356	0.54712
1000	28.23	11.292	2.2584
1100	64.8	25.92	5.184
1200	104.5	41.8	8.36
1300	135.6	54.24	10.848
1400	153.8	61.52	12.304
1500	160.5	64.2	12.84
1600	159.6	63.84	12.768
1700	154.9	61.96	12.392
1800	149.6	59.84	11.968
1900	145.7	58.28	11.656
2000	141.7	56.68	11.336
2100	137.9	55.16	11.032
2200	134.3	53.72	10.744
2300	130.8	52.32	10.464
2400	127.5	51	10.2
2500	124.3	49.72	9.944
2600	121.3	48.52	9.704

Distance (m)	Max. 1hr Conc.	24hr Average conc	Annual Max Average conc
	(µg/m^3)	(µg/m^3)	(µg/m^3)
2700	118.4	47.36	9.472
2800	115.6	46.24	9.248
2900	113	45.2	9.04
3000	110.5	44.2	8.84
3500	99.27	39.708	7.9416
4000	90.14	36.056	7.2112
4500	82.56	33.024	6.6048
5000	76.18	30.472	6.0944
5500	70.75	28.3	5.66
6000	66.07	26.428	5.2856
6500	62	24.8	4.96
7000	58.42	23.368	4.6736
7500	55.26	22.104	4.4208
8000	52.45	20.98	4.196
8500	49.92	19.968	3.9936
9000	47.65	19.06	3.812
9500	45.58	18.232	3.6464
10000	43.7	17.48	3.496
15000	31.26	12.504	2.5008
20000	24.63	9.852	1.9704
25000	20.47	8.188	1.6376
30000	17.61	7.044	1.4088

Table 8.4b: Model output for NOx dispersion

DIST (M)	1-hrCONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	0.000	1	1.7	2.1	1329.6	1307.36	8.32	8.31	NO
100.	0.000	1	1.7	2.1	1329.6	1307.36	51.11	45.67	NO
200.	0.000	1	1.7	2.1	1329.6	1307.36	85.23	75.00	NO
300.	0.000	1	1.7	2.1	1329.6	1307.36	115.47	102.15	NO
400.	0.000	1	1.7	2.1	1329.6	1307.36	143.55	130.67	NO
500.	0.5996E-10	1	1.7	2.1	1329.6	1307.36	170.15	164.69	NO
600.	0.9429E-05	1	1.7	2.1	1329.6	1307.36	195.65	210.52	NO
700.	0.1026E-01	1	1.7	2.1	1329.6	1307.36	220.29	266.15	NO
800.	0.6161	1	1.7	2.1	1329.6	1307.36	244.22	332.20	NO

DIST (M)	1-hrCONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
900.	6.839	1	1.7	2.1	1329.6	1307.36	267.55	408.99	NO
1000.	28.23	1	1.7	2.1	1329.6	1307.36	290.36	496.72	NO
1100.	64.80	1	1.7	2.1	1329.6	1307.36	312.73	595.51	NO
1200.	104.5	1	1.7	2.1	1329.6	1307.36	334.70	705.43	NO
1300.	135.6	1	1.7	2.1	1329.6	1307.36	356.31	826.58	NO
1400.	153.8	1	1.7	2.1	1329.6	1307.36	377.59	959.01	NO
1500.	**160.5**	**1**	**1.7**	**2.1**	**1329.6**	**1307.36**	**398.58**	**1102.80**	**NO**
1600.	159.6	1	1.7	2.1	1329.6	1307.36	419.30	1257.99	NO
1700.	154.9	1	1.7	2.1	1329.6	1307.36	439.77	1424.66	NO
1800.	149.6	1	1.7	2.1	1329.6	1307.36	457.58	1602.17	NO
1900.	145.7	1	1.7	2.1	1329.6	1307.36	470.67	1790.19	NO
2000.	141.7	1	1.7	2.1	1329.6	1307.36	483.90	1990.19	NO
2100.	137.9	1	1.7	2.1	1329.6	1307.36	497.26	2202.18	NO
2200.	134.3	1	1.7	2.1	1329.6	1307.36	510.73	2426.15	NO
2300.	130.8	1	1.7	2.1	1329.6	1307.36	524.28	2662.12	NO
2400.	127.5	1	1.7	2.1	1329.6	1307.36	537.92	2910.11	NO
2500.	124.3	1	1.7	2.1	1329.6	1307.36	551.63	3170.15	NO
2600.	121.3	1	1.7	2.1	1329.6	1307.36	565.40	3442.27	NO
2700.	118.4	1	1.7	2.1	1329.6	1307.36	579.22	3726.50	NO
2800.	115.6	1	1.7	2.1	1329.6	1307.36	593.08	4022.89	NO
2900.	113.0	1	1.7	2.1	1329.6	1307.36	606.97	4331.45	NO
3000.	110.5	1	1.7	2.1	1329.6	1307.36	620.90	4652.24	NO
3500.	99.27	1	1.7	2.1	1329.6	1307.36	690.80	5000.00	NO
4000.	90.14	1	1.7	2.1	1329.6	1307.36	760.83	5000.00	NO
4500.	82.56	1	1.7	2.1	1329.6	1307.36	830.70	5000.00	NO
5000.	76.18	1	1.7	2.1	1329.6	1307.36	900.24	5000.00	NO
5500.	70.75	1	1.7	2.1	1329.6	1307.36	969.37	5000.00	NO
6000.	66.07	1	1.7	2.1	1329.6	1307.36	1038.02	5000.00	NO
6500.	62.00	1	1.7	2.1	1329.6	1307.36	1106.17	5000.00	NO
7000.	58.42	1	1.7	2.1	1329.6	1307.36	1173.81	5000.00	NO
7500.	55.26	1	1.7	2.1	1329.6	1307.36	1240.94	5000.00	NO
8000.	52.45	1	1.7	2.1	1329.6	1307.36	1307.56	5000.00	NO
8500.	49.92	1	1.7	2.1	1329.6	1307.36	1373.69	5000.00	NO
9000.	47.65	1	1.7	2.1	1329.6	1307.36	1439.33	5000.00	NO
9500.	45.58	1	1.7	2.1	1329.6	1307.36	1504.49	5000.00	NO
10000.	43.70	1	1.7	2.1	1329.6	1307.36	1569.20	5000.00	NO
15000.	31.26	1	1.7	2.1	1329.6	1307.36	2193.75	5000.00	NO
MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:									
1532.	160.9	1	1.7	2.1	1329.6	1307.36	405.03	1149.68	NO
INVERSION BREAK-UP FUMIGATION CALC.									
CONC (UG/M**3) = 84.11									
DIST TO MAX (M) = 64120.18									
SHORELINE FUMIGATION CALC.									
CONC (UG/M**3) = 462.7									
DIST TO MAX (M) = 8333.20									
DIST TO SHORE (M)= 1000.00									
SUMMARY OF SCREEN MODEL RESULTS									
CALCULATION PROCEDURE	**MAX CONC (UG/M**3)**		**DIST TO MAX (M)**		**TERRAIN HT (M)**				
SIMPLE TERRAIN	**160.9**		**1532.**		**0.**				
INV BREAKUP FUMI	**84.11**		**64120.**		**--**				

Source: Model output

The long-term concentration will also be very limited. The project is located in tropical cyclone prone area. Unstable atmospheric environment and heavy precipitation during cyclonic event will reduce the pollutant concentration significantly (Chang et al., 2010).

The resultant impact on Sundarbans

The concentration of NO_2 in the ambient air near Sundarbans region is found 16 to 20 µg/m^3 (field monitoring data, see Table 6.5). Hence, it is found that the resultant concentration (24 hr average after emission contribution and only during November to February) from the power plant) of NO_2 in the ambient air may be maximum 51.2 µg/m^3 (see Table 8.4c) which is much below the MOEF's standard (ECR 1997), 80 µg/m^3. Therefore, the concentration of emitted NO_2 is very insignificant to have any impact on Air quality of Sundarbans. However, daily monitoring of emission rate is recommended for protecting Sundarbans from impact of emitted gas.

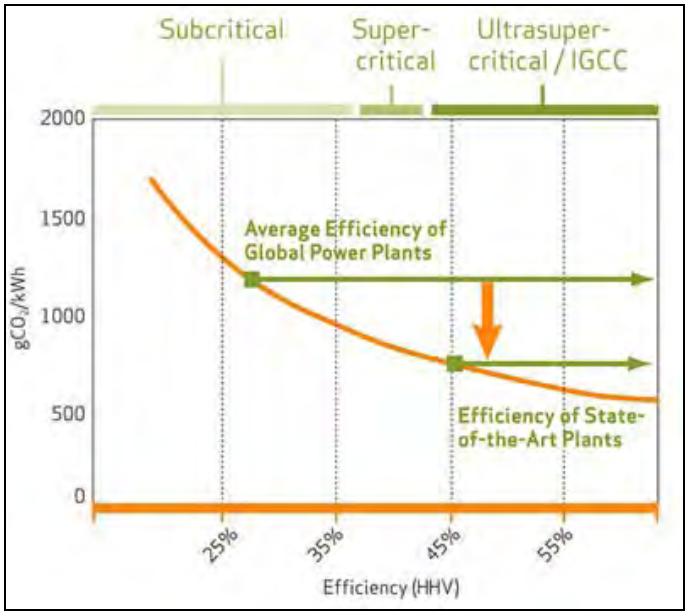
Table 8.4c: Resultant affects NO_2 concentration in ambient air near Sundarbans

Contribution of NO_2 from each unit (24 hr avg)	Contribution of NO_2 from two units (24 hr avg)	Concentration of NO_2 (24 hr avg) near Sundarbans	Resultant concentration of NO_2 (24 hr avg.) near Sundarbans	MoEF's Standard (ECR 1997)	WB Standard of NO_2 (24 hr avg)	WB Standard of NO_2 (Annual avg)
15.6 µg/m^3	31.2 µg/m^3	16 – 20 µg/m^3	47.2 – 51.2 µg/m^3	80 µg/m^3	150 µg/m^3	100 µg/m^3

Note: concentration in ambient air has been monitored during May 2012 with the facilitation of DoE, Khulna. During the sample collection the day was sunny, and wind was flowing northwestward

Greenhouse gas emission

The proposed power plant has been envisaged adopting supercritical boiler technology. Supercritical technology produces less CO_2 than other conventional technology of coal based power plant. Supercritical technology increases efficiency of a power plant. Improving efficiency level increases capacity of extracting higher amount of energy from a single unit of coal. Thus, coal requirement becomes lesser in coal based TPP of supercritical technology. As a result, carbon emission also decreases. There is an estimation that states a one percentage point improvement in the efficiency of a pulverized coal combustion plant results in a 2-3% reduction in CO_2 emissions (WCA, 2012). Figure 8.3 shows emission of CO_2 from power plant of different efficiency levels (Sub-critical, super-critical and ultra critical).



Note: 1% increase in efficiency = 2-3% decrease in emissions

Source: World Coal Association (http://www.worldcoal.org/coal-the-environment/coal-use-the-environment/improving-efficiencies/)

Figure 8.3: CO_2 emission from coal based power plants of different efficiency levels

As per the estimation (Figure 8.5, the proposed power plant will emit around 7.9 million tons of CO_2 per annum (at a rate of 0.86kg/Kwh net, considering 80% load factor), which is at least 10% less than other conventional technology (Subcritical). As such, the increase in national per capita carbon emission because of the operation of the proposed power plant is estimated to be miniscule.

8.3.6 Acid rain

Stack gas will be easily dispersed as there is no terrain effect and any other obstruction like building, dense forest that could cause fumigation and trapping of pollutants. It is very unlikely to form any sulfuric acid mist and the possibility of acid rain is very low due to undisturbed dispersion of SOx. Coal to be used for the electricity generation will have very low Sulfur content (avg. 0.6%) and MoEF's standard (ECR 1997) of emission will be maintained.

8.3.7 Impact on ambient noise

The operation of the plant will produce noise and at plant site, it may be felt exceeding the DoE's limit (50 dB during daytime and 40 dB during nighttime). However, outside the project boundary, there will be no or very limited noise might be felt. The green belt and natural buffer zone around the plant and boundary wall will dampen the generated noise. Traffic movement, loading and unloading of coal, operation of conveyor belt, and coal transportation through waterways may generate noise. Noise from point sources will not be so significant outside the project boundary. Greenery plantation around the plant and boundary wall at project site may act as a noise barrier. However, some impact might occur during accidental event like, explosion or fire.

8.3.8 *Solid waste disposal*

Waste may be generated from coal handling and storage facilities, ash collection and disposal system and domestic activities. Annually, around 0.94 million tons of ash might be generated from the plant of which 80% shall be dry fly ash and the rest 20% shall be bottom ash. The project targets 100% utilization of this generated ash with adoption of efficient ash management system. Very little portion of this ash might escape from the system as waste. A solid wastes management plan has been envisaged that involves ash collection, management and utilization system. No waste shall go unmanaged and be disposed without satisfying MOEF's standard. Leakage or accidental release of hazardous chemicals stored for water treatment plant may affect the soil and water quality.

8.3.9 *Impacts on surface water due to water withdraw*

To meet the water demand for plant operation, domestic water, environmental management 9,150 m^3/hr (equivalent to 2.54 m^3/s) surface water will be withdrawn from the Passur river and after treatment water shall be discharged back to the Passur river at the rate of 5,150m^3/hr (equivalent to 1.43 m^3/s). Whereas, as per BWDB data (BWDB, 2005) in the Passur River minimum discharge is 6000 m^3/s equivalent to 21.6 million m^3/hr (occurred in February) and maximum discharge is 22,500 m^3/s equivalents to 81 million m^3/hr (in August during monsoon). The withdrawal rate (9,150 m^3/hr) designed for the proposed power plant is very insignificant (0.04%) even in lowest flow condition (occurred in the month of February during dry season). Hence, hydrological characteristics of the river related with the discharge (salinity front, salinity level, sedimentation pattern, flooding, tidal behavior, backwater effects, etc.) may not be changed due to withdrawal of the designed water requirement from the Passur River.

Wash off from coal stock piles

Wash-off from the stockpiles shall be drained out to the central effluent treatment sump. Water spraying (in the form of mist) for controlling coal combustion and coal dust suppression shall be made in a way so that no surplus water is produced. Leachate from the coal stock yard shall also be drained to the central effluent treatment plant. Little amount of leachate might be leaching to the ground.

Discharge of thermal plume

No heated water shall be discharged to the environment. With recommendation of Initial Environmental Examination (IEE), the power plant has been designed provided with a closed cycle cooling system with induced draft cooling tower. The cooling tower blow down water will be used for coal dust suppression and ash handling. Thereby, no water shall be discharged in the open water or river from the cooling system.

Wastewater and sludge

A central effluent treatment plant with integrated water and wastewater management has been planned and designed for this project (Figure 4.11). The management system has been designed provided with recycling and reuse of waste water. The sludge and wastewater to be generated from different treatment plant (e.g. Desalination plant, 2nd stage Reverse Osmosis plant, Cooling water system, Service water system, Ash Water Blow

down, etc), domestic sources, etc will be discharged after series of reuse and recycling system to the central effluent treatment sump. After treatment, effluent will be discharged to the Passur River at a rate of 100 m^3/hr. For monitoring the effluent quality, a monitoring system has also been provided. As long the effluent shall be discharged satisfying ECR, 1997 defined standard, there will be no danger to pollute existing water systems of that area.

Disruption of tidal inundation

The proposed power plant shall not obstruct the natural flow of Maidara River. The proposed site is naturally separated from the surrounding area by Passur river, Maidara River and Kaigar Daskati canal. Site establishment in this isolated land may not cause any obstruction to tidal inundation of the surrounding areas. However, if the Kaigar Daskati canal in the North-Western portion of the project boundary is obstructed, natural tidal inundation pattern of Kaigar Daskati village may be changed.

Drainage congestion and water logging

The project area of 1,834 acre land will be developed for project purpose. As the project area is naturally separated from the nearby area by river, the site development may not cause any drainage congestion and water logging in the nearby villages i.e. Bara Durgapur, Rajnagar, Baserhula and Kapasdanga village. However, drainage congestion may arise in the Kaigar Daskati village, only if the reach of the Kaigar Daskati canal is obstructed.

Erosion and Accretion

There will be no significant impacts on erosion and accretion process of the Passur River due to operation of this project. However, construction of Jetty and movement of large vessel for coal transportation may cause shoreline erosion due to generated wave from vessel. If the vessels maintain speed restriction (7 knots to 8 knots), the generated wave may be insignificant to have impact on shoreline erosion.

Impacts due to maintenance dredging (if required)

Maintenance dredging for maintaining navigability of the River for coal transportation may be required. The dredging works shall be executed by the relevant authorities (MPA, BIWTA or BWDB). The relevant authorities shall keep close communication with DoE for necessary clearances. Dredging activities may have impacts on river water quality. During dredging operation, water column may be contaminated due to spillage of oil, grease, machine oil, etc. Unplanned dredging may also cause erosion in some places.

8.3.10 Impact on transportation system and traffic movement

The operation of the project might trigger local and regional infrastructural development. Power security along with the existing Mongla port facilities will attract industrial development. Thence, the following indirect impacts may be observed after commissioning of the plant.

Traffic load on roads

Due to induced development, traffic load on Khulna – Mongla road will increase. Accordingly, traffic system may be developed by the relevant agencies.

River traffic

River traffic will increase due to coal transportation and induced industrial development. It is anticipated that the port activities will also increase accordingly.

Traffic accident

The increased traffic load in both road and river may increase risk of traffic accident.

8.3.11 Impacts on land resources

Agricultural land type

The operation of the project will not have any impact on agricultural land type of the locality, as it will not alter the hydrological process and flood regime of the area. Only the project areas of 1,834 acre that is to be acquired for project development will no longer be used for agricultural and shrimp farming practice. This land will be raised by 5 - 6m above the mean sea level.

Land use

It might be anticipated that the existing agricultural dominant rural land use of the locality will be changed in future due to induced infrastructural and industrial development after completion of the project. Industrial development, township development, new road and communication may take place due to generation and supply of reliable electricity from the proposed power plant. However, a regional development plan should be prepared by the concerned Government Authority to guide the induced development in a planned way and to conserve agricultural land from encroachment.

Soil nutrient status

The power plant will emit fly ash through the stack of 275 m height within the limit of ECR, 1997 defined standard. However, this ash might be deposited on the surrounding agricultural land. Deposition of fly ash increases water retention capacity and nutrient status of soil (Vitekari, H. N., *et al.*, 2012; World Bank-NTPC, 2007; Gupta D. K., et. al., 2002; and NTPC, undated). On the other hand, deposition of ash on agricultural land during accidental release or malfunction of ash collection system might cause toxicity to standing crop.

Heavy metal

Coal and coal waste products, including fly ash, bottom ash, and boiler slag, contain many heavy metals, including arsenic, lead, mercury, nickel, vanadium, beryllium, barium, cadmium, chromium, selenium and, radium, which are dangerous if released into environment. Major portion of these heavy metals may remain with ash. The efficient ash management system adopted for the proposed power plant shall control release of ash as

well as heavy metal into environment. Mercury emission from coal burning is converted into methyl mercury, a toxic compound that harms people who consume freshwater fish. Failure of waste management and ash management system may cause release of these hazardous wastes to environment that might also contaminate food chain.

8.3.12 *Impact on agriculture resources*

Crop production

Deposition of fly ash to be emitted (within the limit of ECR defined standard) from the stack on agricultural land may not have any negative impact on crops. Rather it may increase crop production. Application of fly ash and pond ash in agricultural land increases crop production (Vitekari, H. N., *et al.*, 2012; World Bank-NTPC, 2007; Gupta D. K., *et al.,* 2002; and NTPC, undated). Provision should be kept for utilization of generated ash and pond ash in crop field.

Crop damage

Operation of the power plant might not cause crop damage of the surrounding agricultural land. With the experience of Barapukuria Coal Fired Thermal Power Plant, it is examined as anticipated that deposition of fly ash emitted from stack will not cause crop damage.

Lighting in and around the project area might attract pest. Pest infestation due to this light pollution may cause crop damage.

8.3.13 *Impact on livestock*

Operation of the power plant will not have any impact on livestock resources of the locality.

8.3.14 *Impact on fisheries*

Fish Habitat

No thermal water shall be discharged as the plant adopts close cycle water cooling system. Hence, impacts related to discharge of thermal plume shall not be an issue for this power plant.

The power plant adopts an integrated water and wastewater management system including reuse, recycling and treatment of wastewater. No waste and wastewater shall be discharged to the river without satisfying MoEF's standard (ECR 1997). Hence, the discharge of treated wastewater (within the limit of ECR 1997) may not result any change in water quality to have impact on fish habitat.

In a worst case, treated water may only change water quality of water column up to a certain distance from the discharge point but this change may not be significant to have any impact on fishery habitat. Risk of accidental discharge of any processed water, including wash waters, boiler blow down that may cause deterioration of fishery habitat, may be very low for adopting centrally controlled computer based monitoring and controlled system and hazard and risk management plan.

As the plant emit flue gas through the stack of 275m satisfying MoEF standard by adopting ESP, wet and dry deposition of fly ash, SO_2 and NO_2 over the fish habitat (river, canals,

intertidal areas, pond, ghers, etc) would be very limited.Low sulfur content coal, FGD (if required) and Low NOx burners would also help to mitigate environmental impacts.

For meeting different water demand, water will be abstracted from the Passur river at a rate of 9,150 m^3/hr (equivalent to 2.54 m^3/s, whereas the discharge of Passur river in dry season is 6000 m^3/s as per BWDB data) which is very insignificant to result any change in river flow condition as well as fish habitat.

Construction of water intake structure may locally obstruct fish activities but will not have any impact on fish habitat.

Fish migration

The operation of the power plant and its related activities may not have any impact on fish migration. In addition, the water intake structure may not create any obstruction to fish migration. Nevertheless, the intake current may attract some fish. The fishes those are not strong enough to swim against the current but will be saved by the fish screen. Coal transportation activities may cause limited impact on fish migration that has been discussed in the Section-8.4.

Fish diversity

Power plant operation may not have any direct impact on fish diversity. The minor impacts on fish migration and habitat discussed in the aforementioned sections may not lead to bring any permanent change to fish diversity and composition.

The water intake structure has been designed provided with appropriate fish screens including travelling screens, fixed bar racks, etc to prevent impingement and entrainment of fish by water intake. Despite, some fish and aquatic species, which cannot swim faster against the intake current, may get impingement and entrainment by the water intake. Fish eggs and larva may get entrainment by the intake water. Fine mess screen might also be adopted to save fish eggs and larva from getting entrainment by the intake water.

Fish Production

It is very unlikely that the aforementioned impacts of the plants operation may cause any significant loss of fish production. Land acquisition will cause 564 tons culture fish production loss annually. This reduction of production may not bring any remarkable change in regional and national culture fish production and shrimp export. However, the expected benefits from the power plant may outweigh this loss.

Sundarbans fisheries

Sundarbans is located 14 km away from the plant location. The above-mentioned impacts related with plant operation may hardly reach the Sundarbans. It is very unlikely that operation of the power plant may cause any impacts on Sundarbans fisheries.

8.3.15 *Impact on ecosystem*

Ecosystem habitat

The proposed power plant does not possess any significant negative impact on ecosystem habitat during post-construction phase while the emission of SO_x, NO_x and SPM will be within the MoEF's standard. Moreover, it is very unlikely that, long-term concentration of SO_x and NO_x will increase in Sundarbans because:

- Sundarbans is 14 km southwestwards from the proposed plant location.
- The prevailing wind of most of the time in a year flows northeastwards. Only during November to February, wind flows towards South and South East while Sundarbans is southwestwards from the plant.
- Stack gas shall be emitting from a stack of 275 m height (as per ECR 1997) satisfying emission standard of the World Bank and standard of MoEF (ECR 1997) by adopting pollution abatement measures e.g. ESP, low- NOx burner, etc

According to the estimated result, maximum possible 1-hr and 24 hr average concentration of both SOx and NOx would be insignificant near the Sundarbans and remain below the ECR-1997 standards of ambient air quality and World Bank's standard for emission. In addition, the project adopts automated monitoring and centrally controlled computer based controlling system to ensure effective plant operation and to prevent any accidental event that may cause environmental damage.

As the plant shall not discharge any thermal plume, and untreated waste water to the river, the aquatic ecosystem of the Passur and Maidara River may not be affected from the plant operation.

Terrestrial flora

Fly ash to be generated from the coal burning shall be arrested by the 99.9% efficient ESP before dispersion through the stack. Major portion of the remaining ash (0.01%) in the flue gas may be deposited on the buffer area (e.g. green belt to be developed) within the project area. Hence, it is very unlikely that the remaining ash would be deposited on the leaves of the vegetation of the surrounding area to cause any loss in productivity.

Terrestrial fauna

Project traffic load, human movement and other project activities may sometime disturb free movement of different wildlife like Mongoose, Ring lizards, Rats, Small Indian civet, etc living in road side vegetation. Lighting in the project area may disturb activities of nocturnal animals. On the other hand, green belt (to be developed) for the project shall provide important habitat to different wildlife, local common birds, and other aquatic birds.

Aquatic flora

No thermal plume, no untreated waste water shall be discharged to the river so that aquatic environment of the surrounding area may be affected due to plant operation. Nevertheless, discharge of untreated wastewater may change water quality of the water column within the close proximity but may hardly affect planktonic habitat of the Passur River.

Deposition of the remaining ash after arresting by the ESP on surrounding water bodies may hardly affect health of aquatic flora like red and white Water Lily (*Nymphaea nouchali*), Water Hyacinth (*Echhornia crassipes*), *Pistia stratiotes, Lemna minor*, etc. For preventing accidental release of any pollutant there shall be central controlling and automated monitoring system.

Impact on Sundarbans ecosystem

During the operation of the plant, the vessel movement will increase due to fuel (coal and oil) transportation through the rivers passing inside the Sundarbans. Moreover, coal will be unloaded and loaded at Akram point which may impacts on ecosystem by light, noise, dust etc if proper care would not be taken.

8.3.16 Impact on socio-economic condition

Employment

Acquisition of 1,834 acre land might cause loss of employment opportunity of affected people. However, proper compensation plan might help the affected people to opt for other jobs. On the other hand, operation of the proposed power plant will offer employment opportunity and local people should be given priority in employment and hiring for project activities.

Communication infrastructure

The proposed power plant will trigger local and regional development. The communication infrastructure will be developed in line with the induced industrialization. Locals will also be benefited from the access road of the project.

Health

The different structures of the power plant project may cause environmental hazard, which may eventually affect the health profile of this area. Some of the hazards may rise from ash and SO_2 dispersion if mitigation measures are not properly implemented. Besides, there are some occupational hazards and health risks for the project workers. The details of the health risk have been discussed in Chapter 11.

Another major health risk involves cooling tower. With world experience, different studies suggest that bacterial contamination of cooling tower may cause outbreak of pneumonia in the surrounding community. Aerosol dispersed from the cooling tower favor growth of bacteria causing pneumonia. However, as per world standard, the cooling tower has been designed with drift eliminator to limit the drift up to 0.007%. In addition, it is suggested to use biocides to prevent bacterial contamination of cooling tower. Besides, the cooling system shall have to be maintained as per manufacturer's guideline.

Water sanitation

As the project has been envisaged with plan of using surface water from the nearby Passur river, there will be no impact of plant operation on groundwater level. It might be anticipated that the health and sanitation system of the locality will be improved due to induced development.

Poverty

Land acquisition will cause capital loss of affected people that might lead them to poverty. However, proper compensation plan has to be adopted to prevent them from poverty. On the other hand, the induced infrastructural development, rural electrification, industrial development might contribute in poverty reduction of the locality.

Literacy

Operation of the proposed project shall not affect the literacy of the locality. Rather, employment opportunity may encourage local people to educate their child. The induced development may ease the education system to the locality. Hence, the literacy rate might be improving.

Land ownership and land price

As the time passes, the price of land in the adjacent area of the project site would be increased. In general, due to induced development, land value of the region may increase.

Safety net

It might be anticipated that GO and NGO will extend their safety net program up to the project area due to induced development and other economic activities.

8.3.17 *Impact on tourism*

The proposed site is geographically located at 14 km northeastward from Mongla port and 14 km northwestward from the Sundarbans. The proposed 12 km (approximately) road network from Bhanga to Kaigar Daskati road and the development of sea port (Mongla port) and river port (Chalna port), owing to the implementation of the project, may facilitate a huge concentration of tourists to enjoy the scenic beauty of the biggest mangrove forest of the world, the Sundarbans.

Here it is mentionable that the project area placed clearly outside the Ecological Critical Area of Sundarbans. Thus, operation of the project (e.g. vehicle movement, equipment gathering etc) would not directly affect the ecology of the Sundarbans.

8.3.18 *Impacts on occupational health*

Plant operation will involve working on high height, near rotary machinery and parts, high voltage yards, storage, handling and use of hazardous materials like heavy fuel, coal, chemicals, etc. These essential components of the project may cause different types of hazards for example, fire, explosion, falls, electrocution, intoxication/ toxic exposure etc. And the consequences of these hazards may be health injury, electrocution, organ disease outburst, loss of health, loss of life etc. Employees carrying contagious disease may aggravate health problems. In addition with keeping all safety & precaution measure, the authority must take some hazard and risk management plan, such as fire safety plan, explosion safety plan, electrocution safety plan, medical emergency plan, hazardous material management plan etc., to avoid these adverse impacts on occupation health. The poor health status of the employee may affect the working efficiency. The details of the occupational health and safety have been discussed in Chapter 11 of this report.

8.4 Impact of coal transportation, transshipment and handling

8.4.1 Impact on ambient air quality

Coal will be imported through ships; it will have sufficient moisture that will scale down propensity of dust generation. All the coal carrying vessels, floating crane (FC), floating transfer vessel (FTV) shall be equipped with dust suppression system. Hence, dust generation from the ship's holds during shipping and barging activities within the territory of Bangladesh may be minimum. Furthermore, the proposed project plans efficient dust suppression systems, coal stockyard management and air quality management system to limit generation and dispersion of dust particle.

8.4.2 Impact on noise

Noise may be generated from operation of these vessels. Similarly, coal unloading system and handling system may also generate noise. Coal transportation agency shall limit generation within the MoEF's standard of noise adopting noise management plan.

8.4.3 Wastes from ships

Generally, different types of wastes are produces from ships. The waste includes residue of the bulk (coal in this case), ballast water, bilge water, oil, lubricant, garbage, domestic waste, food and kitchen waste, slurry of sea water, sewage, etc. Discharge of any waste directly to the environment especially within the territory (Exclusive Economic zone) of any country is strongly prohibited by different IMO Conventions on Protecting Marine Environment. Discharge of waste from ships may be minimum if the mentioned regulations are properly enforced and followed by the relevant authorities (MPA, BIWTA and DG Shipping) and coal transportation agency. BPDB shall mention enforcement of these conventions in the Coal Supply and Transportation Agreement so that the coal transportation agent feels obligatory to follow these conventions with the aim of preventing pollution from ships. The responsible authorities (MPA, BIWTA and DG Shipping) shall monitor and spot-check the shipping and barging activities.

8.4.4 Water pollution

Water column may be polluted due to oil spillage, coal spillage and other malpractice like waste discharge, discharge of ballast and bilge water, etc which are prohibited by IMO conventions and ECR 1997. Hence, if the responsible authorities properly enforce these regulations, water pollution due to shipping and barging activities may be minimum.

8.4.5 Wave erosion

All the coal carrying vessels shall be plying along the Passur River limiting the speed in between 7 knots to 8 knots. Thence, wave to be generated from the vessels are to be insignificant to have impact on shore erosion. However, biological protection of riverbank may be adopted at erosion vulnerable places in Sundarbans region.

8.4.6 Impact on Sundarbans

Coal transportation shall be carried out using existing navigational route of MPA and BIWTA. Map 8.1 shows the tentative coal transportation route crossing the Sundarbans. If the vessel do not comply the maritime rules and regulation and IMO conventions for transporting and

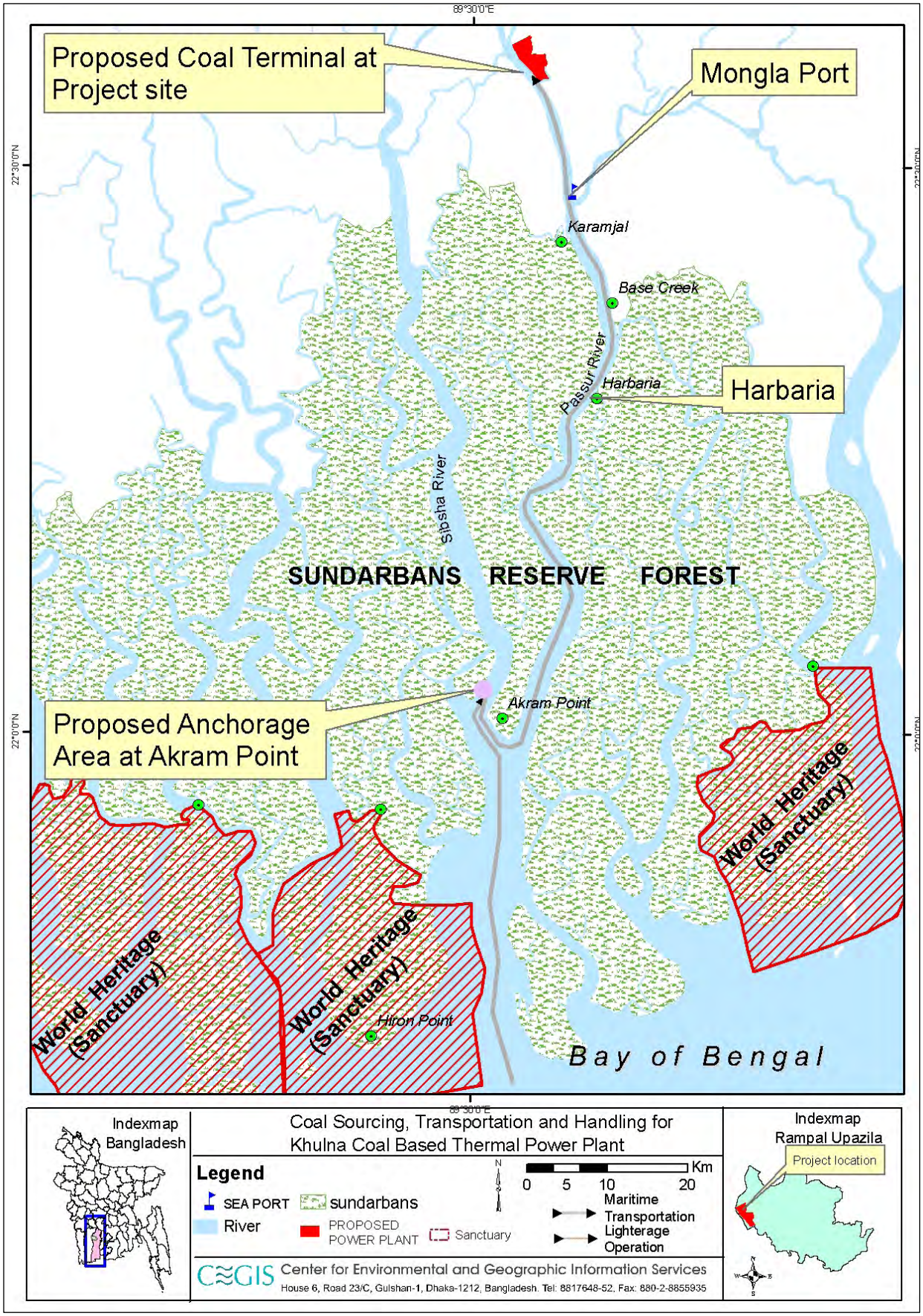
handling coal, ECR 1997, in the Passur river system, it may have impact on the ecosystem of Sundarbans especially Royal Bengal Tiger, crocodile, deer, dolphins, mangrove etc. The width of the river is about 1 km in average as it bisected the Sundarbans. Therefore, impact of lighting, noise will be attenuated to the adjacent ecosystems. If the responsible authorities enforce the rules properly, no malpractice like discharge of ballast water, bilge water, oily water discharge, waste and waste water shall take place within the territory of Bangladesh. Best practice of operation shall be followed by the coal transportation agency due to enforcement of the environmental rules and regulation. Hence, during ship to ship transfer, risk of coal spillage would be minimum.

Terrestrial fauna

At Akram point, ship-to-ship transfer activities, shipping and barging activities shall be carried out keeping a safe distance from the shoreline of the Sundarbans. Standard operational practice shall be followed by the transportation agency. Thence, disturbance to wildlife due to shipping, barging and ship to ship transfer activities may be minimum. Noise generation, beaming of light, etc from shipping and barging activities shall be limited, hence the impact due to noise and light beaming may also be minor.

Aquatic flora

Ballast water, oil spillage and coal dropping might affect pneumatophore of Mangrove plants. The excess traffic loads also possesses risk of intrusion of invasive species. Enforcing IMO conventions especially MARPOL Annexes, HNS Convention and BWM conventions, shall limited the malpractices of the ships and barges. Hence, the impact of such activities on habitat of aquatic flora may also be limited.



Map 8.1: Coal transportation route across the Sundarbans

Aquatic fauna

All kind of shipping and barging activities shall be limited within the existing navigational route of MPA and BIWTA. Hence, disturbance swimming, surface in and surfing of the Dolphin may be moderate. Map 6.18 shows the Dolphin community occurring surrounding the tentative coal transportation route.

Migratory birds

Due to limiting the pollution causing activities, disturbance to migratory bird habitat occurring shallow tidal bars, tidal flood plain and shallow areas of the rivers may be limited. Noise from water vessel may disturb the feeding activities of migratory birds. Risk of habitat deterioration due to pollution from ships will be low if relevant IMO conventions and national Environmental Regulations are properly enforced.

Invasive Species

The transportation of imported coal possesses risk of invasion of alien species. Alien species might come through ballast water and by contract of vessel body. The responsible authority to limit the risk of invasion of foreign species shall enforce related IMO conventions and ECR 1997. These invasive species might intrude into Sundarbans ecosystem and/or the Passur river ecosystem.

Livelihood groups dependent on Sundarbans

Coal transportation and handling may not have any impact on Sundarbans that might result loss of economic resources of Sundarbans. Thence, the livelihood groups dependent on Sundarbans (*e.g.* Bawali, Mawali, Fisher, wood collector, fuel wood collector, etc.) might be unaffected from coal transportation and handling. Fishers of Sundarbans may notice disturbance in fishing activities e.g. damage of fishing nets, etc due to navigation activities. However, special care needs to be taken to avoid and damage to fishing nets. As such, the relevant authorities (MPA, BIWTA, etc) should properly mark navigational route.

8.4.7 Impact on fisheries

Movement of coal carrying vessels and ship to ship transfer operation may cause disturbance on the fish migratory channel and hence on migration during operations. The high river traffic may also affect fishing activities in the river. On the other hand, due to low chances of pollution from ships (as IMO conventions and National Environmental Laws shall oblige the transportation operation), impact on fish habitat might also be low. Fish mortality may result only if vessels disobey IMO conventions and national Environmental Laws by practicing oil spillage, spillage of hazardous waste material, waste water and discharge of ballast water, discharge of bilge water, etc. However, relevant agencies (DG Shipping, MPA, BIWTA, etc) should enforce the IMO conventions and national laws with regular inspection and spot-checking.

8.5 Cumulative Impacts

The region (project area and study area) is less industrialized. There are few industries near Mongla Port and within the ECA boundary which may cause environmental pollution. The industries within the 10 km radius of the plant location are listed below:

1. Mongla Cement Factory, Mongla
2. Meghna Cement Mills Ltd. Mongla
3. Wes Farmers Kleen Heat, Mongla.
4. Summit Surma Petroleum Co. Ltd. Mongla./Bashundhara LP Gas
5. Holcim Bangladesh Ltd. Mongla.
6. Dubai Bangladesh Cement Mills Ltd. Mongla.
7. Sunshing Edible Oil (under construction)

The cement industries cause rise of SPM in the local air within the close proximity of the industries. The navigation activities e.g. ash import, clinker import, cement transportation, etc may cause moderate to minor impact on the surrounding environment.

If the responsible authorities enforce ECA 1995 and the follow up rules ECR 1997 properly, then the cumulative impacts may be within the acceptable limits of ECR 1997.

Chapter 9: Impact Evaluation

Taking into consideration of inbuilt facilities of pollution abatement measures adopted in the plant design as per the feasibility reports, the impacts were identified and assessed in the previous chapter. In this chapter, the identified impacts have been evaluated based on nature, extend, spatial and temporal nature, likelihood, and reversibility. Evaluations were made following expert judgment in Delphi approach. Several round table discussion meeting with the team members were made to finalize the evaluation. A matrix method has been adopted for this evaluation. Evaluation has been made to indicate the magnitude of each impact. Each impact was evaluated based on a word scale defined by word scenario instead of numeric scale. The scaling was finalized by structured expert judgment followed by Delphi approach. The word scale and the scenarios are given below:

Scale		**Word Scenario or Description**
Code	**Meaning**	
Impact		
D	Direct Impact	Directly related with project activities
Id	Indirect Impact	Resultant of any other impacts
S	Short Term	Impact occurs only for a particular time
L	Long term	No particular time, it may extends project life time
Lo	Localized	Impact is limited within the study area
W	Widespread	Impact spreads outside the study area also
R	Reversible	If the loss can be recoverable through implementing EMP or by naturally
Ir	Irreversible	If the loss cannot be recoverable
Likelihood		
Fr	Frequent	Consequence occurs before, during and after the project implementation
Lk	Likely	Conditions may allow the consequence to occur during the project lifetime
O	Occasional	Exceptional consequences to occur within the project lifetime
Sl	Seldom	Conditions do not seem to occur any consequence except some extreme cases
Rr	Rare	Reasonable to expect that the consequence will not occur though it has rare possibility to occur
Consequence		**Defined based on combination of the nature mentioned above**
In	Insignificant	No significant negative impact
Mr	Minor	Localized short term degradation of Environmental quality
M	Moderate	Localized long term/ short term, widespread and reversible loss of environmental quality
Sg	Significant	Widespread, long term and reversible loss of environmental quality or Local Long term, irreversible loss of environment
Ct	Catastrophic	Widespread, long term and irreversible loss of environmental quality

This evaluation will help the decision makers to take decision of issuing environmental clearance certificate and to take further policy initiatives. Table 9.1 presents the impact evaluation.

Table 9.1: Impact Matrix

Potential Impacts	Nature	Temporal nature	Spatial nature	Reversibility	Likelihood	Consequence[8]
	D/Id	S/L	Lo/W	R/Ir	Fr/Lk/O/Sl/Rr	In/Mr/M/Sg/Ct
Pre-construction phase (A)						
Land acquisition						
Fisheries						
Acquisition of shrimp farming land	D	L	Lo	Ir	Fr	Sg
Ecosystem						
Alteration of feeding grounds of aquatic birds	D	L	Lo	Ir	Fr	Sg
Land and Agriculture						
Crop production loss due to survey activities and construction of shed	D	S	L	R	Lk	Mr
Acquisition of 1,834 acre of shrimp and agricultural land	D	L	Lo	Ir	Fr	Sg
Socio-economic Condition						
Population displacement	D	L	Lo	R	Fr	M
Migration of displaced people	D	L	Lo	R	Fr	M
Increase in population density	D	L	Lo	R	Fr	M
Increase in landlessness	D	L	Lo	R	Fr	M
Changes in land price	D	L	Lo	R	Fr	M
Loss of employment	D	L	Lo	R	Fr	M
Land development						
Physical Environment						
Diminution of landscape and scenic beauty	D	L	Lo	Ir	Fr	M
Generation of fugitive particulate matter	D	S	Lo	R	Lk	Sg
Water Resources						
Impact on surface water quality	D	S	W	R	Lk	Sg

[8]Only positive consequences of impacts are mentioned as positive within parenthesis and others are to be considered as negative consequences

Potential Impacts	Nature	Temporal nature	Spatial nature	Reversibility	Likelihood	Consequence[8]
	D/Id	S/L	Lo/W	R/Ir	Fr/Lk/O/Sl/Rr	In/Mr/M/Sg/Ct
Drainage congestion and water logging	D	L	W	R	Fr	Sg
Waste water from workers colony	D	S	L	R	Lk	M
Transportation System						
Increase in traffic load	D	L	W	R	Fr	Sg
Agriculture						
Loss of vegetation	D	L	Lo	Ir	0	Sg
Decrease of grazing land for the livestock	D	L	Lo	Ir	0	Sg
Fisheries Resources						
Loss of aquatic life	D	L	Lo	Ir	0	Sg
Ecosystem Resources						
Health of the ecosystems	D	L	Lo	R	Lk	M
Loss of ecosystem habitat due to site establishment activities	D	S	Lo	R	Fr	M
Socio-economic Environment						
Employment status	D (+)	S	Lo	R	Fr	Sg
Construction (B)						
Physical Environment						
Diminution of landscape and scenic beauty	D	S	Lo	R	Fr	Mr
Generation of fugitive dust particle	D	S	Lo	R	Fr	Mr
Emission of Greenhouse gases	D	L	Lo	R	Fr	M
Noise generation	D	S	Lo	Ir	Fr	M
Generation of construction material waste	D	S	Lo	R	Fr	M
Water Resources						
Impact on ground water table	N/A	S	Lo	R	Lk	M
Impact on surface water quality	D	S	Lo	R	Lk	M
Impact on ground water quality	D	S	Lo	IR	Sl	M
Oil Spillage from maintenance Workshops	D	S	Lo	R	Sl	Mr
Effluent from workers Colony	D	S	Lo	R	O	Mr
Transportation System						

Potential Impacts	Nature	Temporal nature	Spatial nature	Reversibility	Likelihood	Consequence[8]
	D/Id	S/L	Lo/W	R/Ir	Fr/Lk/O/Sl/Rr	In/Mr/M/Sg/Ct
Increase in Accident due to increasing vehicles movement	D	S	L	R	O	Mr
Land and Agriculture						
Impact on Soil fertility due to disposal of waste and waste water	D	S	Lo	R	Sl	Mr
Decrease of livestock fodder due to loss of grazing land in the project area	D	L	Lo	Ir	Fr	M
Fisheries Resources						
Impact on fish habitats due to land development activities, traffic movements, oil and chemical spilling	D	S	Lo	R	Lk	M
Loss of aquaculture area due to land acquisition for power plant	D	S	Lo	Ir	Lk	M
Impact on fish migration due to land development activities and intensive traffic movement	D	S	Lo	R	Lk	M
Impact on Fish diversity	Id	S	Lo	R	O	Mr
Shifting of fish species to avoid the obnoxious environment and disturbance in the migration channel	D	S	Lo	R	O	Mr
Loss of aquaculture production due to deposition of ash (within the limit of ECR 1997)	D	S	Lo	R	O	Mr
Reduction of open water fish production due to deposition of ash (within the limit of ECR 1997)	Id	S	Lo	R	O	Mr
Ecosystem Resources						
Impact on habitat quality and ecosystem health due to deposition of SPM generated from construction activities	D	S	Lo	R	O	Mr
Impact on habitat quality due to disposal of construction waste	D	S	Lo	R	O	Mr
Impact on benthic habitat due to soil extraction in Passur river	D	S	Lo	R	Fr	M
Disturbance to Dolphin colony in Passur and Maidara River	D	S	Lo	R	Lk	M
Disturbance to nocturnal animals due to lighting in construction site	D	S	Lo	R	O	Mr

Potential Impacts	Nature	Temporal nature	Spatial nature	Reversibility	Likelihood	Consequence[8]
	D/Id	S/L	Lo/W	R/Ir	Fr/Lk/O/Sl/Rr	In/Mr/M/Sg/Ct
Socio-economic Environment						
Possibility of employment opportunities	D	S	Lo	-	Fr	M (positive)
Development of communication	D	L	Lo	-	Fr	Sg (positive)
Pressure and disturbance to the existing water-sanitation facilities	D	S	Lo	R	Lk	Mr
Poverty reduction	Id	L	Lo	R	Fr	M (positive)
Occupational health hazard	D	S	Lo	R	Lk	Mr
Post-construction/Operation (C)						
Physical Environment						
Rise of local air temperature due to heat emission through stack	D	L	Lo	R	Sl	Mr
Impact due to generation of fugitive particulate matter (within the limit of ECR 1997)	D	L	Lo	R	Sl	Mr
Impact due to Emission of SO_2, NO_x (within the limit of ECR 1997)	D	L	Lo	R	Sl	Mr
Emission of CO, CO_2	D	L	W	Ir	Fr	Sg
Noise generation	D	S	Lo	Ir	Sl	M
Waste generation and discharge to natural environment	D	S	Lo	R	Sl	Mr
Water Resources						
Impact on Ground Water table	No Impact					
Impact on Surface and Ground Water Quality	D	S	Lo	R	O	M
Impact on surface water due to water withdrawal	D	L	Lo	R	Lk	In
Wash off from coals	D	L	Lo	R	Sl	M
Oil Spillage from maintenance Workshops	D	S	Lo	R	O	Mr
Effluent from workers Colony	D	S	Lo	R	O	Mr
Discharge of treated effluent from central effluent treatment plant	D	S	Lo	R	Lk	Mr
Disruption of Tidal inundation	D	S	Lo	R	O	Mr

Potential Impacts	Nature	Temporal nature	Spatial nature	Reversibility	Likelihood	Consequence[8]
	D/Id	S/L	Lo/W	R/Ir	Fr/Lk/O/Sl/Rr	In/Mr/M/Sg/Ct
Drainage congestion and water logging	Id	L	Lo	R	Lk	M
Erosion and Accretion	D	S	Lo	R	Lk	M
Transportation System						
Increase in Accident due to increasing vehicles movement	D	S	Lo	R	O	M
Increase in Traffic load on roads	D	S	Lo	R	O	M
Increase in River traffic	D	L	Lo	R	Lk	M
Land and Agricultural Resources						
Change of local and regional land use	In	L	Lo	Ir	Fr	Ct
Increase of crop production due to areal deposition of ash on crop field	D	L	Lo	N/A	Lk	M (positive)
Runoff and areal deposition from uncovered coal piles may contaminant the soil with heavy metals like arsenic, mercury, chromium, and cadmium present in the coal.	D	S	Lo	Ir	Rs	M
Crop damage may increase by pest infestation due to lighting of the plant area	In	S	Lo	R	O	Mr
Crop damage due to Acid Rain	In	S	Lo	Ir	Rr	Mr
Fisheries						
Impact on fish habitat due to water abstraction from river and traffic movements	D	L	Lo	R	Sl	Mr
Impact on fish migration due to coal transportation, and other water way traffic movement	D	L	Lo	R	Lk	M
Impact on fish diversity	Id	L	Lo	R	Sl	Mr
Shifting of fish species to avoid the obnoxious environment and disturbance in the migration channel	Id	L	Lo	R	Rr	In
Reduction of overall fish production	Id	L	Lo	R	Sl	M
Ecosystem Resources						
Impact on ecosystem habitat quality and ecosystem health due to deposition fly ash (within the limit of ECR 1997)	D	S	Lo	R	Sl	Mr

Potential Impacts	Nature	Temporal nature	Spatial nature	Reversibility	Likelihood	Consequence[8]
	D/Id	S/L	Lo/W	R/Ir	Fr/Lk/O/Sl/Rr	In/Mr/M/Sg/Ct
Degradation of Mangrove habitat of Sundarbans due to ballast water dumping, oil spillage and Coal spillage	D	S	Lo	R	Sl	Mr
Disturbance to wild life due to noise generation from water vessel during coal transportation and increase river traffic across the Sundarbans	D	L	Lo	R	Lk	M
Disturbance to migratory birds due to coal transportation	D	S	Lo	R	Sl	M
Disturbance to Dolphin colony in Sundarbans and Passur river	D	L	Lo	Ir	O	M
Disturbance to nocturnal animals due to lighting in project area	D	L	Lo	R	Sl	Mr
Disturbance to nocturnal animals in Sundarbans due to lighting of water vessel	D	L	Lo	R	Lk	M
Socio-economic Environment						
Employment opportunities	D	S/L	Lo	--	Lk	M (Positive)
High land price	In	L	Lo	R	Lk	M
Rural Electrification	In	L	W	--	Lk	Sg (Positive)
Regional development	In	L	W	--	Lk	Sg (Positive)
Outbreak of Pneumonia	In	S	W	Ir	Rr	Mr
Poverty reduction	In	L	Lo	--	Lk	M (Positive)
Improvement of sanitation condition	In	L	Lo	--	Lk	M (positive)
Coal Transportation, Transshipment and Handling						
Increase of PM in local air quality	D	L	Lo	R	Lk	M
Noise generation	D	L	Lo	Ir	Fr	M
Increased wave erosion	D	L	Lo	Ir	Sl	Mr
Deterioration of river water quality	D	L	Lo	R	Lk	M
Increase river traffic	D	L	Lo	R	Fr	M
Impact on Fish resources	D	L	Lo	R	Lk	M
Impact on Sundarbans Ecosystem and wildlife	D	L	Lo	R	Sl	M

Legend (Word Scale)		
Code	**Meaning**	**Definition**
D	Direct Impact	Directly related with project activities
Id	Indirect Impact	Resultant of any other impacts
S	Short Term	Impact occurs only for a particular time
L	Long term	No particular time, it may extends project life time
Lo	Localized	Impact is limited within the study area
W	Widespread	Impact spreads outside the study area also
R	Reversible	If the loss can be recoverable through implementing EMP or by naturally
Ir	Irreversible	If the loss cannot be recoverable
Likelihood		
Fr	Frequent	Consequence occurs before, during and after the project implementation
Lk	Likely	Conditions may allow the consequence to occur during the project lifetime
O	Occasional	Exceptional consequences to occur within the project lifetime
Sl	Seldom	Conditions do not seem to occur any consequence except some extreme cases
Rr	Rare	Reasonable to expect that the consequence will not occur though it has rare possibility to occur
Consequence		**Defined based on combination of the nature mentioned above**
In	Insignificant	No significant negative impact
Mr	Minor	Localized short term degradation of Environmental quality
M	Moderate	Localized long term/ short term, widespread and reversible loss of environmental quality
Sg	Significant	Widespread, long term and reversible loss of environmental quality or Local Long term, irreversible loss of environment
Ct	Catastrophic	Widespread, long term and irreversible loss of environmental quality

Chapter 10: Mitigation of Impacts

The impacts identified through this study were later evaluated considering their nature, spatial and temporal extent, reversibility, and consequences. These analyses identify the scope of adopting mitigation measures or reconciliation the project design with the objective of preventing environmental pollution in compliance with ECA 1995. Thereafter, all of the identified impacts were further evaluated with and without mitigation measure adoption. Table 10.1 describes mitigation measure required for limiting the negative impacts of the project activities and contingency measures required for reducing risk of accidental hazard and enhancement measures for enhancing positive impacts with the aim of sustainable implementation and operation of the project ensuring environmental and community safety. The consequence analysis with and without consideration of mitigation measures adoption will give an idea of effectiveness of the measure. It will help the decision makers to have clear idea to reconcile project plan and design preventing negative impacts and conserving project benefits.

Table 10.1: Mitigation Measures

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
Pre-construction phase (Land acquisition and site development)				
Mitigation measures for preventing impacts on Land and Agriculture				
Loss of agricultural and homestead land due to land acquisition. This loss of land and production include : i. Loss of opportunities for agricultural laborers; ii. Decrease in economic participation and loss of opportunities for women especially in post-harvesting stage.	Sg	• Efforts have to be made to use *khas* land as well as fallow land to the extent possible to minimize future further requirement of lands • Project Affected Persons (PAPs) losing homesteads and land should be compensated as per the Law of the Land • PAPs loosing occupation may be involved in project's job opportunity if possible. • Compensation should be given for acquisition of agricultural land as per law of the Land	BPDB and DC office, Bagerhat	M
Measures for compensating socioeconomic impacts				
Population displacement	M	The authority should be careful and take necessary measures that every displaced people can be resettled as per law of the land.	BPDB and DC office of Bagerhat	Mr
Migration of displaced people	M	The displaced people may be resettled in suitable areas as per the law of the land.	BPDB, and DC office of	Mr

[9] Consequence: In- Insignificant, Mr- Minor, M- Moderate, Sg- Significant, Ct- Catastrophic

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
			Bagerhat	
Measures for compensating impacts on Fisheries				
Acquisition of Shrimp farming pond (Gher)	Sg	Compensation to the land owner, shrimp farmer and labor as per law of the Land	BPDB, and DC office of Bagerhat	M
Measures for compensating impacts on Bird				
Alteration of Feeding ground of aquatic birds due to alteration of Shrimp farming pond and agricultural land	Sg	• Protect feeding ground of birds occurring in project nearby areas. • Introduce Bird Conservation Program • Protect large water bodies for Bird conservation • Increase public awareness	BPDB, DoE	M
Measures for controlling air and water quality				
Dust particle releases during land development	Sg	• Fencing of project area by drum sheet or Tarjja • Adoption of Dust Suppression Mechanism (water spraying system) to control generation of SPM	BPDB, JV	M
Deterioration of water quality due to wash out of sediments and waste water from the worker colonies	Sg	• Proper run off management should be adopted to limit sediment runoff from the land developing area. • No waste should be disposed to canals/river	BPDB, JV	M
Construction phase				

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
Measures controlling waste generation and mitigating impacts				
Change of landscape and scenic beauty	Mr	• Limiting site clearance and base stripping activities within the project boundary	BPDB/JV Company/ EPC Contractor	In
Generation of construction material waste	M	• Dispersed gathering and stocking of construction materials and machinery should be within a limited area in the project boundary • The project area should be fenced prior to initiation of construction activities • Stock piles of construction materials should be covered in order to protect them from wind and weathering action • The existing right of way should be used in material transportation and existing right of ways should not be blocked • Provision of sanitary toilet, one toilet for 10 persons • Location of spoil stock pile should be located in safe area and protected from wind and rain action. • No spoil should be stored on River bank/slope • Construction wastes must be reused or recycled as and where possible • Burning of waste material should be restricted • Quality housekeeping should be maintained by regular inspection and checking • Keep provision of onsite waste collection and		Mr

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		disposal • Keep provision of different colored waste bin for dumping biodegradable, reusable and recyclable wastes. • Keep provision of awareness building meeting and training for employees		
Mitigation measures for controlling Air pollution				
Generation of fugitive dust particle	Mr	• Limiting activities may produce fugitive dust particle within project area • Vegetation clearance and base stripping should be minimized • Vehicle speed restriction should be enforced to control dust generation • Earthen roads and undeveloped roads should be avoided to minimize dust generation • Construction materials should be covered to protect from wind action • Keep provision of water spraying system to suppress fugitive dust • Dust particle generated from access roads must be controlled by spraying water during dry season • Stock piles of construction materials should be covered in order to protect from wind action • An appropriate freeboard should be maintained in	BPDB/JV Company/ EPC Contractor	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		trucks hauling construction materials		
Emission of Greenhouse gases	M	• Burning of any kind of solid waste should be banned • Regular maintenance of water vessels, vehicles, generator and machinery in accordance with manufacturer's specifications. • Approved pollution control devices to be fitted in equipment and machinery. • Transport vehicles should not be overloaded. • Avoid queuing of vehicles in areas adjacent to site, particularly near sensitive receptors including housing. • Switch off / throttle down all site vehicles, water vessels, generator and machinery when not in use	BPDB/JV Company/ EPC Contractor	In
Mitigation measures for controlling Noise generation				
Noise generation	M	• Switch off / throttle down all site machinery, vehicles, water vessels, and generator when not in use • No construction activities at night • Use noise damper on project boundary • Introduce vehicle speed limit and its monitoring	BPDB/JV Company/ EPC Contractor	Mr
Mitigation measures for controlling impacts on Water Resources				
Ground water table	Mr	• Keep provisions of rain water harvesting system to		In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
• Dry season water table may lower down due to excess withdrawal during construction period		limit ground water use.		
Surface Water Quality • Deterioration of surface water quality by kitchen wastes from worker shade or colony and construction wastes. • Oil Spillage from maintenance Workshops • Effluent from workers Colony	M	• Surface water must be saved from any harmful effluent emission and waste dumping from project site using Garbage Disposal Management plan. Municipality of Bagerhat should take care of this issue. • Provide closed system facilities and wastewater treatment plant to minimize emission of effluents from workers colony. • Good housekeeping at workshop and construction site • Appropriate equipments with safety measures should be used for storage and handling of oil • Provide training and awareness building program to the workers during construction. The training and awareness programs are: a) arrange weekly consultation session among the workers through plant site managers. The duration of consultation is one hour according to ISO14031 standard, b) arrange monthly environmental meeting among the mid level officers through top management when those issues will be discussed under guidance of ECR 1997.	BPDB/JV Company/ EPC Contractor	Mr
Ground water quality	M	• Harmful effluents and wastes leakage from oil and		Mr

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
• Deterioration of ground water quality by leakage of oil and chemical from tank or storage. • Oil Spillage from maintenance Workshops • Effluent from workers Colony		chemical tank or storage are to be controlled. • High tech treatment plant will be installed in the plant site. So effluent discharged to the Passur River would be minor as the proposed treatment plant will be operated satisfying all relevant standards of MoEF. • Provide training and awareness building program to the labors and professionals.		
Mitigation measures for controlling impacts on Land and Agriculture				
Impact on soil fertility due to disposal of waste and waste water	Mr	• Construction materials should be collected, stored, and disposed in an appropriate manner	BPDB/JV Company/ EPC Contractor	In
Damage to surrounding crops	Mr	• Recycled waste should be disposed in a suitable landfill • Fencing of project area by drum sheet or Tarjja • Limiting the construction activities and stocking within the project boundary		In
Deterioration of soil and ground water quality by leakage of oil, fuels and hazardous chemicals from tank or storage	M	• Harmful effluents and waste leakage from oil and chemical tank or storage should be controlled strictly • Wastes or used oil should be stored in a designated area for disposal through authorized vendors • Measures should be undertaken for fire suppression and the neutralization and collection of any spilled materials		Mr

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		• Treatment plant should be installed • Provide training and awareness building program to the labors and professionals.		
Mitigation measures for controlling impacts on Fisheries				
Impact on fish habitats due to land development activities, traffic movements, oil and chemical spilling	M	• Avoid fish breeding season during construction works (if possible) • Most excavation, backfilling, and site grading will be undertaken during the dry season. Sediment should be trapped on-site using sediment fences and traps and basins, and by preventing the off-site movement of coarse material. • Alternate sourcing of sand other than river bed dredging. • Enforcing the speed restriction and regular maintenance to control noise, dust generation. • Oil spillage from vehicle/water vessel should be controlled	BPDB/JV Company/ EPC Contractor	Mr
Impacts on spawning and nursing habitats due to clearance of Mangrove	M	• Construction contractors should be instructed to avoid tree cutting wherever possible. • Contractors will also be required to supply cooking fuel to the workers' camp to avoid tree cutting. • The disturbance of habitats in the inter-tidal zones should be minimized. • Mangrove plantation may facilitate some fish habitat	BPDB/JV Company/ EPC Contractor	Mr

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		to compensate the habitat loss in project area		
Impact on Fish migration due to land development activities and intensive traffic movement	M	• Avoid construction works (if possible) during fish breeding season. Generally, April to July for common fish and Sept-October and March to May for Hilsa spawning migration, should be avoided for construction work	BPDB/JV Company/ EPC Contractor	In
Impact on Fish diversity due to change in fish habitats, spawning, etc	Mr	• Fish conservatory (sanctuary) should be established at a safe zone. • Enforce banning of fishing activity within the sanctuary zone	BPDB/JV Company/ EPC Contractor/ DoF	In
Shifting of fish species to avoid the obnoxious environment and disturbance in the migration channel	Mr	• EMP for effluent discharge, waste water discharge, construction material disposal and traffic movement should be followed	BPDB/JV Company/ EPC Contractor, DoF, DoE, JV Company	In
Reduction of open water fish production due to disposal of waste within ECR 1997 limit	Mr			In
Mitigation measures for conserving Ecosystem				
Impact on habitat quality and ecosystem health due to deposition of SPM generated from construction activities	Mr	• Implement On-site Waste and Air quality Management Plan	BPDB/JV Company/ EPC Contractor	In
Impact on habitat quality due to disposal of construction waste	Mr			In

Impact	**Consequence [9] with no mitigation measures adopted**	**Mitigation/ Enhancement/ Compensation/ Contingency measure**	**Responsible Institution (s)**	**Consequence with mitigation measures adopted**
Impact on benthic habitat due to soil extraction from the Passur river	M	• Limiting dredging activities within defined area if possible	As above	Mr
Loss of ecosystem habitat due to site establishment activities	Mr	• Limiting vegetation clearance and base stripping within project boundary • Protect existing Mangrove strip along the Passur River • Mangrove plantation program along Maidara river	As above and DoE	In
Disturbance to Dolphin colony in Passur and Maidara River	M	• Avoid soil extraction activities during surfacing and swimming time of Dolphin i.e. at dawn and evening • Dolphin conservation program may be implemented	As above and DoE	Mr
Disturbance to nocturnal animal due to lighting in construction site	Mr	• Restrict night lights at places where necessary • Keep provision of outdoor lights with shade directed downwards • Cut-off time to switch off unnecessary lights at night	BPDB/JV Company/ EPC Contractor	In
Measures for enhancing Socioeconomic condition				
Possibility of employment opportunities	M (positive)	• The labor recruitment policy should be formulated in such a way that the local laborers can easily get chance of employment in the power plant project • Gov/NGOs should provide support skill development program and income generation activities to local people	BPDB, contractor, NGOs	Sg (positive)

Impact	**Consequence [9] with no mitigation measures adopted**	**Mitigation/ Enhancement/ Compensation/ Contingency measure**	**Responsible Institution (s)**	**Consequence with mitigation measures adopted**
Impact on communication: the communication may be developed	+Sg (positive)	• For the increased movement of people and heavy vehicles the road networks should be developed	BPDB in association with LGED and RHD	++Sg (positive)
Measures for controlling negative impacts on socioeconomic				
Imposing the pressure and disturbance to the existing water-sanitation facilities	Mr	• Manage separate water and sanitation facilities for the construction workers in the project area so that they cannot make any disturbance to the existing facilities of the local people • Provision of appropriate water supply and sanitation facilities at construction site as well as labor sheds • Provision of rain water harvesting system at construction site as well as labor sheds	BPDB/JV Company/ EPC Contractor/ DPHE	In
Shifting or losing of occupation due to land occupation	M	• To mitigate the sudden loss of habitat and occupation, the displaced people should be compensated and rehabilitated for their income restoration and poverty reduction • PAPs should be preferred in project related employment	BPDB/JV Company/ EPC Contractor , DC Bagerhat	Mr
Occupational health hazard	Mr	• Arrangements of gloves, helmets, sunglasses and other tools, dresses & uniforms for each worker so that the workers can keep themselves safe from any kinds of accident	BPDB/JV Company/ EPC Contractor/ Civil Surgeon office,	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
			Bagerhat	
Post-construction/Operation phase				
Air Pollution Control				
Rise of local air temperature due to heat emission through stack	Mr	• The plant equipment must be performance tested during commissioning phase to ensure that standard has been maintained • Regular inspection and maintenance of boiler, pressure parts, FD and ID fans and ash separation and handling system, and other ancillaries • Safety and emergency plan for accidental hazard • Remote monitoring and control of total production process • Regular maintenance and overwhelming as per design specification	BPDB/JV Company	In
Rise of local air temperature during accidental fire or explosion event	M			Mr
Generation of fugitive particulate matter	Mr			In
Emission of SO_2, NO_x within ECR 1997 limit	Mr			In
Emission of CO, CO2	Sg			M
Noise control				
Noise generation	M	• Plant must be designed so as to ensure Bangladesh's standard of emission • 275m stack height and high velocity of plume (minimum 20m/s) should be maintained • Discharge of emissions through stack must be directed vertically upward without any impedance or hindrance • Provision of buffer zone and green belt	BPDB/JV Company	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		• Maintain coal quality of low Sulfur content as stipulated in project description • Maintain DoE standard of Noise level • Provision of buffer zone • Provision of green belt through tree plantation • Construct high and thick boundary wall that could act as noise damper • Noise insulation should be implemented surrounding the turbine and generator casing • Noise dumper/insulator must be installed around the casing of conveyor belt • Introduce and enforce vehicle speed limit • Switch off / throttle down all vehicle and engine of vessel when not in use		
Controlling waste generation and its impacts				
Waste generation and discharge to natural environment	Mr	• On site waste collection and disposal system should be provided by municipality of Bagerhat through Rampal Upazila administration. • Dust control mechanism must be utilized for Ash handling and coal handling system • Provision of different waste bin with color code for different waste (recyclable, reusable, biodegradable, hazardous, etc) in road side, parking places, office, eco-parks, and other official and public places in the	BPDB/JV Company	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		plant site. • Provision of waste management department with given responsibility of waste collection, hauling, disposal and overall management and the department should be vested under Environmental quality and Safety Management wings • Provision of regular awareness building meeting of programs		
Controlling impacts on water resources				
Impact on Passur River flow due water withdrawal	Mr	• Provision of Rain Water harvesting System • Water reuse and recycling • Water conservation program	BPDB/JV Company	In
Surface Water Quality • Surface water may be contaminated by coal residues due to wash of from storage. • Change of river water quality due to effluent discharge within ECR 1997 standard. • Ash from coal can contaminate water bodies. • Deteriorate surface water quality by domestic waste effluent from residential area of power plant	Mr	• Direct emission of harmful effluents and waste from power plant should be restricted. • Provide closed system facilities to minimize emission of effluents from power plant area • Effluent treatment plant should be constructed in the project site • Green building concept should be initiated in preparation of residential plan to minimize the emissions of effluent • Proper ash management and reuse plan should be initiated for sustainable resource management	BPDB/JV Company	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
• Oil spillage from maintenance workshops				
Ground water quality • Deterioration of ground water quality by leakage of oil and chemical from tank or storage.	M	• Ground water must be free from any harmful effluents and wastes leakage from oil and chemical tank or storage through seepage • Provide training and awareness building program to the labors and professionals	BPDB/JV Company	Mr
Tidal Inundation: *Obstruction on tidal inundation*	Mr	• Any structure in connection with power plant project should not be designed on the way of tidal creeks • During construction work, the bed of tidal creeks must be clear for easy tidal water movement • Proper guide lines should be developed for Operation & Maintenance facilities	BPDB/JV Company	In
Drainage congestion and Water Logging • In Kaigar Daskati area	M	• Any structure in connection with power plant project should not be designed on the way of Kaigar Daskati tidal creeks • During construction work, the bed of creeks must be clear for rain water movement • Proper guide lines should be strictly followed for Operation & Maintenance facilities • Keep proper facilities to make runoff without any encroachment in its way • Proper set back rules and regulations in connection with river system management should be strictly	BPDB/JV Company	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		followed in Operation & Maintenance period • Keep river free from any encroachment and obstruction		
Erosion and Accretion • River bank erosion may occur for wave action due to frequent movement of feeder vessels in Passur river from ***Akram point*** to project site.	M	• Bank protection measures (mangrove plantation, controlling vessel speed, etc) should be taken under consideration	BWDB/ BPDB/JV Company	Mr
Controlling impacts on Land and Agriculture				
Rate of solid waste specially coal burned ash and other domestic and industrial waste production may increase. Soil fertility might be reduced due to deposition of ash or disposal of solid waste	M	• Advanced technique should be initiated for ash management and reuse • Temporary waste dumping facilities on site and permanent waste dumping facilities off site • Fly ash (dry form) generated from the plant should be commercially utilized to maximum extent possible • Unutilized fly ash should be transferred from the silo in wet form and stored in the ash pond until suitable users are identified. • Bottom ash should be collected in wet form and should be stored in the ash dyke until suitable users are identified	BPDB/JV Company/ DAE	In
Crop damage may increase by pest infestation due to lighting of the	Mr	• Pest infestation can be minimized by Integrated Pest Management (IPM) through “Light Trap”	DAE	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
plant area				
Rise of Crop Production due to deposition of ash or utilization of ash	M (positive)	• Proper training to the farmer on using fly ash in agricultural field • Awareness building	DAE	Sg (positive)
Crop Damage due to dry and wet deposition of Sox and NOx (to be emitted within the limit of ECR 1997)	Mr	• Flue gas desulfurization scrubbing systems, which use lime to remove the sulfur dioxide, and steam injection method to reduce the NO_x emission, can reduce or eliminate the likelihood of acid rain. • Adoption of Air quality Management Plan	JV Company/ DAE	In
Controlling impacts on Fisheries				
Disturbance to Fish habitat due to water abstraction from river and traffic movements	Mr	• The water supply pipeline intake point from the feeder canal should be provided with sufficient screening to filter out larger aquatic organisms (e.g., fish, frogs, and toads) and foreign matter, preventing this material from being drawn into the pumps • Drum screens need to be adopted in order to limit the entrainment of fish in the cooling water system and intake velocities should be as low as possible. • The water velocity in the intake channel should be less than 0.5 m/s in normal conditions. • Temporary water reservoir can be built for water storage rather than direct abstraction from river. • Monitoring should continue to ensure the deterrents	BPDB/JV Company	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		are working effectively.		
Disturbance to fish habitat due to oil and chemical spilling, accidental discharge and effluents from different units of the plant.	M	• On-site wastewater should be treated to achieve maximum reuse and recycling. • Leftover wastewater should be used to irrigate on-site vegetation throughout the year except in monsoon.	BPDB/JV Company	In
Disturbance on Fish migration due to coal transportation, coal handling, Ash disposal and other water way traffic movement	M	• Enforcement of ECR 1997, IMO Conventions, MARPOL, etc • Spot check of shipping and barging activities by relevant agencies. • Ash should be handled in dry form, using a closed circuit pneumatic mechanism, and directly loaded into enclosed trucks through ash silos. • Fly ash should be collected in dry form. Fly ash generated from the plant should be commercially utilized to the maximum extent possible in industries such as cement and ash brick manufacture, road construction, pavement laying, and fly ash aggregates production.	JV Company/ Coal Transportation agency/MPA, BIWTA/DG Shipping/DoF	Mr
Impact on Fish diversity due to minor changes on fish habitats, spawning ground, etc	Mr	• Rehabilitation of fish and shrimp habitats by conserving and protecting existing fish nursing ground by extending the existing mangrove forest area other than power plant area. • Enforcement of fishing ban in the mangrove forest areas during breeding/nursing period	JV Company, DoF, DoE	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
Shifting of fish species to avoid the obnoxious environment and disturbance in the migration channel	In	• EMP measures for effluent discharge, and traffic movement should be followed	JV Company, DoF, DoE	In
Reduction of overall fish production	M	• All the above mentioned EMP measure for fisheries	JV Company, DoF, DoE and other mentioned above	In
Measures for controlling impacts on Ecosystem				
Impact on ecosystem habitat quality and ecosystem health due to deposition fly ash during accidental release	Mr	• Implement Air quality Management Plan	BPDB/ JV Company	In
Impact on Mangrove habitat of Sundarbans due to seldom ballast water dumping, oil spillage and dropping of coal during coal transportation	Mr	• Enforce the relevant law of restricting Ballast water Dumping in Sundarbans territory • Enforce existing law of controlling oil spillage • Monitoring activities of the Foreign ships during coal transportation • Establish check post for monitoring activities of Foreign ships during coal transportation • Limiting coal spillage and escapee during unloading to feeder vessel/lighter vessel • Follow standard practice for shipping and barging operation	JV Company/ Coal Transportation agency/MPA, BIWTA/DG Shipping/ Forest Department	In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
Disturbance to wildlife due to noise generation from water vessel during coal transportation and increase river traffic across the Sundarbans	M	• Restrict blowing of whistle within Sundarbans Territory • Introduce speed limitation for vessel in Sundarbans Territory • Anchorage should be allowed at particular location within the Sundarbans area • Enforce Forest Protection Acts	JV Company/ Coal Transportation agency/MPA, BIWTA/DG Shipping/ Forest Department	Mr
Disturbance to migratory birds due to coal transportation	M	• Restrict blowing of whistle near bird colony • Awareness building • Restrict trapping, killing of migratory birds and local aquatic birds		Mr
Disturbance to Dolphin colony in Sundarbans and Passur river	M	• No trapping and killing of Dolphin • Plan measures for accidental oil spillage, refueling • Anchorage of water vessel only in designated sites • Adoption of Dolphin Conservation Program		Mr
Disturbance to nocturnal animal due to lighting in project area	M	• Restrict night lights at places where necessary • Outdoor lights with shade directed downwards • Cut-off time to switch off unnecessary lights at night		In
Disturbance to nocturnal animal in Sundarbans due to lighting of water vessel	M	• Restrict outside lighting of the water vessel during navigation across the Sundarbans • Restrict the beaming of searchlight on Forest area		In

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		• Use low beam of searchlight during navigation across the Sundarbans		
Measures for enhancing better socio-economic condition				
Employment opportunities	M (positive)	• The local labors should be recruited permanently and temporarily in both technical and non-technical posts. Some posts should be reserved for the local workers. This recruitment may help to reduce the poverty status of the whole study area. • At least 10% of the jobs (non-hazardous) in the power plant should be reserved for women.	BPDB/ JV Company	Sg
Induced infrastructural development, rural and regional development	Sg (positive)	• Concerned government department like Khulna Development Authority, Bagerhat District Parishad, Rampal Upazila Parishad, LGED, RHD, MPA, Rail Way Department, etc should guide the induced development. The existing development plans, Master plans might be improved in harmony with the project.	Mentioned Govt. Department	Ct (positive)
Rural Electrification	M (positive)	• Development of electric transmission and distribution line, priority of local and displaced people in providing electricity, priority in providing electricity for irrigation water pump for local people	BPDB, REB, GoB	Sg (Positive)
Poverty reduction	M (Positive)	• Integrated planning • Priority of local people in employment opportunity • Extension of social safety nets for affected people	DC office, Bagerhat, TNO office Rampal, GOB	Sg (Positive)

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
		and people under exposure of plant possessed risk • Monitoring NGO's activities		
Measures for controlling impacts on socio-economy				
Outbreak of Pneumonia from contaminated Cooling tower	Mr	• Limiting cooling tower drift using eliminator as per world standard • Use biocides to prevent bacterial contamination • Maintenance of cooling tower as per Manufacturer guideline • Strong monitoring of bacterial contamination in cooling tower • Community Health monitoring within 10 km radius of cooling tower • Establish communication with nearby hospital to keep record of pneumonia affected patient to monitor outbreak of Pneumonia	BPDB/ JV Company	In
High land price	M	• Both the land acquisition and economic development of the area for the project implementation may cause the higher price of land. If the displaced people are not provided with compensation properly the poor displaced people will not be able to purchase land in compliance with the market price of land. Their land compensation should be equivalent to the market price. They also deserve additional resettlement support for their income restoration.	DC of Bagerhat	Mr

Impact	Consequence [9] with no mitigation measures adopted	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institution (s)	Consequence with mitigation measures adopted
Coal Transportation, Transshipment and Handling				
Increase of SPM in local air quality	M	• Adoption of Dust suppression system • The vessel to be engaged should comply with international and national standards • Adopt enclose system for coal unloading and transportation (through conveyor belt) • Maintain ECR 1997, IMO Conventions, MARPOL, etc	JV Company/ Coal Transportation agent/ MPA/DG Shipping/BIWTA	Mr
Noise generation	M	• Restrict blowing of whistle within Sundarbans Territory • Switch off / throttle down all equipment and Machinery when not in use • Introduce speed limit for vessel in Sundarbans Territory • Anchorage should be allowed at selected location within the Sundarbans area • Enforce Forest Protection Acts • Limit dropping of coal and escapee during unloading to feeder vessel/lighter vessel		Mr
Deterioration of river water quality	M	• Ensure no dumping of ballast water, no oil spillage, no discharge of waste water, no waste dumping • Practice of dust suppression should be to moisten the coal, not to wet the coal		Mr

Impact	**Consequence [9] with no mitigation measures adopted**	**Mitigation/ Enhancement/ Compensation/ Contingency measure**	**Responsible Institution (s)**	**Consequence with mitigation measures adopted**
Wave erosion	Mr	• Introduce speed limit of coal transportation vessel • Keep vessel speed in between 7 knots to 8 knots • Plant mangrove forest along the bank of rivers vulnerable to wave erosion • Plant and conserve native mangrove plants along the River bank of coal transportation rout across the Sundarbans • Regular monitoring of erosion	JV Company/ Coal Transportation agent/ MPA/DG Shipping/BIWTA /BWDB	In
Increase river traffic accident	M	• Proper training for vessel crews, traffic inspectors, in charges, and other concerned professionals • All vessel should be provided with GPS, radar and other electronic navigation systems to prevent grounding or collisions, such as depth sounder, radar and radio equipment for communication • All vessel should comply with rules and regulation of IMO, Port authority, BIWTA and national laws of safety, and environmental conservations • Ensure that port/coal terminal inspector, environment and safety manager are available.	JV Company/ Coal Transportation agent/ MPA/DG Shipping/BIWTA /Coast Guard	M
Impact on Fish resources	M	• Awareness building for fisher and facilitate the fisher to use nets/boats provided with signals and marking • Reduce speed if net is seen • Ensure no dumping of ballast water, no oil spillage, no discharge of waste water, no waste dumping	JV Company/ Coal Transportation agent/ MPA/DG Shipping/BIW	Mr

Impact	**Consequence [9] with no mitigation measures adopted**	**Mitigation/ Enhancement/ Compensation/ Contingency measure**	**Responsible Institution (s)**	**Consequence with mitigation measures adopted**
Impact on Sundarbans Ecosystem and wildlife	M	• Ensure enforcement of ECR, 1997, Forest Protection Act, and other rules, regulation and treaties for conserving Sundarbans • Ensure no dumping of ballast water, no oil spillage, no discharge of waste water, no waste dumping • Restrict outside lighting of the water vessel during navigation across the Sundarbans • Restrict the beaming of searchlight in Forest area, Use low beam of searchlight during navigation across the Sundarbans • Limiting dropping of coal and escapee during unloading to feeder vessel/lighter vessel • Restrict blowing of whistle within Sundarbans Territory • Introduce speed limitation (7 – 8 knot) for vessel in Sundarbans Territory • Anchorage of water vessel only in designated sites • Adoption of Dolphin Conservation Program • Monitoring activities of the Foreign ships during coal transportation • Establish check post for monitoring activities of Foreign ships during coal transportation	TA /DoF/FD/DoE / Coast Guard	Mr

Note: Here, the role of DoE would be as a regulatory authority on the behalf of GOB.

Legend (Word Scale)		
Code	**Meaning**	**Definition**
D	Direct Impact	Directly related with project activities
Id	Indirect Impact	Resultant of any other impacts
S	Short Term	Impact occurs only for a particular time
L	Long term	No particular time, it may extends project life time
Lo	Localized	Impact is limited within the study area
W	Widespread	Impact spreads outside the study area also
R	Reversible	If the loss can be recoverable through implementing EMP or by naturally
Ir	Irreversible	If the loss cannot be recoverable
Likelihood		
Fr	Frequent	Consequence occurs before, during and after the project implementation
Lk	Likely	Conditions may allow the consequence to occur during the project lifetime
O	Occasional	Exceptional consequences to occur within the project lifetime
Sl	Seldom	Conditions do not seem to occur any consequence except some extreme cases
Rr	Rare	Reasonable to expect that the consequence will not occur though it has rare possibility to occur
Consequence		**Defined based on combination of the nature mentioned above**
In	Insignificant	No significant negative impact
Mr	Minor	Localized short term degradation of Environmental quality
M	Moderate	Localized long term/ short term, widespread and reversible loss of environmental quality
Sg	Significant	Widespread, long term and reversible loss of environmental quality or Local Long term, irreversible loss of environment
Ct	Catastrophic	Widespread, long term and irreversible loss of environmental quality

Chapter 11: Hazard and Risk Assessment

11.1 Introduction

The hazard and risk assessment including occupational hazard and safety analysis have been carried out based on the hazard and risk assessment carried out. In the EIA, hazard assessment has been carried out to identify the potential hazard associated with or inherent in the design process and to identify possible measures to avoid the hazard along with the safety plan for minimizing the risk. Incorporating these measures and safety plan in design, planning and operational procedure of the proposed power plant the potential hazard points can be eliminated.

11.2 Hazard assessment process

Attempt has been made to identify and evaluate the potential points of the hazards with possible safety plan. The assessment also includes occupational hazard and safety analysis.

Steps followed in this assessment are mentioned below:

1. Identification of potential hazard points
2. Hazard cause identification
3. Consequences of exposure
4. Risk management
5. Safety plan

The hazard assessment was carried out based on the experience gained through visiting Barapukuria Coal based thermal power plant, expert opinion and secondary literature. Effort was made to identify the potential hazards possessed by the proposed thermal power plant. Cause and consequence analysis was carried out to identify the root cause and potential consequence. Apart from the hazard assessment, remedial measures for safety were suggested.

11.3 Hazard categorization and potential hazard points

11.3.1 Plant construction and operation

The potential hazards associated with the plant construction and operation screened preliminary assessment have been categorized for identifying the root cause and consequences. The potential hazard points are listed in Table 11.1.

Table 11.1: Potential hazard points possessed in proposed coal based thermal power plant

Hazard category	Hazard points
Mechanical	Turbine and its ancillary components
Electrical	Generator and its ancillary components
	Cable gallery
	Power transformer
	Switchyard
	230KV switchyard control room
	230KV transmission line
Fire and Explosion	Boiler and its pressure parts
	Live steam line
	Fuel stockpile (Heavy fuel and coal)
Toxic/Carcinogenic chemical exposure	Chemical storage
	Discharge of Sulfuric acid from SOx absorber
Failure mode hazard	Blocked filter
	Non-functional ESP
	Non-functional NOx absorber
	Non-functional dematerialized water and waste water treatment plant
	Non-functional air circulating system
	Non-functional lightning arrestor
	Safe working place

11.3.2 Coal transportation and handling

Coal carrying vessel of 80,000 DWT will anchor at Akram Point from where further transshipment up to project site shall be made through purpose built coal carrying barge of 8,000 to 10,000 DWT. Ship to ship transfer (mother vessel to lighter vessel) shall be done by crane of the mother vessel or by floating crane. The coal transportation route will follow the existing navigational route of the Mongla Port Authority in close proximity of Sundarbans World Heritage site and reserve forest as well. Hazard and risk assessment have been carried out for smooth operation of the coal transportation ensuring environmental safety. Through preliminary assessment process the following hazards have been identified in Table 11.2.

Table 11.2 Potential hazards associated with coal transportation and handling

Hazard category	Hazard points
Fuel Spillage	Floating Crane (FC)/Floating Transfer Vessel (FTV)
	Purpose built Coal Carrying Barge
	Mother Vessel
Discharge/Spillage of fuel/oily water	Wrecks/collision
Coal pollution	Floating Transfer Vessel (during adverse climate)
	Project site stockyard (during adverse climate)
	Wrecks
Coal dust	Ship holds

Hazard category	Hazard points
	Floating Transfer Vessel
	Unloading/loading operation
	Project site stockyard
Fire	Ship holds
	Floating Transfer Vessel
	Project site stockyard
Vessel capsizing	Mongla Port Fare Way buoy
	Approach to Sundarbans
	Anchorage area at Akram Point
	Mooring area at Project site Coal Terminal
Wave erosion	Erosion vulnerable place of river bank
Injuries and fatalities	Mother vessel
	Barge
	Coal terminal

11.4 Hazard assessment and consequence analysis

The potential hazards, root causes and the consequences were identified through hazard assessment. The hazards points were identified for pre-construction, construction and post-construction stages. Moreover, specific safety measures were identified for each of the identified hazards. Given the scope of EIA study, the findings of the hazard assessment with suggested safety plans are presented in Tables 11.3 and Table 11.4.

Table 11.3: Hazard assessment for the proposed power plant construction and operation

Hazard point	Use	Potential hazard	Root causes	Consequences	Suggested safety measures
Pre-construction					
Machinery and equipment	Site clearance activities	Accident	Unconsciousness, mechanical failure,	Health injury, life loss	Regular inspection and maintenance. Use of PPEs
Construction					
High heights	Construction of building, steel structure and its foundation, painting works, drilling work, etc	Falling during works	Unconsciousness, equipment failure,	Health injury, life loss	Fall protection, use of PPE, awareness
Motor vehicle	transportation	Noise, accident	Noise from engine running, tire friction, Hydraulic horn, Mechanical failure, unconsciousness,	Health injury, life loss	Traffic safety measures, regular checking, servicing and maintenance of vehicle, awareness
Cutting and welding	For construction purpose	Burning, electrocution	Electric failure, lack of training, exposure to workers and passerby	Eye injury, health injury	Proper training, PPE, awareness, warning signal for passerby and adoption of welding standard practice.
Handling of hazardous chemical	For construction and storage purposes	Accidental release, explosion	Accidental failure, mechanical failure of handling equipment, unconsciousness	Health injury, life loss, loss of environmental quality	Regular maintenance of equipment, careful handling, following safety procedure, labeling of chemical specification and potential hazards, keeping Material

Hazard point	Use	Potential hazard	Root causes	Consequences	Suggested safety measures
					Safety Data sheet
Operation					
Turbine and its ancillary components	Converts pressure and temperature of the generated steam into mechanical energy	Mechanical and fire hazard	Mechanical failure	Health injury, loss of life, loss of Environmental quality & damage of equipment.	Safe design, regular inspection, continuous monitoring, computerized controlling system and monitoring. Installation of fire defense and fighting systems.
Circulating cooling water pump station	Pump water from river to cooling system				
Generator	Converts mechanical energy into electrical energy	Mechanical, electrical, fire hazard and short circuit, noise	Mechanical and electrical failure,	Health injury, loss of life & damage of equipment.	As above
Cable gallery	Transmit electricity from generator to unit transformer	Fire in cables galleries, short circuit in control room and switch gears,	Fire hazard, Mechanical/electrical failure in generator, malfunction of ventilation system	Health injury, loss of life & damage of Cables.	As above, Proper ventilation system, insulation of cables with non-inflammable fire resistance sealing materials
Power transformer	High voltage (230KV) power transmission	Fire and explosion	Electric short circuit, lightning, External fire hazard, etc	Health injury, loss of life loss of environmental quality & damage of equipment.	Maintaining of the specific standard for all electric fittings and cables, insulation of covering of electric cable with non-inflammable fire

Hazard point	Use	Potential hazard	Root causes	Consequences	Suggested safety measures
					resistance sealing materials. Installation of fire fighting system including water deluge System.
Switchyard	Open air power transmission	Electric fire, electrocution of the workers and passerby due to exposure to generated magnetic field and electric field	External fire, electrical failure, lightning, etc	Health hazard, loss of life. Loss of environmental quality from induced fire hazards including damage of equipment and accessories.	As mentioned above for power transformer, Installation of light arrestor, keeping safe distance from right of way, fencing, warning signal, fire fighting system and portable fire extinguisher.
230KV Switchyard control room	Controlling and monitoring the power transmitting system	Electric fire in cable gallery and switch	Electrical failure, external fire	As above	As mentioned above for power gallery and power transformer,
Boiler and pressure parts	Coal combustion and steam generation	Fire (near burner) steam, explosion	Failure of the water pumps, busting of furnace and pressurized pipes, contaminant present in fuel, accidental leakage, lack of heat sink for combustion process and non functional safety and by pass valve.	Incomplete combustion, equipment damage, health injury, life loss, environmental degradation,	Control system to monitor and regulate temperature, intake air, and furnace system. Monitoring fuel quality & safety system. Provision of fire fighting and safety
Compressed air	Operate, pressure	Explosion	Mechanical failure of	Equipment damage,	Safety bulb, limited entry, use

Hazard point	Use	Potential hazard	Root causes	Consequences	Suggested safety measures
system and pipeline	bulb, switch and control system		safety switch and bulbs	health injury	of PPE, Control system to monitor required pressure at different points.
Live steam line	Flows live high pressure steam from boiler to turbine	Explosion, High pressure steam build-up,	Blocking of line, throttled valve, line rupture and pressure loss at the weaker points	Damage to equipment, health injury	Regular monitoring and testing of all pipe lines. Provision of fire fighting and safety
Fuel stockpile	Fuel supply to the boiler	Fire hazard and explosion, self combustions in coal stock pile	Quality deviation of coal, lack of maintenance of storage system and monitoring	Damage to equipment, Health injury, Loss of air quality	Availability of appropriate fire hydrant with auto water sprinkler and regular monitoring
Water pre-treatment, treatment and waste water treatment plant	Produce clarified, dematerialized water for steam generation and treat effluent water before discharge	Chemical hazard	Chemical spillage and misuse, accidental release	Health injury, Loss of life, degradation of air, water and soil quality	Chemical use safety, Limited entry, use of PPE, available spill kits in case of accident, safety shower, eye wash and first aid facilities
Chemical storage	Use for water treatment in different phases of dematerialized water, cooling water and potable water.	Toxic accidental release due to multifunction of equipment & callousness of operator.	Chemical spill and misuse	Damage to equipment, Health injury, Loss of life, degradation of air, water and soil quality	Limited entry in storage, PPE, available spill kits in case of accident, safety shower, eye wash and first aid facilities
Different oil system	Different bearing cooling,	Fire, mechanical failure of any	Failure of temperature monitoring system	Damage to equipment, Health injury, Loss of	Continuous monitoring, safety bulb, safety measures for fire

Hazard point	Use	Potential hazard	Root causes	Consequences	Suggested safety measures
		equipment or parts, oil spillage		life, degradation of air, water and soil quality	hazards and oil spillage
SOx absorber	Use for maintaining rate of sulfur emission as per design standard	Toxic accidental release, Air pollution	Discharge of sulfuric acid due to technical failure in sulfur absorption system	Damage of air quality as well as surrounding ecosystem	Regular monitoring of absorption system and quality of coal
Blocked filters (Particulate filter system)	Filter out particles during combustion	Toxic gas release, Atmospheric pollution	Generation of excess coarse size particles due to incomplete combustion of coal	Hazard to human health and surrounding environment	Regular maintenance, alert temperature, oxygen and CO alarms
Non-functional ESP	Remove fine particulate fly ash	Toxic accidental release	Malfunction of device and equipment failure, lack of monitoring	Equipment damage and environmental degradation	Proper monitoring of combustion process and functioning of boiler.
Air circulating system	Use for generated air flow both into and out of boiler	Non-functional air circulating system	Failures of fans, incomplete combustion	Equipment damage and risk to human health and surrounding environment	Regular maintenance and monitoring control system, functioning of FD, ID Fans and vacuum systems.
Non-functional lightning arrestor	To arrest thunder and keep the equipment safe	Risk of lightning	Malfunction	Equipment damage and electric fire, short circuit	Regular testing and maintenance following the specification provided by the manufacturer
Lack of safe working condition	To maintain accident free working atmosphere	Risk of major, minor & fatal accident	Due to unsafe working condition and unawareness of workforce	Health injury, Electrocution, organ loss including death	Keeping all safety & precaution measures in order, maintaining first aid & well equipped primary health centre & training on awareness.

Table 11.4: Hazard assessment for coal transportation and handling

Hazard Point	Root Cause	Potential hazard	Consequences	Suggested Safety measures	Remarks
Fuel spillage from FC/FTV during refueling	• Unskilled operation of refueling • Mechanical failure • Ignorance of operational procedure, principal • Ignorance of Rules and Regulations	• Spillage of heavy oil/light oil during refueling of FC/FTV	• The spilled oil will be transported by prevailing wind and tide. During dry season northwesterly wind is dominant that will transport the spilled towards Bay of Bengal. The transportation time will depend on wind speed and tidal condition. Oil spillage may have impact on marine and Sundarbans ecosystem.	• The fuel suppliers shall practice standard refuelling and operating procedure to be specified by the BPDB/coal transportation agency in tender document • The suppliers should be well trained and equipped • The responsible agencies (DoE, MPA, DG Shipping, BPDB. etc) shall inspect and spot check the operation periodically. • Environmental Rules and Regulations of the Country and IMO conventions shall have to be obliged by the suppliers. • DG Shipping, BIWTA and MPA shall enforce and monitor the relevant rules and regulation to ensure best operation practice. • MPA should prepare an Emergency Response Plan provided with	Spillage of fuel during refueling is very rare in Mongla Port Region. There is no recorded significant incident of fuel spillage during refueling in Mongla Port. If the suggested safety measures are followed properly during operation, the possibility of the hazard would be very low.

Hazard Point	Root Cause	Potential hazard	Consequences	Suggested Safety measures	Remarks
				emergency response equipments	
Ship Collision/wrecks	• Unskilled operation • Poor loading • Poor ship condition • Extreme weather condition • Mechanical failure • Ignorance of navigational signals, warning and safety laws	• Discharge of oil/oily water • Coal Pollution • Injuries or fatalities of employees • Navigational obstruction	• The spilled oil will be transported by prevailing wind and tide. During dry season northwesterly wind is dominant that will transport the spilled towards Bay of Bengal. The transportation time will depend on wind speed and tidal condition. Oil spillage may have impact on marine and Sundarbans ecosystem. • Wrecks might obstruct navigational activities if not rescued	• Tender documents for Coal Transportation shall include specifications of Ships and Barges • All the coal carrying vessels shall be certified and monitored by DG Shipping and IMO • Standard operating procedures (SOPs) for loading and handling of coal to be specified by the Coal Transportation Agency shall be followed • Mother Vessel shall be guided by the facilities of MPA • The barges shall be navigated by Certified Master Pilots • Periodical training shall be provided by the coal transportation agencies • Cooperation between GoB departments to develop, implement and	The Passur river is comparatively safe navigation route considering river bathymetry, bed material, wave condition, etc. Akram point is also very safe place to anchor. There is no record of ship collision in the Mongla region in last 10 years. During peak generation, only 5-6 mother vessels shall come in a month. Hence, probability of ship collision may be rare if the suggested safety measures are properly followed.

Hazard Point	Root Cause	Potential hazard	Consequences	Suggested Safety measures	Remarks
			properly. • Environmental and Ecosystem Damage • Injuries and fatalities	enforce robust legislation and systems to predict and disseminate information regarding impending adverse weather conditions • Suspension of barge operations in adverse weather conditions. • Coal barges shall be complied with COLREGS and other legislative instruments of DG Shipping • DG Shipping, MPA and BIWTA should enforce and monitor rules, regulation and IMO conventions (signed by GOB). • Transportation Agency shall follow MPA, BIWTA, DG Shipping's guideline and emergency response plan in case of collision	
Coal spillage from cargo	• Extreme weather condition • Poor loading	Coal Pollution	• Contamination of water column with coal particles	• Coal transportation Agency shall prepare a best operation procedure for loading, unloading	MPA and BIWTA regularly circular cyclone and storm forecast of BMD. If the warning is properly

Hazard Point	Root Cause	Potential hazard	Consequences	Suggested Safety measures	Remarks
			• Local changes of water quality: ➢ *Increase in turbidity and DO* ➢ *Change of salinity and acidity*	and operation of the coal carrying vessels • Transportation Agency shall follow MPA, BIWTA, and DG Shipping's guideline and emergency response plan in case of collision • DG Shipping, MPA and BIWTA should enforce and monitor rules, regulation and IMO conventions (signed by GOB). • Coal barges shall be complied with COLREGS and other legislative instruments of DG Shipping • Operation shall be carried out following navigational information, signals and warning of MPA and BIWTA. • The barges shall be navigated by Certified Master Pilots • Periodical training shall be provided by the coal transportation agencies	followed and coal loading activities are properly operated, the risk of coal spillage may be very rare.
Coal dust from	• Poor dust	• Exposure to	• Dry and wet	• Coal surface moisture	In general, coal is loaded

Hazard Point	Root Cause	Potential hazard	Consequences	Suggested Safety measures	Remarks
Ship Holds	suppression system • Poor moisture • Wind action	coal dust • Air pollution	deposition of coal dust on surrounding area	shall be maintained above 7% to control coal dust generation • Mother vessel shall have dust suppression system • FTV shall be equipped with dust suppression system to control dust generation from ship holds, loading/unloading activities and to moisturize coal during loading of barge	in the mother vessel with proper moisture to control coal dust generation. Vessels are also equipped with dust suppression system at ship holds. Hence, generation of coal dust from the ship hold may be minimum.
Fire at Ship Holds	• Poor fire prevention system • Poor dust suppression system	• Fire • Injuries and fatalities • Damage to ships	• Fire at ship holds	• Use of heat monitoring instrument • Use of moisture monitoring instruments • Periodical training for barge and FC/FTV operators	If the inbuilt fire preventing equipment (water gun or spray system) is properly operated the coal fire at holds of barge and ships can be controlled. Hence, possibility of fire at ships hold may be rare.
Shoreline erosion	Wave generated from barging and shipping activities	Shoreline erosion	• Loss of land • Erosion at Sundarbans	• Control barge speed. There is a study carried out by IWM for Asia Energy (SMEC 2005) that suggested 7 knot speed for 8,000DWT project barge that may be also followed in the case. • Use of barges with low	In general, wave generated from barge moving with 7 knots are relatively shallower to have impact on shoreline.

Hazard Point	Root Cause	Potential hazard	Consequences	Suggested Safety measures	Remarks
				wake. • River bank protection at vulnerable areas • In Sundarbans region biological protection of river bank might be introduced at vulnerable places	
Ship Pollution	• Ignorance of rules and regulation • Malpractice • Unskilled manpower	Discharge of ballast water, bilge water from Ships	• Deterioration of river water quality • Ecosystem damage • Impact on Fisheries	• DG Shipping, BIWTA and MPA shall enforce and monitor the relevant rules and regulation, IMO conventions, MARPOL to ensure best operation practice.	Discharge of any kind of waste, waste water, ballast water, bilge water are strongly prohibited by ECR 1997, Port Act, IMO Conventions, MARPOL, etc. If the rules and conventions are properly enforced, the possibility of any pollution from ship would be rare.
Occupational Hazard	• Lack of consciousness • Unskilled operation • Bad weather • Ignorance of safety procedures	Injuries and fatalities	• Loss of health • Loss of life • Loss of working hour	• Enforcement of SOLAS conventions, IMO Conventions by DG Shipping, BIWTA and MPA	GOB has adopted different IMO Conventions and SOLAS conventions that are enforced to ensure safety on Ships.

11.5 Occupational Hazard Assessment

Plant operation will involve working on high height, near rotary machinery and parts, high voltage yards, storage, handling and use of hazardous materials like heavy fuel, coal, chemicals, etc. Workplace hazard assessment and safety are therefore important for the safety of the employees and the plant as well. Besides, the health status of the employees is also important which may affect the working efficiency. Hazard assessment and job safety analysis are very much essential for ensuring the safe working place for the employees. Therefore safety measures dealing with these potential hazards are of vital importance. In the scope of EIA study the occupational hazard assessment has been carried out based on findings of the IEE study and experience of existing only coal based thermal power plant located in Barapukuria. The Table 11.5 presents the potential occupational hazards with safety measures.

Table 11.5: Occupational hazard and safety analysis

Hazard	Source	Consequences	Safety measures
Stuck by	Falling/moving pipe, tools/ debris dropped from elevated location, vehicles, any rotator machinery or parts, turbine and its ancillary	Health injury, loss of life	Fall protection, use of Personal Protection Equipments (PPE)
Fire	Cable gallery, power transformer, generator, turbine and its ancillary components, furnace, switchyard, switchyard control room fuel stockpile	Health injury and loss of life	Adoption of fire safety for each equipments and machinery subject to fire hazard Use of PPE Consciousness during working period.
Explosion	Hazardous chemical, power transformer, boiler and pressure parts, live steam line, fuel stockpile,	Health injury and life loss	Safe handling and storage of hazardous chemicals Regular inspection and monitoring of pressure parts and units, Use of PPE Awareness and training
Falls	Fall from elevated areas, high heights,	Health injury, loss of life	Fall protection, awareness, use of PPE
Electrocution	Cutting and welding, switchyard, cable gallery,	Health injury and loss of life	Use of PPE, Proper training, awareness, keeping safe distance from hazardous points, maintaining safety of high switchyard, cable gallery, control room
Intoxication/	Chemical storage, SOx	Health injury,	Safe storage of chemicals

Hazard	Source	Consequences	Safety measures
Toxic exposure	absorber, Blocked filters (Particulate filter system), Non-functional ESP	Loss of life	Safe working condition Use of PPE, Emergency Health Services
Health	Lack of safe working condition, employee having contagious disease	Health injury, Electrocution, organ Disease outburst, loss of health, loss of life	Keeping all safety & precaution measure in order, maintaining first aid & well equipped primary health centre & training on awareness Monthly health inspection, provision of medical leave for labor, awareness

Chapter 12: Environmental Management Plan

12.1 Introduction

Environmental Management Plan (EMP) outlines the way as how to implement the mitigation measures identified and discussed in the previous chapter. The main objective of the EMP is to guide the implementing agency- Bangladesh Power Development Board to achieve sustainability of the project ensuring environmental conservation as per national and international standard.

The EMP includes mitigation, enhancement, compensation and contingency measures for each of the three phases of the project – pre-construction, construction and post-construction/operation. The management plan covers air quality management plan, noise management plan, waste management plan, site establishment plan, water resources management plan, ash management plan, fisheries management plan, ecosystem management plan, agricultural management plan and socio-economic management plan. Scope of those management plans will adopt pollutants abatement measures in different phase of the power plant. Important instrument like ESP, ETP, Water treatment plant and process like green belt development, flood protection measures will be guided by relevant management plan. Each plan describes implementation procedure, task to be completed, and responsible person or body. Some of the pollution abetment measures take account of inbuilt construction and some of them are external. Inbuilt measures include ESP, ETP, WTP, DSS, Ash disposal, Occupational health and safety and regular training and motivations to the employees. External measures include green belt development, air quality monitoring stations, water quality monitoring stations, acoustic monitoring and regular training and monitoring to the respective management plan.

The implementation and monitoring of EMP shall have to be ensured. Therefore, a team of Environmental Specialist and Environmental Auditor has to be engaged with responsibility of strong monitoring during implementation of EMP and their environmental and social consequences.

12.2 EMP during Pre-construction Phase

Socio-economic management plan

12.2.1 Compensation Plan

The process of compensation is based on act and rules of Bangladesh Government. This process is generally depends on the types of land and properties to be loss for the project which has already been initiated by DC office Bagerhat. The DC office estimated total compensation cost as BDT 624,580,226.80 following Immovable Property Ordinance, 1982 (Ordinance II of 1982). BPDB has already handed over this amount of money to DC office Bagerhat. The project affected people has been listed out (Annex-XV) which is being compensated. The estimation considered land price (as per registration), home, trees, standing crops, and 50% of present market price of land. DC office, Bagerhat is paying this compensation directly to the affected person as per the Government Rules. However, it is

recommended to monitor the compensation process to ensure transparency in the payment process. Compensation should also be paid to the people dependent on the acquired land like agricultural labor, day labor in shrimp farm, people engaged in marketing of shrimp produced in that area, etc. Therefore, the authority must take all efforts to complete the compensation payment before construction starts.

12.2.2 Resettlement Action Plan

The authority should carefully take necessary measures that every displaced people can be resettled. Every displaced people must be contented with this resettlement plan.

12.2.3 Youth Empowerment Plan

A proper management plan should be taken in this pre-construction phase to utilize evicted local youth labor. This youth labor force was engaged in shrimp farming. Before the construction of this project, the authority should train them to initiate alternative employment opportunities, such as, technical and vocational training, cattle rearing, poultry farming training etc or some specific income generating training so that this youth can be engaged in the construction and operation phase of this project. In this away, their livelihoods will improve which subsequently progress regional socio-economy status in future.

12.3 EMP during Construction Phase

Site development plan

12.3.1 Site development by backfilling

It is proposed that site development for each unit of power plants and townships will be developed sequentially one after another. This development will be either using dredging spoils or only extracted soil from other places. So far, any part of site development, it is required to encompass the site development demarcated and well-compacted earthen ring dyke initially. So that, no loose earthen materials can move to the river by runoff water. Before dumping of dredging materials, base stripping of top soil has to be made proper bonding and stripped materials has to be kept in safe place for reuse it after completion of site development. Backfilling has to be made layer by layer ensuring proper compaction and water spraying so that no dust can emit in air causing air pollution.

12.3.2 Construction site management plan

The construction yard and the site should be managed in such a way that would cause minimum degradation or damage to the surrounding environment. The contractor must take responsibility for the construction site to confirm contractual aspects and applicable environmental standards. Adequate numbers of bins, sanitary toilet, water supply system, run-on and run-off drains, fire safety and fighting system, etc should be provided in the site. However, good housekeeping is necessary for preventing environmental damage. All the construction materials and stockpiles should be maintained within the project area provided with rain and wind protection. An Environment Manager should be employed with responsibility of monitoring the activities which causes any environmental effects and ensuring enforcement of EMP during construction activities.

12.3.3 Construction waste management plan

Construction waste should be managed properly. The rate of waste generation should be reduced adopting efficient technique and limiting waste generating activities. The measures for controlling construction waste may include limiting site clearance activities, planned stocking and gathering of construction materials and equipments, fencing around the construction yard, maintaining existing right of way to carry construction materials, adopting proper sanitation system for employees, banning of waste burning, and quality housekeeping. A waste dumping place should be provided with efficient waste collection and disposal techniques. No waste should be dumped to the surrounding rivers. Appropriate measures provided with run-on and run-off system might be constructed from controlling run off from construction yard and liquid waste. Initiatives must be taken to reuse and recycle of waste materials. Hazardous material including fuel and other combustible materials shall have to be stored with highest care and safety. Spillage, accidental release must be controlled adopting Hazardous material handling guideline.

Ambient air and acoustic management plan

12.3.4 Air quality management plan

Construction activities generate large volume of particulate matter and some time significant volume of green house gases. However, with these project activities, a large amount of particulate matter might be generated. Hence, an efficient air quality management plan has to be adopted. The mitigation plan includes limiting PM generating activities, adopting dust suppression system, limiting vegetation clearance activities, avoiding earthen road for traffic movement, covering of stockpiles, traffic management, etc.

12.3.5 Acoustic management plan

Noise to be generated from different mechanical equipment machineries and vehicle used in construction activities shall have to be managed to ensure ECR, 1997 defined standard. Adopting the necessary mitigation measures might reduce the generation of noise.

Water resources management plan

12.3.6 Ground water management plan

To control drawdown of ground water level, surface concreting may be minimized as minimum as possible for allowing natural recharge. Dependency of ground water might be reduced adopting rainwater harvesting system and anticipating consumptive water use. Construction waste water management would control discharge of waste into river. Proper training might be provided involving the monitoring professionals during construction work.

12.3.7 Dredging activities and dredge spoil management plan

In case of dredging works proper dredging and spoil management should be followed in the following procedure to mitigate the temporary and localized turbidity and sedimentation in Passur river.

- Installation of bamboo placating to contain suspended sediments within dredge perimeter
- Installation of bamboo fencing to protect entry of water hyacinth along the periphery of the protected area
- Equipments should be kept in good order with skilled operators. Disposal must be made in confinement chamber
- Cutter head speed will always be kept to the minimum level that yields an acceptable production rate
- Dredging activities should be planned avoiding surfacing and swimming time of Juvenile Dolphins (*i.e.* dawn and evening)

The dredge spoil management plan has to be participatory with the presence of stakeholders before starting the dredging activities and through spoil along side of Passur river.

12.3.8 Dredging spoil management plan

Spoil management from dredging activates is important in construction phase if the project site were developed through the dredging of adjacent river. The following activities should take care during capital dredging at the outer bar region.

- Dredged spoil should be disposed off in such a manner so that it does not any additional environmental issues and refill the dredged channel.
- Probable spoil disposal locations should be selected considering distance from dredging sites, environmental issues and social surveys and after discussions with local people.
- Proper management of dredged spoil should be planned and implemented during site development by the implementing agency. The implementing agency should obtain necessary approval from DoE (if required).
- Detail separate study should be carried out for dredging and spoil management

Agricultural resources management plan

12.3.9 Agricultural resources management plan

Crop production may reduce for misplacement of spoil and intrusion of saline water if proper measures are not being taken during construction period. Care should be initiated so that the standing crops are not been damaged by the placement of spoils. During construction of structures, precautionary measures should be taken so that intrusion of saline water will not inundate the standing crops/agriculture lands. For this, alternative bund should be made to overcome the risk of breach of the concerned temporary *bundh*.

Socio-economic management plan

12.3.10 *Priority for affected and local people in project employment*

The affected people and locals shall have to be given priority in hiring and employing of construction worker, labor, and professionals. Besides, local businessmen should be given priority in hiring supplying agent for food, construction materials, vehicles and other daily supplies.

12.3.11 *Occupational health and safety plan*

Use of Personal Protective Equipment shall be made mandatory for each project personnel, worker and even for the visitor. The safety plan described in Chapter 11 shall have to be adopted. Necessary training shall be given to project employees. Awareness program shall be arranged regularly. Safety talk, safety meeting, safety motto, safety billboard etc. are good techniques of raising awareness among the workers, visitors and locals.

12.3.12 *Labor recruitment plan*

The labor recruitment policy should be formulated in such a way that the local laborers can get preference in both temporary and regular employment of the power plant project. As these labors have no previous experience on such type of technical jobs, it is suggested that, the authority can recruit them in non-technical posts of this project or the authority can facilitate technical training them.

12.3.13 *Employment generation plan*

This is true that because of the implementation of this project a good number of local people will lose their only means of livelihood, the shrimp farming. To make up this loss, the implementing authority should develop an alternative employment generation plan. This plan will include active Public-Private Partnership (PPP). The PPP should motivate the NGOs to provide support for skill and capacity development and for income generation activities.

12.3.14 *Community liaison*

During construction, a close liaison with community and local government institution should be maintained. The local community and local government institution should be made aware of all the construction activities and possible environmental and socio-economic disturbances. A community liaison officer or Health and Safety Manager should be given responsibility of maintaining close communication with community groups, local government institutions and concerned government departments.

12.4 EMP during Operation Phase

Ambient air and acoustic management plan

12.4.1 *Air pollution management plan*

Operation and maintenance of boiler, ESP, stack has to be carried out regularly as per instruction given in the manufacturer's maintenance manual. At the same time, the quality of the coal has to be maintained as per design of the boiler and to comply with ECR, 1997. The coal shall have low sulfur content. The ash handling system must be regularly inspected

and tested to evaluate its performance as per the standard. Regular inspection of boiler, FD and ID fans, separation and handling system and other ancillaries shall also be inspected and tested regularly weather this level remains lower than the allowable limit. Safety measures shall have to be ensured of all components and accessories for entire life period of the project. Emission level of SO_2, NOx and PM shall also have to be monitored regularly. The Environment Manager shall be responsible for regular monitoring of emission level, inspection and testing of mitigation measures, environmental efficiency of the plant and regular reporting of the inspection. The monitoring and inspection report shall have to be submitted to DoE for renewing Environmental Clearance Certificate.

12.4.2 Coal transportation and handling plan

The vessel to be used for coal transportation shall have to satisfy all national laws and IMO conventions signed by GOB. Bangladesh is a signatory 25 IMO Conventions and Maritime Protocols to protect marine and terrestrial environment of the country. All of these conventions and protocols have been discussed in Chapter 2. Therefore, all activities relating to shipment of coal through the Port shall have to be done strictly in compliance with the standards set by the IMO, particularly the conventions, protocols and agreements. Shipping, barging and transferring should be regularly monitored by the relevant authorities (*e.g.* Chairman) Shipping, MPA and BIWTA to ensure enforcement of these conventions and protocols. Coast guard might be given responsibility for inspecting whether the vessels are adopting mitigation measures, complying national and international rules of safety and environmental conservation. Besides, an Environment Manager shall be given responsibility of monitoring transportation activities and of auditing environmental efficiency of the transportation system.

Proper dust suppression and self combustion mitigation system must be adopted. Practice to moisten the coal but not wet them should be followed. However, water treatment plant should be planned and constructed for management of runoff and wash off water from coal stockpile and unloading system. The unloading system and conveyor system should be enclosed typed that would reduce generation of fugitive dust particles from coal.

12.4.3 Acoustic management plan

All equipments and mechanical machineries shall have to be maintained in good working order. Noise level should be monitored at different selected location within power plant and nearest community. The greenbelt shall be planted with the aim of dampening the noise level. The boundary wall will also dampen the noise level further. Whether possible, mechanical parts of high noise potential shall be provided with acoustic hood. Noise from other line sources like project vehicle, vessel, etc shall be controlled adopting mitigation measures. An Environment Manager shall be given responsibility of monitoring efficiency of the management plan and regular monitoring of noise level.

Waste management plan

12.4.4 Solid waste management plan

Waste to be generated from different point sources like office, household, workshops, construction yards, etc shall be efficiently collected, disposed and managed. Waste shall be collected and managed separately as per type. Hazardous waste should be managed

separately. Initiatives might be taken for recycling and re-use of waste. On site waste disposal system should be constructed and their performance should be monitored.

12.4.5 Coal yard management

Coal is a self combustible material. Proper aeration system and water spraying system must be installed to control self-heating of coal in stock pile. The dimension and height of the stockpile should be designed considering self heating, aeration, wind effect, etc. There should be a continuous monitoring of the inside temperature of coal stockpile.

Coal stocking, handling, and other activities generate considerable amount of coal dust. The surface moisture of the coal should be maintained in such a way that would limit propensity to spontaneously combust and produce dust. Generally, with surface moisture of at least 7%, coal shows low propensity to self combustion and producing dust. Water must be sprayed on the stockpile if surface moisture goes below 8%. There should be an automated monitoring and water spraying system. In addition, water must be applied on coal:

- As it moves on conveyor belt
- At transfer points
- At stockpile

Care should be taken to control aerosol formation after water spraying. The runoff and wash off from the stockpile and coal unloading system should be treated properly before discharging it to open environment. However, wash off and runoff from stock pile should be limited. The water spraying approach should be, to moisten the coal not to wet the coal. The recommended practice is to fog spray or mist the stockpile surface as frequently as necessary to maintain the surface of the coal in moist condition, not in wet condition. This will minimize propensity of self combustion and dust generation and accordingly no runoff water will be produced.

Provision of regular monitoring has to be kept for inspection proper pathway with entry and exit should be provided in stockpile area and conveyor belt.

12.4.6 Dust suppression system (DSS)

Dust suppression systems have to be installed at coal receiving terminal and plant site. The system functions (dust suppression) replenishing the evaporated moisture. An integrated system has to be installed to control dust at ship's hold, ship unloader, loaders, stackers, reclaimers, conveyor system (including each transfer point), and stock yard. An automated system may be adopted to suppress the dust maintaining moisture level of coal surface not below 7%– 8%. Sprinklers have to be set up in a way that will spray maximum water inform of the mist so that no surplus water will be generated. However, water collecting and recycling system also needs to be installed in line with dust suppression system.

Furthermore, the conveyor system might be covered typed so that coal dust from wind action can be controlled. At transfer points, water sprinkler should be installed.

In case of ship's holds, water sprinkler jets should be provided at the bottom of the boom of the unloaders so that the operator will be able to operate the sprinkler as and when required. In such case, no need to install automated sensor.

The major source of dust generation is stockyard. The entire stockyard should be covered with water sprinkler provided with automated moisture sensor. Sprinkler system provided with electrically operated valves and pumps are standard. Entire system *i.e.* sensor, valves, pumps should be connected with computerized monitoring and control system.

12.4.7 Ash management plan

Ash is the prime coal combustion products that release as fly ash and bottom ash during the operation of power plant. In order to avoid airborne dust about 99% fly ash has been captured in the ESP and temporary storage at ash silo. Ash carries out to the ash pond mixing with water. Closed cycle water system should be implemented during ash transfer process. The following measures should be taken for proper management of ash.

- Engineering control measures should be considered to maintain the ash dust concentration as low as is reasonably practicable.
- The capacity of ash pond should be higher
- Additional ash disposal facilities should be plan as for contingencies
- Proper design is necessary for local and national marketing of the ash
- Regular monitoring the ash disposal facilities
- Avoid prolonged skin contact especially where the product is dampened
- Wear protective clothing; good working practices as well as high standards of housekeeping and personal hygiene should be maintained

Water resources management plan

12.4.8 Water resources conservation plan

Water resources should be conserved and prevented from any pollution and hydrological alteration. The internal canals, nearby rivers, tidal creeks should be kept away from any obstruction and waste dumping. No tidal creeks outside the project area should be obstructed by project activities. If any tidal creeks are flowing through the project area that drains water from outside the project area should be free flowing without any obstruction. Proper guidelines should be developed for Operation & Maintenance of drains, internal canals, and tidal creeks.

12.4.9 Waste water management plan

The waste water management plan provided with recycling, reuse and treatment of water designed for the project should be inspected regularly. Performance of the treatment plants shall have to be monitored and maintained as per manufacturer's maintenance manual. Effluent quality shall have to be monitored at different stage of discharge and intake. Before discharging the treated effluent from the central monitoring sump the effluent standard shall have to be complied with ECR, 1997 defined standard for effluent.

12.4.10 Rain water harvesting plan

In Township, each building should be constructed with rain water harvesting system, which will help to harvest the water for different water activities as well as for domestic uses. In addition, water efficient technology should be opted. This process will reduce the pressure of river water.

12.4.11 *Maintenance dredging and spoil management plan*

Regular maintenance dredging might be required during the operation period of the power plant. The riverbed of Passur and the outer bar is highly susceptible of sedimentation (*e.g.* identified in section 6.6.3) as it carries huge amount of sediments. Therefore, it is necessary to monitor regularly the bathymetry of coal transshipment route. Provision of maintenance dredging is important for reliable coal supply in the plant site. However, disposal of dredging spoil should be guided by environmental protection policies. The adjacent ecosystems and socio-economic activates should free from the dredging and spoil disposal process.

Ecological management plan

12.4.12 *Ecosystem Management Plan*

Ecosystem Management Plan in an integral part of the EMP. Different management plans mentioned in this chapter has been developed with the aim of protecting ecosystem. Implementation of these management plans is essential for safeguarding the ecosystem. The principle should be set that the plant shall be operated ensuring all pollution abatement measures are in order. The following measures should be implemented during different stage of the power plant

- Limiting vegetation clearance and base stripping within project boundary
- Development of Green Belt:
    - Local species should be chosen for green belt development
    - In green belt plant composition should be made considering plant of different height and different canopy size to facilitate deposition of ash
    - Protect existing Mangrove strip along the Passur River
    - Along the Passur and Maidara river bank adjacent to the project area, mangrove species e.g. *Gewa, Keora, Sunduri, Bain*, etc should be planted
    - Plantation should be made following the guideline of the Department of Forest
- Other management plan suggested in this chapter should be implemented for ensuring safeguard of ecosystem
- Plant operation:
    - Plant should be operated ensuring all pollution mitigation and abatement measures e.g. ash management system, ESP, FGD (in case of coal having high Sulfur content), close cycle cooling system, monitoring system, waste water and effluent treatment plant, etc are in order
    - Implement On-site Waste and Air quality Management Plan
    - Regular inspection and maintenance of the equipment following the manuals of the suppliers
    - Restrict night lights at places where necessary
    - Outdoor lights with shade directed downwards
    - Cut-off time to switch off unnecessary lights at night
- Coal Transportation and Handling:
    - Enforce the relevant law of restricting Ballast water dumping in Sundarbans territory
    - Enforce existing law of controlling oil spillage
    - Monitoring activities of the Foreign ships during coal transportation

- Establish check post for monitoring activities of Foreign ships during coal transportation
- Limiting coal Spillage and escapee during unloading to feeder vessel/lighter vessel
- Follow standard practice for shipping and barging operation
- Restrict blowing of whistle within Sundarbans Territory
- Introduce speed limitation for vessel in Sundarbans Territory
- Anchorage should be allowed at particular location within the Sundarbans area
- Enforce Forest Protection Acts
- Restrict blowing of whistle near bird colony
- Awareness building
- Restrict trapping, killing of migratory birds and local aquatic birds
- No trapping and killing of Dolphin
- Plan measures for accidental oil spillage, refueling
- Anchorage for water vessel only in designated sites
- Adoption of Dolphin Conservation Program
- Restrict outside lighting of the water vessel during navigation across the Sundarbans
- Restrict the beaming of searchlight on Forest area
- Use low beam of searchlight during navigation across the Sundarbans
- Restrict night lights at places where necessary
- Outdoor lights with shade directed downwards
- Cut-off time to switch off unnecessary lights at night

12.4.13 Greenbelt development plan

A green belt shall be developed within the project boundary. This greenbelt will act as a buffer zone. The greenbelt will dampen the generated noise from the power plant. This zone will also be acting as safeguard from power plant for nearby community and Power Plant Township. Local tree species should be selected for green belt development. In addition, mangrove plant species should be planted along the river banks of Passur and Maidara around the project boundary. However, a landscape planning is necessary for obtaining benefit from green belt. This green belt will increase scenic beauty around the plant area.

12.4.14 Dolphin conservation plan

All coal carrying vessels should be obliged by IMO Conventions signed by GOB and national Environmental Regulations to ensure minimum impact on dolphin community and habitats. Vessels should be plying following the existing navigational routes. Speed of the vessels should be maintained within 7-8 knots. Standard operation practice should be followed in shipping and barging activities. All shipping and barging activities shall ensure zero waste dumping, zero ballast water dumping, zero pollution causing activities as per the IMO Conventions and national Environmental Regulations. DG Shipping, BIWTA, MPA, Coast Guard should regularly inspect shipping and barging activities to enforce the relevant conventions and rules. In addition, following measures should be taken into account during shipping and barging activities and other project related activities:

- Avoid dredging activities during surfacing and swimming time of Dolphin i.e. at dawn and evening

- No trapping and killing of Dolphin
- Plan measures for accidental oil spillage, refueling
- Anchorage of water vessel only in designated sites
- Throttle down vessel speed if dolphin activities are seen in navigational route
- Keeping noise from shipping and barging activities within the limit of ECR 1997
- Ensure zero waste dumping, zero ballast water, bilge water, oily water, etc dumping

12.4.15 Fisheries management plan

Fish management plan has been developed with the aim of avoiding pollution causing activities and to protect fisheries of the Passur river and Sundarbans. The EMP includes the followings:

Measures for navigational activities

- Enforcement of ECR 1997, IMO Conventions, MARPOL, etc
- Ensure non dumping of ballast water, non spillage of oil, non discharge of waste water and non dumping of wastes
- Spot check of shipping and barging activities by relevant agencies.
- Awareness growing for fisher and facilitate the fisher to use nets/boats provided with signals and marking
- Reduce speed if net is seen across the navigational route
- Ensure implementation of other EMP for coal transportation

Measures for plant operation

- Should follow the EMP for effluent discharge
- On-site wastewater should be treated to achieve maximum reuse and recycling.

Measures for Water Intake Structure

- The water supply pipeline intake point from the feeder canal should be provided with sufficient screening to filter out larger aquatic organisms (e.g., fish, frogs, and toads) and foreign matter, preventing this material from being drawn into the pumps
- Drum screens need to be adopted in order to limit the entrainment of fish in the cooling water system and intake velocities should be as low as possible.
- The water velocity in the intake channel should be below 0.5 m/s during normal conditions.
- Temporary water reservoir can be built for water storage rather than direct abstraction from river.
- Monitoring should continue to ensure that the deterrents are working effectively.

Fish Conservation Program

- Rehabilitation of fish and shrimp habitats by conserving and protecting existing fish nursing ground by extending the existing mangrove forest area other than power plant area.
- Enforcement of fishing ban in the mangrove forest areas during breeding/nursing period

Socio-economic management plan

12.4.16 Housekeeping

Good housekeeping is one of the prime steps of safety. Good housekeeping of mechanical parts, rotator parts, electrical equipments, plant site, green belt, ESP, stack, etc will ensure workplace safety and efficient functioning of the system. This good housekeeping has to be made in regular interval and as per need.

12.4.17 Employment generation plan

Preference should be given to the local labors in requirement of permanent and temporary post (both technical and non-technical). This recruitment may help to reduce the poverty status of the whole study area.

12.4.18 Rural electrification plan

Locality of the power plant area may be benefited by allocating certain loads from the national grid if possible. Relevant authority may formulate necessary rural electrification plan in order to satisfy both affected and unaffected people of that region.

12.4.19 Resettlement Action Plan (RAP)

A Resettlement Action Plan (RAP) should be taken to mitigate the adverse effects of Land Acquisition. BPDB has already acquired 1,834 acre of land in Sapmari Katakhali Mauza in Rampal Upazila. Field survey shows that approximately 150 households (almost 700 people) are now living at that Mauza and a number of family outside the project area directly (e.g. belonging the land) and indirectly (e.g. livelihoods) depends on the proposed project land area. If Government of Bangladesh acquires this land in Sapmari Katakhali then these households will lose their homesteads and other establishments in addition to their traditional occupations. So, a just resettlement action plan is indispensible throughout the implementation of this project. The key guiding principle of this RAP should be the Operational Policy (OP 4.12) of the World Bank and associated GoB rules and regulations. The compensation plan should be made on these guidelines. The study team consulted with various stakeholders on the institutional arrangement for resettlement and compensation payment and considering their perceptions the RAP should include the following facts:

- In addition to the landowners, people those do not own land but directly dependent on acquired land for livelihoods should be included in the RAP;
- The value of land should be determined by the current market price instead of government price;
- The compensation should be given in one installment before starting the construction work and the payment should be given in cash;
- As the households will lose their occupation because a great portion of households engaged with jobs based on the locality, a labor recruitment strategy should be taken to rehabilitate the jobless workers;
- The social institutions (school, madrasa, mosque) should not be acquired;
- Resettlement should be done in a adjacent locality;

- In resettled areas there should be enough room, separate space for courtyard and gardening for their living;
- Infrastructural development of newly settled area;
- After the acquisition, the authority should take immediate initiatives for skill development of unemployed labor force etc.

12.5 Hazard and Risk Management Plan

Hazard Management Plans are developed to address a range of plausible hazard scenarios and emphasize the tasks required to respond to a physical event. The Hazard Management Plan for the proposed power plant has been developed listing various actions to be performed in a very short period in a predetermined sequence if it is to deal effectively and efficiently, major and minor accidents, and even near misses. The primary objective of the plan is to keep the workplace safe and to achieve zero incidents for health hazard, and to minimize the potentiality of material, machinery/equipment damage, impacts on the environment to minimum.

The plan should include:

- Fire safety plan
- Explosion safety plan
- Electrocution safety plan
- Medical emergency plan
- Hazardous material management plan

12.5.1 Safety and emergency plan

Safety plan has been developed based on safety measures identified through hazard assessment process. During hazard assessment including occupational hazard, safety measures for each potential hazard were identified. Incorporating the identified hazard safety measures, this safety plan has been developed. The safety plan includes fire safety plan, explosion safety plan, electrocution safety plan, medical emergency plan and hazardous material management plan. Mongla Port Authority and BIWTA shall prepare emergency response plan for ship collision, oil spillage and pollution from ships.. The tender documents of BPDB for engaging coal transportation shall include relevant rules and regulation (described in Chapter 2) that have to be obliged by the transportation agency. The detail plan including safety and emergency preparedness are presented in Table 12.1.

Table 12.1: Safety and emergency plan

Hazard	Safety plan	Responsible person	Emergency plan	Responsible person
Fire	Fire prevention, instruction and training of staff, maintenance of escape route, fire protection systems and equipment, maintenance of fire safety register, provision of information to workers, reporting	Emergency Manager, Fire Officer	Fire alarm system, exit system, fire extinguishing equipment, smoke control equipment, fire and emergency evacuation plans, drills, assistance to the fire brigade	Fire Safety Director
Explosion	Explosion prevention, instruction and training stuff, maintenance of escape route, explosion protection systems and equipment, provision of information to building users, regular inspection and monitoring of pressure parts and units, reporting	Employer, owner, occupier	Explosion and emergency evacuation plans, exiting the building as quickly as possible and move to designated evacuation areas, roadways and walkways should be clear for emergency vehicles and crews	Emergency Personnel
Electrocution	Prevention measures, instruction and training of staff, maintenance of escape routes, proper training, awareness, control room, reporting	Supervisor, Coordinator	Prevention and precaution from electricity and avoid contact with overhead lines	Safety Officer
Medical	Provision of Health service center, Provision of on duty trained medical officers specializing in burn injury, orthopedics, electrocution, chemical toxicity or poisoning and shock treatment.	Chief Medical Officer	Rescue action, first aid, ambulance services, transportation facilities	Rescue Officer
Hazardous Material Management	Safe design, regular inspection, continuous monitoring, regular maintenance, reporting	Emergency Manager	Internal alarm, notification, use of personal protective equipment	Hazard responding agencies

Note; Emergency personnel means safety officers, medical officers, fire fighter, rescue offices and other responsible persons

12.5.2 *Safety training*

In order to reduce the risks associated with accidents, internal and external threats, and natural disaster a safety training program is essential for workers in plant operation. There should be a regular training program on safety for the workers to increase their awareness and also to reduce the risks. Provision of yearly professional training for health and safety, would enhance the effectiveness of safety. Safety training should be planned for the local people living around the project area so that they can be aware about the risk possessed by the power plant and can take appropriate preparedness. The suggested training schedule has been shown in Table 12.2.

Table 12.2: Present the training schedule that should be adopted for safety

Target trainee	Training schedule
Worker	Four training per year
Professional	Two training per year
Local people	Two training per year
Drivers	Four training per year
Safety professional	Two training per year

In addition, there could be a discussion and awareness session for increasing awareness on safety in each kind of meeting. The employee should regularly practice toolbox meeting and job safety analysis.

12.5.3 *Documenting and reporting*

Implementation status of the safety plans should be monitored and documented regularly. Monthly monitoring report should be prepared based on regular inspection and should be submitted to the Managing Director of the Power Plant. Any kind of incidents or even near misses should be documented and reported to the Managing Director.

12.5.4 *Environmental safety management team*

There should be provision of Environmental Safety Management Team with responsibility of implementation, inspection, documentation, and reporting of the safety plans. The team will also be responsible for implementing emergency plans under the Directorate of Environment, Health and Safety. The team should be a combination of multidisciplinary professionals. The team composition could be as:

- Environmental Quality and Safety Manager (Team Leader)
- Emergency Manager
- Fire Safety manager
- Safety Manager
- Chief Security Officer
- Security Officer
- Chief Medical Officer

- Medical Officer
- Rescue Officer

12.5.5 Hazardous and toxic material management plant

Hazardous materials (HAZMAT) management must be done in a manner that is conducive to the maintenance of the safety and health of all employees and in accordance with national legislation, regulations and procedures as per ECA 1995 and ECR 1997. World Bank Group. Environmental Health and Safety Guideline should be followed in management of hazardous and toxic materials[10]. Proper management of the hazardous materials will minimize the risk of public, environment and financial cost. Therefore, proper planning will be needed to efficient documentation, storage, handing, transportation and disposal of the hazardous materials. The following philosophy should be taken into account for appropriate management of hazardous and toxic management plan:

- Categorization of the toxics or hazardous materials depending on the potential impacts
- Producing data inventory for each of the hazardous materials throughout the production cycle
- Listing of the hazardous or toxic materials with its persistence life
- For proper documentation, a comprehensive data sheet/inventory should be developed. Computer based Management Information System (MIS) is a best tools for inventory management
- The inventory should contain name and description, classification, threshold, quantity, characteristic, HAZMAT quantity to be used in a month
- Appropriate labels must be affixed to containers holding hazardous substances, including those substances that have been decanted from their original container
- Safety measurement has to be taken care for storage of the hazardous materials
- Appropriate personal protective equipment (PPE), engineering controls have to be taken during storage, handing and management of hazardous and toxic materials
- Appropriate equipment, safety measures and accidental cases have to be taken at every steps of hazardous materials management for the safety of human health and environment
- Try to minimize the hazardous waste generating materials in the production system
- Efficient hazardous waste removal plant has to be detailed out considering the toxicity and potentiality of the hazardous materials
- Leaching proof canal line and site has to be constructed for hazardous waste transportation
- All categories of hazardous waste have a specific waste container and disposed maintaining the regulations

[10] Available at www.equator-principles.com

- Regular monitoring needs to carry out at every level of storage, handling and management of hazardous and toxic materials
- Legislative or regulatory action has to be taken for zero hazardous wastes disposal
- Hazardous Material Management Guideline of World Bank Group 11 Section 1.5 of the EHS Guideline of World Bank Group

12.6 Ash Utilization

12.6.1 Ash production

Based on the specified coal (refer to chapter 5) it is estimated that an amount of 4.7 million tons of coal shall be consumed per year (considering GCV of 6100 Kcal/kg, AR basis and 100% load factor) by the proposed coal based thermal power plants. As per this boundary condition the annual production of ash shall be 0.94 million ton (ash content of coal estimated at 15%). Out of a 0.94 million ton 20% shall be bottom ash and 80% shall be dry fly ash, that is respectively 0.2 million-ton bottom ash and 0.75 million-ton dry fly ashes respectively per year.

12.6.2 Ash utilization

The dry ash is taken to buffer hoppers for its onward transportation in dry form to storage silo near plant boundary for utilization. The residual ash can be used in Brick manufacturing, clinker industries, cement industries, feelings the low lands, compaction purposes etc. There will be also scope for ash export. At initial stage, the generated ash will be used in and for development of the project area.

Many Cement plants exist in the vicinity, hence, 100% fly ash utilization might be considered. Hundred percent bottom ash utilization might also been considered. However, ash dyke of 100 acres has been planned in case of non-utilization of ash.

Ash may be utilized for the following purposes:

- Concrete production, as a substitute material for Portland cement and sand
- Embankments and other structural fills (usually for road construction)
- Grout and Flowable fill production
- Waste stabilization and solidification
- Cement clinkers production - (as a substitute material for clay)
- Mine reclamation
- Stabilization of soft soils
- Road sub-base construction
- As aggregate substitute material (e.g. for brick production)
- Mineral filler in asphaltic concrete
- Agricultural uses: soil amendment, fertilizer, cattle feeders, soil stabilization in stock feed yards, and agricultural stakes

[11] Section 1.5 of the EHS Guideline of World Bank available at http://www1.ifc.org/wps/wcm/connect/47d9ca8048865834b4a6f66a6515bb18/1-5%2BHazardous%2BMaterials%2BManagement.pdf?MOD=AJPERES

- Loose application on rivers to melt ice
- Loose application on roads and parking lots for ice control

Among these 13 uses of ash, few uses have high potential and have present market in case of Khulna Thermal power plant. The following sections discuses potential sectors of ash utilization in case of Khulna Thermal Power Plant.

Ash Demand in Cement production

Fly ash is used as a partial replacement for Portland cement. It can replace up to 30% by mass of Portland cement, and can add to the concrete's final strength and increase its chemical resistance and durability. Recently concrete mix design for partial cement replacement with High Volume Fly Ash (50 % cement replacement) has been developed. For Roller Compacted Concrete (RCC) [used in dam construction] replacement values of 70% have been achieved with processed ash. Due to the spherical shape of fly ash particles, it can also increase workability of cement while reducing water demand. The replacement of Portland cement with fly ash is considered by its promoters to reduce the greenhouse gas "footprint" of concrete, as the production of one ton of Portland cement produces approximately one ton as compared to zero CO_2 being produced using existing fly ash. New fly ash production, i.e., the burning of coal, produces approximately twenty to thirty tons of CO_2 per ton of fly ash. Since the worldwide production of Portland cement is expected to reach nearly 2 billion tons by 2010, replacement of any large portion of this cement by fly ash could significantly reduce carbon emissions associated with construction. A scientific study on use of fly ash in cement carried out by NTPC India, concludes that use of fly ash in cement have the following advantages (NTPC, undated):

- Reduction in heat of hydration and thus reduction of thermal cracks
- Improves soundness of concrete mass.
- Improved workability / pump ability of concrete
- Converting released lime from hydration of OPC into additional binding
- material – contributing additional strength to concrete mass.
- Pore refinement and grain refinement due to reaction between fly ash and liberated lime improves impermeability.
- Improved impermeability of concrete mass increases resistance against ingress of moisture and harmful gases resulting in increased durability
- Reduce requirement of cement for same strength reducing cost of concrete.
- Environmental benefits:
    - Reduce cement requirement
    - Less emission of carbon

There is a huge demand of ash in Bangladesh. At present there are 81 cement industries. Among these around 37 - 40 cement industries are always in production. Grossly, country's annual cement production is around 14 – 15 million ton. Table 12.3 gives present and forecasted cement production as well as possible ash demands.

Table 12.3: Present and forecasted cement production and ash demand in Bangladesh

Year	Cement Production and future projection (million Ton)	Required amount of Ash (million Ton)
2011	14	2.1
2015	18	2.7
2020	25	3.75

Source: Estimated from data of Bangladesh Cement Manufacturer Association (BCMA, 2011)

Removing Arsenic from Drinking Water

In the largest case of mass poisoning in the world, arsenic contaminates the drinking water of about a hundred million people worldwide. In Bangladesh alone, forty million people are exposed to arsenic levels as high as 1,200 ppb, 240 times the level deemed acceptable by the Bangladeshi government. There are several technologies for Arsenic removal from water. A very recent technology introduced by Ashok Gadgil and his Berkeley Lab is very affordable and practical for rural areas of Bangladesh. The technology called ARUBA-Arsenic Removal by Using Bottom Ash which has been designed for people of low income group of Bangladesh.

The technology involves coating particles of coal ash with ferric hydroxide. Sold for around $2 per person for a year's supply, this low cost powder (Arsenic Removal Using Bottom Ash — ARUBA) is affordable to low-income villagers while allowing the factory and local distributors to make a small profit.

In Bangladesh where arsenic problem is very severe, introduction of this technology would be very practical. In such case Department of Public Health Engineering (DPHE) might come forward. And BPDB may work together to supply the generated ash to the DPHE or directly to the local people from production end.

Embankment construction

Fly ash properties are somewhat unique as an engineering material. Unlike typical soils used for embankment construction, fly ash has a large uniformity coefficient consisting of clay-sized particles. Engineering properties that will affect fly ash's use in embankments include grain size distribution, compaction characteristics, shear strength, compressibility, permeability, and frost susceptibility. Bangladesh Water Development Board construct embankment in along the river side in different regions of the country. In coastal region, BWDB constructs thousands of kilometers of coastal embankment. Bangladesh Water Development Board might be an important client having scope of using large volume of the generated ash. BPDB may establish relationship with BWDB by signing a MOU to introduce and encourage ash use in embankment construction.

Pre-stressed Railway Concrete Sleepers

Fly Ash might be used in manufacturing the pre-stressed Concrete Sleepers. Over the years Bangladesh Railway Authority manufactures Concrete Sleepers. BPDB may negotiate with Bangladesh Railway and demonstrate scope of ash utilization in concrete sleeper manufacturing.

Utilization in agricultural field

Ash might be used as fertilizer. Blending with organic matter and taking some measures, the fly-ash might be used as safe and effective fertilizer (Swamy, T. N., *et al.*, 2012; Gupta, D. K. et. al., 2002). Ash acts as soil modifier and source of micro and macro nutrients. There are different studies around the world especially in India shows that, using ash in agricultural field might result better crop yields (NTPC, undated). Another research jointly carried out by World Bank and NTPC-India (World Bank-NTPC, 2007) finds Fly Ash doses of 50 to 200 ton per Hectare in every five years helps to improve soil nutrient status, textures, permeability, etc. The following advantages of fly ash use in agricultural field are scientifically accepted (Vitekari, H. N., *et al.,* 2012 and Gupta, D. K. *et al.*, 2002) and practically established in field (World Bank-NTPC, 2007):

- Improve Soil Texture
- Reduces bulk density of soil–Improves water holding capacity and porosity
- Improve permeability status of soil
- Optimizes pH value
- Improves soil aeration
- Reduces crust formation
- Provides micro nutrients like Fe, Zn, Cu, Mo, B etc.
- Provides macro nutrients like K, P, Ca etc.
- Works as a part substitute of gypsum for reclamation of saline alkali soil and lime for reclamation of acidic soils
- Surface cover of bio reclaimed vegetated ash pond get stabilized and can be used as recreational park
- Ash ponds provides suitable conditions and essential nutrients for plant growth, helps improve the economic condition of local inhabitants
- Works as a liming agent
- Helps in early maturity of crop
- Improves the nutritional quality of food crop
- Reduces pest incidence
- Conserves plant nutrients / water
- Carryover of trace & heavy metals & radioactivity is insignificant
- Improves the yield by 10 to 40%

Khulna region is famous for leafy vegetables and edible crop production where ash can be used. There is a vast scope of selling the generated ash to the local farmers. However, in that case, farmers should be given proper training on how to use ash in agricultural field.

Brick manufacturing by using coal Ash

Most modern manufacturing processes use a greater proportion of fly ash, and a high pressure manufacturing technique, which produce high strength brick with environmental benefits. They are widely used for the inner skin of cavity walls. They are naturally more thermally insulating than normal bricks made with other aggregates. Recently in Bangladesh private brick manufacturing organizations are using these kinds of bricks products because it is more cost effective and good quality of brick. This makes ash utilization in this sector more essential.

Road sub-base construction

The geo-technical and pozzolanic properties of ash enables its use in coal pavement construction in many ways. Compacted pond ash and bottom ash possess adequate bearing strength and also meet gradation requirements and can be used as a granular sub-base material. Fly ash can be utilized for construction of semi-rigid pavement using lime fly ash concrete and lean cement fly ash concrete. These compositions possess more flexural strength than flexible pavements and can be adopted for high traffic density roads. In the concrete roads and runways, fly ash can be utilized as part replacement of ordinary Portland cement (up to 35%) and sand (5-15%). This would result in lowering the cost of concrete without affecting strength and also increase durability.

As such, Bangladesh Roads and Highway and LGED could be principal users of ash to be generated from the power plant. BPDB may establish communication with Roads and Highway Department and LGED.

12.7 Standard Operational Principle

The power plant shall be operated following the guideline of ECA 1995 and ECR 1997 (and the amendment thereafter). In addition, for ensuring environmental safety, the standard Operational and Maintenance Philosophy of NTPC (discussed in Section 14 of the Feasibility Study Report) which is based on Good International Industry Practices (GIIP)[12] should also be followed. The Good International Industry Practice (GIIP) including the World Bank Group Environmental, Health and Safety Guideline prepared on the basis of Equator Principles[13] should be followed in all aspects of plant operation and maintenance.

During coal transportation including shipping, ship to ship transferring and barging activities, operational philosophy should be prepared by the proponent under the guideline of IMO Conventions[14] and relevant national environmental regulations as discussed in Section 2.5.

12.8 EMP Cost

The Project cost is inclusive of cost for implementing Environmental Management Plan and installation of pollution abatement and mitigation measures described in the feasibility study report. The costs for Environmental Management Plan and responsible institute has been estimated in Table 12.4.

[12] The detail of the GIIP can be found at http://www1.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/IFC%20Sustainability/SiteMap

[13] The Equator Principle (EP) is a credit risk management framework for determining, assessing and managing environmental and social risk. The EPs are adopted by financial institutions and are applied where total project capital costs exceed US$10 million. The details of the EPs can be found at http://www.equator-principles.com/index.php/about-the-equator-principles

[14] The details of the IMO conventions may be found at http://www.imo.org/About/Conventions/ListOfConventions/Pages/Default.aspx

Table 12.4: Environmental Management Plan (EMP) cost estimation

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
Pre-construction phase (Land acquisition and site development)			
EMP for preventing impacts on land and agriculture	Efforts have been made to use *khas* land as well as fallow land to the extent possible to minimize future requirement of lands Project Affected Persons (PAPs) losing homesteads and land should be compensated as per the law of the land PAPs loosing occupation may be involved in project's job opportunity if possible Compensation should be given for acquisition of agricultural land as per the law of the land	BPDB and DC office, Bagerhat	Included in Project cost
EMP for compensating land acquisition and resettlement	The authority should be careful and take necessary measures that every displaced people can be resettled as per law of the land The displaced people may be resettled in suitable areas as per the land of the law	BPDB, and DC office of Bagerhat	Included in Project cost
EMP for compensating impacts on fisheries	Compensation to the land owner, shrimp farmer and labour as per the law of the land	BPDB, and DC office of Bagerhat	Included in Project cost
EMP for compensating impacts on Bird	Protect feeding ground of birds occurring in project nearby areas. Introduce Bird Conservation Program Increase public awareness	BPDB, DoE	3
EMP for controlling	Fencing of project area by drum sheet or Tarjja Regularly spraying over the land development site for control the generation of SPM	BPDP, JV or DC office	(In clued in Project cost

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
the regional air and water quality	Proper run off design needs to be implemented for reducing any water logging Location of backfilling stockpile should be located in safe area and protected from wind and rain action No backfilling materials/spoil should be stored on River bank/slope No waste should be disposed to canals/river Create awareness program	Bagerhat	and BDT.3 m external cost) 3
EMP in case of river dredging for site development	Stakeholder consultation is prerequisite for selection of dredging spoil disposal Dredging spoil should be dumped in such a manner that it would not create any additional environmental issues as well as refill the dredged channel Monitoring the site of spoil disposal and its associated issues regularly	BPDB/DoE/ JV Company/ EPC Contractor/Local administrations	4
Sub-total (A)			**10**
Construction phase			
EMP for controlling waste generation and mitigating impacts	Limiting site clearance and base stripping activities within the project boundary Dispersed gathering and stocking of construction materials and machinery should be within minimum area in the project boundary The project area should be fenced prior to initiate the construction activities Stock piles of construction materials should be covered in order to protect them from wind and weathering action The existing right of way should be used in material transportation and existing right of ways should not be blocked Provision of sanitary toilet facilities, one toilet for 10 persons Construction wastes must be reused or recycled where possible	BPDB/DoE/ JV Company/ EPC Contractor	(Included in project cost and Tk. 5 million external cost) 5.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
	Burning of waste material should be restricted Quality housekeeping should be maintained by regular inspection and checking Keep provision of onsite waste collection and disposal Keep provision of different colour waste bin for biodegradable, reusable and recyclable waste dumping Keep provision of awareness building meeting and training to the employees Awareness build up program		
EMP for controlling air pollution	Limiting activities may produce fugitive dust particle within project area Vegetation clearance and base stripping should be done carefully Vehicle speed restriction should be enforced to control dust generation Avoid using of earthen road and undeveloped road to minimize dust generation Construction materials should be covered to protect from wind action Keep provision of water spraying system to suppress fugitive dust Dust particle generated from access roads must be controlled by water spraying during dry season Stock piles of construction materials should be covered in order to protect from wind action An appropriate freeboard should be maintained in trucks hauling construction materials Creating awareness program	BPDB/JV Company/DoE/ EPC Contractor/ Local Administration	(Included in project cost and Tk. 4 million) 4.0
EMP for controlling greenhouse gases	Burning of any kind of solid waste should be banned Regular maintenance of water vessels, vehicles, generator and machinery in accordance with manufacturer's specifications Approved pollution control devices to be fitted in equipment and machinery	BPDB/DoE/JV Company/ EPC Contractor	3.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
	Switch off / throttle down all site vehicles, water vessels, generator and machinery when not in use Crating awareness and monitoring program		
EMP for controlling noise generation	Regularly monitoring noise level both night and days Switch off / throttle down all site machinery, vehicles, water vessels, and generator when not in use Construction activities should be limited in night Use noise damper on project boundary Monitoring the speed limit of the vehicles and vessels Avoid queuing of vehicles in areas adjacent to site, particularly near sensitive receptors including housing.	BPDB/DoE/ JV Company/ EPC Contractor/ Local administration	(Include in project cost and external Tk. 2 million) 2.0
EMP for controlling impacts on ground water resources	Keep provisions of rain water harvesting system to limit ground water use Use of surface water as much as possible	BPDB/DoE/JV Company/ EPC Contractor	Include in project and external Tk. 3 million) 3.0
EMP for controlling impacts on surface water resources	Surface water must be saved from any harmful effluents and waste dumping from project site using waste disposal management plan Provide close system facilities and wastewater treatment plant to minimize domestic waste from workers colony Provide training and awareness building program to the workers during construction. The training and awareness programs are: a) arrange weekly consultation sessions among the workers through plant site managers. The duration of consultation is one hour according to ISO14031 standard, b) arrange monthly environmental meeting among the mid level officers through top management. The issue will be discussed under this meeting is ECR 1997	BPDB/DoE/ JV Company/ EPC Contractor	5.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
EMP for controlling impacts on ground water quality	Harmful effluents and wastes leakage from oil and chemical tank or storage would be controlled High tech treatment plan will be installed in the plant site for effluent discharged to the Passur River. It must be operated satisfying all relevant standards of MoEF Regularly monitoring the ground water to identify the anthropogenic interferences Provide training and awareness building programs to the labors, professionals and local people	BPDB/DoE/ JV Company/ EPC Contractor	4.0
EMP for controlling impacts on land and agriculture	Construction materials have to be collected, stored, and disposed in an appropriate manner Recycled waste should be disposed in a suitable landfill Limiting the construction activities and stocking within the project boundary Regular monitoring the waste disposal process carefully Harmful effluents and waste leakage from oil and chemical tank or storage should be controlled strictly Wastes or used oil should be stored in a designated area for disposal through authorized vendors Measures should be provided for fire suppression and the neutralization and collection of any spilled materials Treatment plant should be installed Provide training and awareness building programs to the labours and professionals and local people	BPDB/DoE/ JV Company/ EPC Contractor	(Include in project cost and Tk. 3 million external cost) 3.0
EMP for controlling impacts on fisheries	Avoidance of construction work during fish breeding season if possible. Generally, April to July for common fish and Sept-October and March to May for Hilsa spawning and migration Most excavation, backfilling, and site grading will be undertaken during the dry season. Sediment will be trapped on-site using sediment fences and traps and basins, and by preventing the off-site movement of coarse material		(Include in project cost and external Tk. 5 million)

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
	Alternate sourcing of sand other than river bed dredging Limiting the vessel speeds and regular maintenance to control noise Oil spillage from vehicle/ vessel should be controlled Carefully monitoring the water quality u/s and d/s of the project regularly and traffic movement should be followed the law Fish conservatory (sanctuary) should be established at a safe zone Enforce banning of fishing activity within the sanctuary zone The disturbance of habitats in the inter-tidal zones should be minimized Mangrove plantation may facilitate some fish habitat to compensate the habitat loss in project area Reduce to cut of trees, bushy plants and swampy plants around the water areas		5.0
EMP for conserving ecosystem	Implement on-site waste management plant and air quality monitoring system Limiting soil extraction activities within defined area if possible Limiting vegetation clearance and base stripping within project boundary Protect existing mangrove strip along the Passur River Mangrove plantation program along Maidara river may be implemented Avoid dredging activities during surfacing and swimming time of Dolphin *i.e.* at dawn and evening Dolphin conservation program may be implemented Restrict light at night where necessary Keep provision of outdoor lights with shade directed downwards Cut-off time to switch off unnecessary lights at night	BPDB/DoE/Forest department/DoF/JV Company/ EPC Contractor/ Local administration	(Included in project cost and Tk. 15 million external cost) 15.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
	Regular monitoring the above activities and consultation with the stakeholders		
EMP for enhancing socioeconomic condition	The labour recruitment policy formulate in such a way that the local labourers can easily get chance of employment in the power plant project Gov. and NGOs should provide support skill development program and income generation activities to local people Youth and women empowerment training centre, introducing diverse income generating activities training Stronger the safety net program in this area Regular consultation meeting should be introduce between locals and project personnel to exchange the knowledge For the increasing movement of people and heavy vehicles the road networks should be developed Manage separate water and sanitation facilities for the construction workers in the project area so that they cannot make any disturbance to the existing facilities of the local people	MoLE/ MoSW, BPDB/ DoE/ MoE/ NGOs/LGED/ RHD/ DPHE/ JV company/ EPC company/ Contractor/ local government and administration	(Included in project cost and Tk. 15million external cost) 15.0
EMP for safety and emergency situation	Safe design should be implement to reduce the risk in each of the construction process Use of personal protective equipment (PPE) like gloves, helmets, sunglasses and other tools, dresses & uniforms Regular checking, monitoring and carefully handing with safety procedure Precautions has to be ensured during handling the hazardous chemicals	BPDB/DoE/JV company/Contractor	Included in project cost
Sub-total (B)			**64.0**
Post-Construction (Operation Phase)			
EMP for air	Ensuring the standard of Bangladesh (MoEF) and WB where emission always should be lower	BPDB/DoE/JV	(Include in

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
pollution control	due to nearly presence of Sundarbans The plant equipment must be performance tested during commissioning phase to ensure standard has been maintained Regular inspection and maintenance of boiler, pressure parts, FD and ID fans ESP, FGD and ash separation and handling system, and other ancillaries Maintain coal quality of low Sulfur content as stipulated in project description Properly use of flue gas desulfurisation scrubbing systems to remove sulfur dioxide through lime and steam injection method to reduce the NO_x emission Safety and emergency materials for accidental hazard Remote monitoring and control of total production process Regular maintenance and overwhelming as per design specification Regular monitoring the air quality at identified locations Automatic monitoring process and presenting on the real time WebPages should be implemented	Company	plant operation cost and Tk. 18 million external cost) 18.0
EMP for controlling noise pollution	275 m stack height and high velocity should be maintained Discharge of emissions through stack must be directed vertically upward without any impedance or hindrance Maintaining DoE standard of acoustic environment with spatial and temporal basis Use sound absorbing boundary wall that act as noise damper Noise insulation should be implemented surrounding the turbine and generator casing Noise dumper/insulator must be installed around the casing of conveyor belt Switch off / throttle down all vehicle and engine of vessel when not in use	BPDB/DoE/ JV Company	(Include in plant operation cost and Tk. 7 million external cost) 7.0
EMP for	Onsite, waste collection and disposal system would be provided by municipality of Bagerhat	BPDB/Local	(Include in

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
controlling the impact of waste generation	through Rampal Upazila administration Dust control mechanism must be utilized for coal and ash handling system Provision of different waste bin with colour code for different waste (recyclable, reusable, biodegradable, hazardous, etc) in road side, parking places, office, eco-parks, and other official and public places in the plant site Temporary waste dumping facilities on site and permanent waste dumping facilities off site after treatment should properly continue Green building concept will be initiated in the preparation of residential plan to minimize the effluent Provision of waste management department with given responsibility of waste collection, transportation, disposal and overall management and the department may be maintain Environmental Quality and Safety Management wings Regular monitoring the waste management instruments and process Provision of regular awareness building meetings programs	Administration/ DoE/ JV Company	plant operation cost and Tk. 13 million external cost) 13
EMP for the produced ash from the power plant	Advanced technique like ESP, ash silo and ash pond have to be maintained regularly for ash management Fly ash (dry form) generated from the plant should be separated after burning of coal through ESP and commercially utilized to maximum extent possible Unutilized fly ash should be transferred from the silo in wet form and stored in the ash pond until suitable users are identified Bottom ash should be collected in wet form and should be stored in the ash dyke until suitable users are identified Increase the facilities of ash marketing through infrastructure development, creating awareness and formulating policies	BPDB/JV Company	(Include in plant operation cost and Tk. 15 million external cost) 15

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
EMP for controlling impacts on surface water resources	Regular maintain of the rain water harvesting process Increase the efficiency of water reuse and recycling Water conservation plan should be implemented in broader scale Direct emission of any harmful effluents and wastes from power plant must be restricted Provide close system facilities to minimize emission of effluents from power plant area Effluent treatment plant needs to proper working with the provision of additional load bearing capacity during accidental cases Regular monitoring to the water quality at specified locations in certain time interval Regular consultation meeting should be introduce between locals and project personnel to improve the surface water quality	BPDB/Local Administration/ DoE/ JV Company	(Included in plant operation cost and Tk. 15 million external cost) 15.0
EMP for controlling impacts on ground water resources	Ground water must be free from any harmful effluents and wastes leakage from oil and chemical tank or storage through seepage Regular monitoring the level and quality of ground water in side and adjacent to the power plant Provide training and awareness building programs to the labours and professionals during monitoring the sources of ground water contamination Implies incentives for conserving the local wet lands sealed or paved the coal, ash and waste silo/storage/disposal site to blocked the communication between hazardous materials/leacheate and ground water	BPDB/DoE/ DPHE/ JV Company	(Included in plant operation cost and Tk. 5 million external cost) 5.0
EMP for controlling impacts of tidal intrusion	Proper connectivity should be maintained through the tidal creeks Regular maintenance the tidal natural and artificial creeks/*khals*/channel for easy tidal water movement Proper guide lines would be followed for Operation & Maintenance facilities	BPDB/JV Company	4.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
EMP for controlling impacts of drainage congestion and water logging	Kaigar Daskati tidal creeks remain free from any kind of interferences Regular maintain the depth and flow of the existing creeks/channel and river Practicing integrated water resources management plan for reducing the water logging problem Proper set back rules and regulations in connection with river system management would be strongly followed in Operation & Maintenance period Keep rivers free from any encroachment and obstructions Stakeholder consultation should be arranged for such kind of problem	BPDB/Local government and administrations / BWDB/JV Company	15.0
EMP for erosion and accretion	Bank protection measure like hard structure, mangrove plantation on the bank Maintain the green belt development areas regularly Scientifically justified for any kind of dredging in a particular place Monitoring the vessel speed, river flow and erosion and accretion prone areas	BWDB/ BPDB/JV Company	13.0
EMP in case of maintenance dredging for river navigation	Scientifically justified for any kind of dredging work in the river Stakeholder consultation is necessary for site selection for dredging spoil disposal Regular monitoring is necessary during maintenance dredging Monitoring the site of spoil disposal and its associated social and ecological issues regularly	BPDB/DoE/ JV Company/ EPC Contractor/ Local government and administrations	Included in plant operation and Tk. 25 million external cost) 25.0
EMP for controlling impacts on land and agriculture	Introduce the Integrated Pest Management (IPM) technique for pest control adjacent agricultural field like “Light Trap” Proper training to the farmer on using fly ash in agricultural field Awareness growing to use the by-product of the power plant efficiently	DAE/Local Administration/ JV Company	(Included in plant operation cost and Tk. 10 million external cost)

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
	Monitoring not only inside but also outside the land areas free from any kind of waste disposal or potentially to be polluted lands Use of bio-indicator for pollution measurement		10.0
EMP for controlling impacts on fisheries	The water supply pipeline intake point from the feeder canal should be provided with sufficient screening to filter out larger aquatic organisms (e.g., fish, frogs, and toads) and foreign matter, preventing this material from being drawn into the pumps Drum screens need to adopt in order to limit the entrainment of fish in the cooling water system and intake velocities should be as low as possible The water velocity in the intake channel should be less than 0.5 m/s during normal conditions Temporary water reservoir can be built for water storage rather than direct abstraction from river Monitoring should continue to ensure that the deterrents are working effectively. On-site wastewater should be treated to achieve maximum reuse and recycling rather than ultimate disposal to the river Leftover wastewater should be used to irrigate on-site vegetation throughout the year except during the monsoon Regular consultation, training and stakeholder meeting should be arranged with the local bodies and project personnel Use of bio-indicator for pollution measurement like benthic community, plankton or sensitive organisms Enforcement of ECR 1997, IMO Conventions, MARPOL, etc Spot-check of shipping and barging activities by relevant agencies Rehabilitation of fish and shrimp habitats by conserving and protecting existing fish nursing ground by extending the existing mangrove forest area other than power plant area Enforcement of fishing ban in the mangrove forest areas during breeding/nursing period	BPDB/ DoE/ JV Company/ Coal Transportation agency/MPA, BIWTA/DG Shipping/DoF	(Included in plant operation cost and Tk. 10 million external cost) 10.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
	Should follow the EMP for effluent discharge, and traffic movement		
EMP for controlling impacts on ecosystem	Automatic air quality monitoring at certain ecological important point regularly Enforce the relevant law of restricting ballast water and haul water dumping in Sundarbans territory Enforce existing law of controlling oil spillage Monitoring activities of the Foreign ships during coal transportation Establish check post for monitoring activities of Foreign ships during coal transportation Limiting coal spillage and escapee during unloading to feeder vessel/lighterage vessels Follow standard practice for shipping and barging operation Restrict blowing of whistle within Sundarbans territory Introduce speed limitation for vessel in Sundarbans territory Anchorage should be allowed at particular location within the Sundarbans area Enforce Forest Protection Acts Restrict blowing of whistle near bird colony Awareness building activities should be carried out continuously Restrict trapping, killing of migratory birds and local aquatic birds No trapping and killing of Dolphin Plan measures for accidental oil spillage, refuelling Anchorage for water vessel only in designated sites Adoption of Dolphin Conservation Program Restrict night lights, only in places where necessary	BPDB/ DoE/ JV Company/ Coal Transportation agency/MPA, BIWTA/DG Shipping/ Forest Department	(Included in plant operation cost and Tk. 35 million external cost) 35.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
	Outdoor lights with shade directed downwards Restrict outside lighting of the water vessel during navigation across the Sundarbans Restrict the beaming of searchlight on forest area		
EMP for enhancing better socio-economic condition	The employee (labors or professionals) should be recruited permanently and temporarily depending on the skills emphasizing on local man power Gov. and NGOs should continue training for developing skilled population and support them with micro capital Some posts should be reserved for the local project affected population (both properties and livelihoods) At least, 10% of the job should be reserved for women. Youth and women empowerment training centre and introducing diverse income generating activities training Relevant government department like Khulna Development Authority, Bagerhat District Parishad, Rampal Upazila Parishad, LGED, RHD, MPA, Rail Way Department, etc should guide the induced development. The existing development plans, Master plans might be improved in harmony with the project Development of electric transmission and distribution line, priority of local and displaced people in providing electricity, priority in providing electricity for irrigation water pump for local people Integrated planning among the power generation, industrial development, and socio-economic improvement Extension of social safety nets for affected people and people under exposure of plant possessed risk Support Gov and NGO's activities	MoLE/ MoSW, BPDB/ LGRD/ MoE/ MHFW/NGOs// LGED/ REB/ JV company/DC office/ Local administration	(Included in plant operation cost and Tk. 50 million external cost) 50.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
	Use biocides to prevent bacterial contamination to the adjacent society Community health monitoring facilities within 10 km radius from the power plant Establish communication with nearby hospital to keep record of pneumonia and other related diseases like bronchitis, skin lesion, eye cataracts and accidental hazardous		
EMP for Safety and emergence hazardous	Regular monitoring both automatic computerized and manual in every hazard points Use of personal protective equipment (PPE) in the work places Regular checking, monitoring and carefully operations with standard procedure Precautions has to be ensured during handling the hazardous chemicals Ensure the hospital facilities emergency after any kind of accidental event Auto signalling system should be installed as a safety plan Training to the professionals regularly Regular practicing or showdown by the rescue team for pseudo accident Compliance monitoring to the charged professionals and monitoring devices Regular consultation meeting should be introduce between locals and project personnel to exchange the knowledge Introducing health insurance for the employees	BPDB/DoE/MHFW/ Local Administration	Included in plant operation cost
Sub-Total (C)			235.0
Coal Transportation, Transshipment and Handling			
EMP for Coal Transportation, Transshipme	Adoption of dust suppression system The vessel to be engaged shall have to be complied with international and national standard Adopt enclose system for coal unloading and transportation (through conveyor belt)	JV Company/ Coal Transportation agent/ MPA/DG	Included in coal import cost

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
nt and Handling	Maintain ECR 1997, IMO Conventions, MARPOL, etc Restrict blowing of whistle within Sundarbans Territory Switch off / throttle down of all equipment and machinery when not in use Introduce speed limitation for vessels within Sundarbans territory Anchorage should be allowed at particular location within the Sundarbans area Enforce Forest Protection Acts Limiting dropping of coal and escapee during unloading to feeder vessel/lighter vessel Ensure no dumping of ballast water, no oil spillage, no discharge of waste water, no waste dumping Practice of dust suppression should be to moisten the coal not to wet the coal	Shipping/BIWTA	
	Introduce speed limit of coal transportation vessel Keep vessel speed in between 7 knots to 8 knots per hour Plant mangrove forest along the bank of rivers vulnerable to wave erosion Plant and conserve native mangrove plants along the river bank of coal transportation route across the Sundarbans Regular monitoring of erosion	JV Company/ Coal Transportation agent/ MPA/DG Shipping/BIWTA /BWDB	10.0
	Proper training for vessel crews, traffic inspectors, in charges, and other concerned professionals All vessels should be provided with GPS, radar and other electronic navigation systems to prevent grounding or collisions, such as depth sounder, radar and radio equipment for communication All vessels should be complied with rules and regulation of IMO, Port authority, BIWTA and national laws of safety, and environmental conservations	JV Company/ Coal Transportation agent/ MPA/DG Shipping/BIWTA /Coast Guard	(Included in coal import cost and Tk. 25 million for training cost) 25.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
	Ensure port/coal terminal inspector, environment and safety manager are enforced Training for awareness building and monitoring		
	Awareness building for fisher and facilitate the fisher to use nets/boats provided with signals and marking Reduce speed if net is seen Ensure no dumping of ballast water, no oil spillage, no discharge of waste water, no waste dumping Ensure enforcement of ECR, 1997, Forest Protection Act, and other rules, regulation and treaties for conserving Sundarbans Ensure no dumping of ballast water, no oil spillage, no discharge of waste water, no waste dumping Restrict outside lighting of the water vessel during navigation across the Sundarbans Restrict the beaming of searchlight on Forest area Use low beam of searchlight during navigation across the Sundarbans Limiting dropping of coal and escapee during unloading to feeder vessel/lighter vessel Restrict blowing of whistle within Sundarbans Territory Introduce speed limitation for vessels in Sundarbans Territory Anchorage should be allowed at particular locations within the Sundarbans area Anchorage for water vessel only in designated sites Adoption of Dolphin Conservation Program Monitoring activities of the Foreign ships during coal transportation Establish check post for monitoring activities of Foreign ships during coal transportation	JV Company/ Coal Transportation agent/ MPA/DG Shipping/BIWTA /DoF/FD/DoE/ Coast Guard	(Included in coal import cost and Tk. 15 million for monitoring and training cost) 25.0

EMP for the Impacts	Mitigation/ Enhancement/ Compensation/ Contingency measure	Responsible Institutions	EMP Cost (BDT. million)
Safety and emergency plan	Use of personal protective equipment (PPE) Regular checking, monitoring and carefully handing with safety procedure Spraying water like mist in order to reduce the risk of ignition Precautions has to be ensured during handling the coal	BPDB/DoE/ JV company	Included in coal import cost
Sub-Total (D)			60.0
Grand Total (A + B+ C+D)			369.0

Note: These mentioned costs (*e.g.* the external cost) are tentative at the time of this study and might be changed during detail design of the project. The EPC contractor shall be appointed after obtaining of Environmental Clearance Certificate from DoE.

Chapter 15: Stakeholder Consultation

15.1 Introduction

Stakeholder consultation, where the consultation is targeted at people/communities who may – directly or indirectly, positively or negatively- affect or be affected by the outcomes of a project. According to the stakeholder guideline[17] of the International Finance Corporation (IFC) of World Bank Group, consultation is a two-way process of dialogue between the project planners/company and its stakeholders. Stakeholder consultation is really about initiating and sustaining constructive external relationships over time. In this study, stakeholder consultations were conducted at four different tiers of stakeholders: local people, NGOs, Local Government authority and Government Department. The main purpose of the consultation was to intrude awareness of the stakeholders about the project and to collect their opinion, suggestions for planning and designing of the project.

15.2 Public Consultation

Public consultation is defined as a process in which the members of the general public are invited to express their views and enter into a consultation dialogue. It is a session of discussion where the study team discusses about the proposed project and grasps local people's perception, suggestions, recommendations, etc. on the project. In line with this context, ten public consultation sessions were held in different locations of the study area (Table 15.1).

15.2.1 Methodology

The consultation sessions were started with the short description of the power plant project and project impact zone. The objectives, proposed sites and the possible impacts of the project and the connectivity links of the study area with the project were also explained. The study team recorded their perceptions, demands and recommendations, about the power plant project.

Stakeholder identification: First of all the stakeholders and their key groupings and sub-groupings were reviewed thoroughly. From this flows stakeholder analysis, a more in-depth investigation was made at stakeholder group interests, how they will be affected and to what degree, and what influence they could have on the project. On the basis of necessary adaptation of mentioned above stakeholder consultation guideline of IFC, World Bank Group, the study team identified the project stakeholders in the following ways:

- Selection of directly and indirectly affected project stakeholders;
- Prioritization of stakeholders;
- Referring to past stakeholder information and consultation;
- Develop socio-economic fact sheets with a focus on vulnerable groups;
- Verification of stakeholder representatives;
- Engaging with stakeholders in their own communities;
- Determining government as the key stakeholder;

[17] International Finance Corporation (IFC). 2007. *Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets*. Washington. D.C: IFC, World Bank Group.

- Ensuring representation of NGOs;
- Recognizing local power structure as a good channel of communication

Therefore, the participants of consultations belong to different occupational groups, for example, farmer, fisher, day labor, school teacher etc. Moreover, to grasp the women's perception consultation sessions were also facilitated among a group of women to know the existing occupational status, future possibilities for employment due to the implementation of this project.

Consultation process: On the basis of Stakeholder Engagement guideline of IFC, the periodic steps of consultation process is discussed below:

1. Overall planning: before consultation process, the study team prepared an overall stakeholder consultation plan including purpose, requirements, stakeholders, scoping, techniques etc.
2. Consultation using basic principles of good practice: the consultation was targeted, informed, meaningful, gender-inclusive, localized etc.
3. Incorporation of public feedbacks: the consultation considered public/stakeholder opinions during the decision-making process.
4. Documentation of the process and results of consultation: the documentation of consultation process demonstrated the views of potential affected people and civil society. These views were incorporated in the project's environmental and social mitigation strategies.

Generally, public consultation is a formal participatory approach in which local people and development experts interact actively. Considering the study objectives and the socio-economic and political setting in the study area, the study team revised to some extent the mentioned above stakeholder consultation guideline in the following ways:

- The main idea of public consultation sessions were to grasp grassroots' voice without any political biasness;
- The study team was split into two groups and facilitated public consultation sessions at the same locations;
- The public consultation sessions were held with the Rapid Rural Appraisal techniques simultaneously;
- To grasp the living picture of the study area the study team discussed with local people in their familiar setting instead of any formal round-table discussion;
- To avoid any conflict of interest and to ensure voice all classes in the power structure, the study team consulted with different stakeholders separately;
- The study team used an multidisciplinary team approach centered on multidisciplinary problems/opportunities;
- Respondents of public consultations were selected purposively, not at random.

Table 15.1: Public consultation meetings by location and date

Mode of Public Consultation	Mauza	Union	Upazila	Date
Consultation with school teacher	Kapasdanga	Gaurambha	Rampal	11/08/2010
Consultation with	Baserhula	Rajnagar	Rampal	11/08/2010

Mode of Public Consultation	Mauza	Union	Upazila	Date
farmers				
Consultation with day labors	Rajnagar	Rajnagar	Rampal	11/08/2010
Consultation with gher owners	Sapmari Katakhali	Rajnagar	Rampal	12/08/2010
Consultation with fishermen	Bara Durgapur	Rajnagar	Rampal	12/08/2010
Consultation with farmers	Chunkuri	Bajua	Dacope	13/08/2010
Consultation with NGO personnel	Rajnagar	Rajnagar	Rampal	11/07/2012
Consultation with women	Rajnagar	Rajnagar	Rampal	11/07/2012
Consultation with fishermen	Rajnagar	Rajnagar	Rampal	12/07/2012
Consultation with people in cluster village	Kaigar Daskati	Rajnagar	Rampal	12/07/2012

15.2.2 *Feedback of the stakeholder*

Knowledge about the project

The participants of the public consultation sessions of seven Mauzas had shallow and not so clear idea about the power project while the people of Chunkuri Mauza had no idea at all about the power plant project, as the Mauza is situated far away from the project area of Sapmari Katakhali Mauza of Bagerhat. A few among the people, however, gathered knowledge about the project through reading newspaper, and listening to BBC news. Some of them heard about the project from the local leaders, the elected MP or from the government officials etc. They heard that a coal based power project is going to be implemented in their area. The people of the study area heard a rumor about the project that the government of India would finance the 1300 MW power plant project and of total production India would consume 1000 MW. However, some schoolteachers opined that the political factions were mainly affecting such type of information among the people. Furthermore, people were aware of land acquisition for the project implementation and the land owners also identified their plots to be acquired.

- *The local people mainly heard about the project through the newspaper, BBC news, local leaders and member of parliament (MP)*
- *There was a rumor that India would finance the project and consume 1000 MW out of total production.*
- *To the local people Sapmari Katakhali is mostly known as the project site.*



Plate 15.1: Consultation with people in cluster village in Kaigar Daskati



Plate 15.2: Consultation with Fishermen in Rajnagar

Knowledge about the location of the project

Although the participants of Chunkuri Mauza had no idea about the project location yet the participants from other five Mauzas more or less knew about the project location. Most of them thought Sapmari Katakhali Mauza as the project sites while some others from Baserhula were less scared even their village as a whole could be acquired. The participants, however, from Baserhula and Kapasdanga thought that they would be able to retain their lands from acquisition for implementation of the project. Some participants in Rajnagar union opined that the alternative site of this project, Labanchara, could be the best option. From the miscellaneous perception of participants regarding the project site the study team perceived that people had no clear idea as the PDB did not disclose any information among them.

Attitude to the project

People's attitude varies (whether it is positive or negative) depending on the loss of their properties owing to the project implementation. People having no land in the project area were in favor of the project. They want implementation of this project because they belief that the communication infrastructure and other utility facilities of the study area would be improved for implementation of the project. On the other hand, people having land in the project area and that would be acquired for implementation of the project were not in favor of that, as they would lose their land - the only means of livelihood and it would be impossible for them to survive without these lands used for shrimp cultivation, they had no other resources for their survival. They confessed that the project would positively impact on the economy of the country. They apprehended that if the government wish to compensate for loss of their land through paying cash there would be chances of corruption and they may not get the full compensation money or it (compensation payment) would take long time that the money would remain unproductive. They were also in doubt about their rehabilitation. The most unfortunate fact is

- *Because of this project some people will lose their only means of livelihood.*
- *Those who have no land in project site speak in favor of the project.*
- *They are dubious about the proposed compensation.*
- *Proposed project may induce regional infrastructural development*

that the local people have lost their faith in development activities. They suspected that this project will not be implemented due to the political changes in the forthcoming election and ultimately the evicted people will suffer severely. On the other hand, local people are optimistic about the potential benefit of the project. Locals hope the proposed project may induce infrastructural development.



Plate 15.3: Consultation with fishermen in Bara Durgapur



Plate 15.4: Consultation with farmers in Baserhula

Occupation trends in the study area

According to the local people most of the people in the study area is engaged with fishery and shrimp cultivation is the only means of livelihood. People have limited access to the agriculture or other crop farming due to the soil and water salinity. People engaged with shrimp cultivation are divided into two groups: owners of *ghers* and day laborer in the *ghers*. The gher owners belong to the outside of the study area while the laborers are from the study area. Other common occupations in the study area were: boat ply, van/motorcycle pulling, construction works, petty business, porter in Mongla port, etc.



Plate 15.5: Consultation with gher owner in Sapmari Katakhali



Plate 15.6: Consultation with day laborers in Rajnagar

Potential positive impacts of project

The participants of PCMs identified several possible positive impacts of this project, such as; the national development would be accelerated with a huge pace. The lack of electricity is now causing the development of the country stagnant. The foreign investment is gradually decreasing owing to the shortage of power in the country. If the power plant is implemented the development will continue smoothly. This regional development will accelerate the national economic growth. The participants feel that because of the implementation of this project their bad communication infrastructure will be structured. The development of communication infrastructure will connect the areas with the centre more rigorously. This connection will ensure financial blessing. The participants think that their sole dependency on shrimp cultivation and their unemployment, low literacy rate, low wage, less economic productivity and thus resulting poverty in this area is owing to lack of electricity. The available electricity supply in future may change their fate.

The intervention of huge number of workers will create rural markets. These will create employment opportunities in the area. Besides they think that the project will have to recruit huge number of labors and they expect that contractor will recruit the jobless farmers in non-technical works of the power plant construction, as such they will earn more than that they earn from shrimp cultivation. Thus they will not have to depend on shrimp cultivation, their unemployment, the curse of their life, will also be reduced.

- *People will lose their habitat, occupation and means of livelihood.*
- *Cultural conflicts between settlers and outsiders may rise.*
- *Unemployment may spoil social solidity.*
- *Dispossessed people may create imbalance migration to the urban locale.*
- *Existing basic facilities will be disturbed.*

Potential negative impacts of the project

For most of the participants, the demerits of the power plant project will be more than its merits. The participants identified that the occupational hazard will be the worst impact of the project. They will lose their only means of survival. Shrimp cultivation is the sole source of their income. The people are afraid that if the government acquires the land they will be fully unemployed because there was no other option for them to survive. Because of the high salinity intrusion there is rarely any grass field for the livestock. Now the project implementation will make the condition worse for the cattle. Gathering of huge number of workers in the study area may make some cultural conflict. Also the loss of occupation will compel people to participate in unsocial and criminal activities while will affect the social solidity. The evicted people do not know where they will be resettled. A huge number of evicted people will go to the urban locale in search of work which will impose pressure on the urban life. Finally, at present the villagers are facing shortage of water-sanitation facilities. If there is no facility of water-

- *National development would be accelerated.*
- *The communication network would be developed and the region will be connected to the centre.*
- *The development personnel's intervention may create rural market.*
- *Huge amount of local labor would be recruited.*

sanitation for the workers of the project the villagers might be disturbed for the excessive use of their facilities by the outsiders (workers), and/or the area might be polluted. The ash of the project may affect their water and health system. Finally, they are scare that financial compensation will bring more corruption to get it, the government will not give full amount of compensation and they will suffer for it. The participants of Chunkuri Mauza believe that because of the Sapmari Katakhali project they will not get any benefit as their area is located on the other side of the Passur River.

The local people doubted that huge amount of water will be needed to implement this project and the main source of this requirement will be the ground water. Thus, the level of ground water will be decreased and the locale will face shortage of pure drinking water. Moreover, if the electricity could be available due to the implementation of this project then different government agencies and industrial companies will come to this area and acquire their lands and the inhabitants will lose their land as a result. Finally, the local people were scared as they think that the power plant will induce the disease prevalence in the adjacent area, for example, the fertility will be decreased strikingly.

Perceptions about the Sundarbans

The Sundarbans is only 14 km away from the proposed power plant. In addition to its biological diversity, this largest mangrove ecosystem supports livelihood for enormous people. So there is great concern among the local people about the Sundarbans. They think that if the project implemented at Sapmari Katakhali, the ecosystem of Sundarbans will be damaged severely. They pointed out several points behind this damage, such as,

- The smoke from chimneys may adversely affect the trees;
- The ashes of the plant may reduce the productivity;
- Coal transportation may destroy the marine ecosystem of Sundarbans etc.

Local people suggested taking mitigation measures to save the Sundarbans, such as, structural adjustment in the plant so that the smoke and ashes will not affect the ecosystem. Finally, they presumed that if the project was planned and designed taking consideration of appropriate mitigation measures there might be little negative impacts on the Sundarbans.



Plate 15.7: Consultation with different occupational groups in Sapmari Katakhali



Plate 15.8: Consultation with gher owners in Rajnagar

Suggestions for mitigation

For the local people, due to land acquisition not only the landowners will be affected but also all the people those were dependent on this land will be affected equally. They opined that due to the implementation of this project, in addition to the landowners, mostly the fishermen, farmers, day laborers will be affected severely. The sudden loss of employment will trigger this suffering. The participants of public consultations suggested some mitigation measures for the affected landowners due to the implementation of the project, such as- the participants expected that the evicted landowners and households would be resettled with payment of financial compensation properly. They believe that the jobless workers will get job, especially non-technical/non-hazardous jobs in the power plant project. They demanded that if the government finalizes the project to be implemented the government should improve the road communication infrastructure which will reduce the pressure on the waterways. If the villagers lose their traditional expertise on shrimp cultivation the government should train and rehabilitate them with their new occupational skill. The contractors should manage water-sanitation facilities on their own for the laborers of the power plant project. The compensation should be given in one installment before starting the construction work and the payment should be given in cash. The government should manage extra health care system for the surrounding villagers in case of any accident in the power plant project.



Plate 15.9: Consultation with van pullers in Rajnagar



Plate 15.10: Consultation with youths in Chunkuri

Suggestions for the project planners and implementers

The participants of the PCMs made several suggestions for the project planners and implementers. Participants who have no land in the project site expressed positive attitude to the project implementation and demanded its rapid implementation. They wished a huge recruitment of local labors in the project. They suggested for the development of road communication network which in a sense would create income generating sources for the villagers. They strongly demanded a plan which will not affect the local development with an excuse of national development. The social institutions (social and religious) should not be acquired. The best plan should be made to save these. Although the project is going to be implemented in the Sapmari Katakhali Mauza the benefits should reach equitably to every Mauza of Rampal Upazila. This group of people who supported the project does not find any

problem with the project implementation in Sapmari Katakhali because the population density is really low in that Mauza. They preferred this Mauza as the perfect place for this project and demanded to the planner and implementer for finalizing Sapmari Katakhali as the project area.

People who belonging the land in the project area are against this project requested, the planner and implementer not to acquire their land. If it is badly needed for acquisition they demanded their resettlement in any adjacent villages rather than financial compensation payment for acquisition. In resettled areas there should be enough room, separate space for courtyard and gardening for their living. If there is no other option without financial compensation payment the money should be given in cash at a time not in installments. The compensation should be fixed in compliance with the market value of the land not with the value assessed by the government. Moreover, some posts should be reserved for local labor and certain amount of electricity should be given to the local REB. The people expressed that this project will not bring any benefits for them and they do not want the power plant rather they want interventions of Bangladesh Water Development Board (BWDB) for stopping saline water intrusion in the area. The scarcity of sweet water is more severe than the scarcity of electricity. This group of people proposed some alternative sites to avoid the land acquisition in the project area, such as, Chandpai and Balir Matth of Mongla, acquired place for Khan Jahan Ali Airport, Shilar Char and Gordaskati Char of Mongla as their proposed sites are less populated compared to their villages.

- *Financial compensation not in installment but at a time.*
- *Recruitment of more jobless local labors in the project.*
- *Training and rehabilitation of local labors on new occupation.*
- *Separate arrangements of basic facilities for the workers in the project campus.*
- *Strong contingency measures for any kinds of potential risk, especially for health risks.*
- *Road communication infrastructures should be developed.*
- *Equitable distribution of electricity.*
- *Interventions of BWDB for sweet water.*
- *Careful consideration of alternative sites.*

Table 15.2: List of participants attended Public Consultation Meeting

Name	Age	Occupation	Address/Phone No.
Sapmari Katakhali, Rajnagar, Rampal, Bagerhat			
Mostafiz	32	Agriculture & Fishery	01710127109
Sujaujjaman Fakir	52	Petty Business	Rajnagar
Monirul Haque Monir	52	Agriculture & Fishery	01914664407
Saiful Islam	45	Agriculture & Fishery	01911839735
Mostaq	50	Agriculture & Fishery	01912559180
Ekramul Haque	62	Agriculture & Fishery	Sapmari Katakhali
Khokon	62	Agriculture & Fishery	01711965151
Monjurul Haque	55	Agriculture & Fishery	Sapmari Katakhali
Abdul Jobbar	51	Agriculture & Fishery	Sapmari Katakhali
Rahim Sheikh	40	Fishery	Sapmari Katakhali

Name	Age	Occupation	Address/Phone No.
Rofiqul Islam	45	Fishery	Rajnagar
Khurshid Alam	38	Agriculture & Fishery	Gaurambha
Osman Ali Morol	32	Daily Labor	Rajnagar
Alamin Gazi	21	Daily Labor	Rajnagar
Ajad Mollah	29	Fishery	Rajnagar
Imran Hossain	35	Fishery	Rajnagar
Kajol Fakir	56	Petty Business	Rajnagar
Kapasdanga, Gaurambha, Rampal, Bagerhat			
Prince	24	Employee, BRAC	01728450222
Mijanur Rahman	34	Quack Doctor	01712449024
Peer Ali	32	Fishery	01932086654
Gazi Ziaul Haque Tutul	30	Fishery	01714950019
Md. Rakib Ullah Molla	40	Teacher	01713921522
Morshedul Islam	51	Agriculture & Fishery	Kapasdanga
Haris Ahmed	33	Agriculture & Fishery	Kapasdanga
Md. Shipon	22	Fishery	Kapasdanga
Shafiqul Alam	25	Fishery	Kapasdanga
Golam Mostafa	39	Fishery	Kapasdanga
Baserhula, Rajnagar, Rampal, Bagerhat			
Hafizur Rahman	27	Agriculture & Fishery	Baserhula
Aminul Islam	35	Agriculture & Fishery	Baserhula
Proshanto Chandra	25	Agriculture & Fishery	Baserhula
Shankar Dash	40	Agriculture & Fishery	Baserhula
Rejoan Hossain	55	Agriculture & Fishery	Baserhula
Shamsul Alam	38	Agriculture & Fishery	Baserhula
Rahim Gazi	33	Agriculture & Fishery	Baserhula
Md. Babul	28	Unemployed	Baserhula
Shohag	26	Unemployed	Baserhula
Bara Durgapur, Rajnagar, Rampal, Bagerhat			
Ruhul Amin	35	Agriculture & Fishery	01915362310
Chironjit	20	Student	01929606930
Shorodindu Biswas	35	Agriculture & Fishery	01711479276
Roton Mondal	22	Student	01735800011
Bidhan Chandra Biswas	37	Agriculture & Fishery	01710887152
Md. Moshtaq Ahmed	41	Teacher	01718445674
Gonesh Chandra Biswas	40	Agriculture & Fishery	01937286662
Dulal Sarkar	41	Agriculture & Fishery	01721056356
Nur Ali	55	Agriculture	Bara Durgapur
Sajib Biswas	21	Student	Bara Durgapur
Rajnagar, Rajnagar, Rampal, Bagerhat			
Sujit Mondal	35	Field Officer, Rupantor	01715645015
Khairunnesa Begum	40	President, Nari Bikash Kendra (NBK), Rajnagar	Rajnagar
Sagorika Halder	36	Treasurer, Nari Bikash	Rajnagar

Name	Age	Occupation	Address/Phone No.
		Kendra (NBK), Rajnagar	
Sokhina Begum	44	UP Member	Rajnagar
Loli Sarker	45	UP Member	Rajnagar
Renuka Bala Das	50	UP Member	Rajnagar
Zinnat Ali Molla	60	Fishery	01937741242
Sobuj	18	Student	01914037803
Abu Jafar	50	Fishery	N/A
Zahid Hazra	40	Fishery	01710888140
Aminur Rahman	20	Student	01718416781
Mina Mondal	40	UP Member	Rajnagar
Sulekha Ghosh	45	UP Member	Rajnagar
Gita Ghosh	42	UP Member	Rajnagar
Anima Sontol	50	UP Member	Rajnagar
Aliur Rahman	40	Fishery	01724718204
Md. Omor Ali	62	Fishery	01741092748
Hafizur Rahman	28	Fishery	01729824857
Amanat Ali	50	Fishery	N/A
Anissuzaman Khan	35	Fishery	01739814205
Forhad Goldar	55	Business	01718207790
Hiru	30	Fishery	01928475726
Md. Abdur Rahman	59	Health Inspector (Retd.)	01729606663
Kaigar Daskati, Rajnagar, Rampal, Bagerhat			
Amir Dhali	65	Agriculture	Kaigar Daskati
Moulavi Motiar Rahman	80	*Imam*	Kaigar Daskati
Showkat Fakir	55	Agriculture Labor	Kaigar Daskati
Joinal Koyal	61	Agriculture Labor	Kaigar Daskati
Rouf Gazi	45	Agriculture Labor	Kaigar Daskati
Ariful Islam	35	Agriculture Labor	Kaigar Daskati
Khaleda Begum	50	Housewife	Kaigar Daskati
Khadiza Begum	40	Housewife	Kaigar Daskati
Henara Begum	35	Housewife	Kaigar Daskati
Fahima Begum	35	Housewife	Kaigar Daskati
Chunkuri, Bajua, Dacope, Khulna			
Haidar Ali	45	Agriculture	N/A
Nazrul Islam	30	Agriculture	01923722484
Kamrul Sheikh	40	Agriculture	N/A
Rofiqul Mirza	31	Agriculture	01912838825
Abdur Razzaq	32	Agriculture	N/A
Md. Masud	23	Unemployed	N/A
Abdur Rahman	29	Labor	N/A
Abdul Kader	52	Agriculture	N/A
Rashedul Islam	45	Agriculture	N/A
Kamal Uddin	48	Labor	Chunkuri

15.3 Consultation with Women

Women, in the study area, are victims of prevailing impoverishment. Chronicled social deprivation further victimized them and worsens their social status. They are deprived of their rights and other opportunities because of traditional social structure, religious fanaticism, superstition, vicious circle of poverty. Discrimination in educational opportunities, early marriage, dowry, wage discrimination, to this extent, is also notable. Despite the obstacles mentioned above, in the study area the rate of female literacy is not so much less than of their male counterpart. Employment opportunity for women is not significant. At present women are mostly engaged in household chores. The literate have limited employment opportunities and thus they remain unemployed. This situation is reducing the will power to be educated among the girl child and their parents.



Plate 15.11: Consultation with women from different occupations in Kalekarber, Rajnagar

The women participants of public consultation sessions ensured that if the government can make any employment opportunities for them through the implementation of this project then they are very much eager to contribute their family financially. They opined that due to the implementation of this project they can find miscellaneous jobs, such as,

- earthwork,
- plantation,
- road construction,
- porter in port,
- day laborer,
- non-technical and non-hazardous jobs in power plant,
- petty business (e.g. glossary shop) in project site, etc.

They implied that if available training facilities could be ensured then they also can contribute in technical jobs. Finally, they demanded some reserved employment options for them in the proposed power plant.

15.4 Consultation with local government authorities and government departments

The consulted different stakeholders of local government authority and government departments and their concerned issues are summarized in the following Table 15.3.

Table 15.3: Inventory and summary of stakeholder consultation with Local government authorities and Government departments

Stakeholder	Name	Issues
Local Government Authority		
DC office, Bagerhat	Md. Akram Hossain DC, Bagerhat	• Initiation of the land acquisition procedure • NOC and Land acquisition will be subject to preliminary observation on navigability, coal handling facilities and erosion problem of the area. • Potential Environmental Impact especially on river morphology and ecosystem • Anticipation of potential regional development of Bagerhat and Khulna
	Md. Delwar Hayder ADC (Revenue), Bagerhat	• Process of land acquisition and resettlement plan
	Nittya Gopal Land Acquisition officer, Bagerhat	• The update status of land acquisition plan • Detailed video and picture of the land area to be acquired • Conducting reconnaissance survey by DC office for initiating land acquisition procedure • Collection of meeting resolution
Government Department		
BWDB, Khulna	Jibon Chandra Saha Superintending Engineer, Dredger unit	• BWDB has been requested by BPDB for land filling. • Practicality of the suggested height up to which the land will be raised. • Capacity of BWDB Dredging unit in completing this work. • Non availability of sand in Passur river for filling • Suggestion for using the dredged material of navigation maintenance dredging work of Mongla port for land development
BPDB, Khulna	Mossaraf Hossain Sub-Assistant Engineer, BPDB, Khulna	• Suitability of Sapmari site for being close to Mongla port • Easier coal transportation and construction material transportation in Sapmari site • Initiatives for land acquisition

Stakeholder	Name	Issues
UNO office, Rampal	Mr. Narayan Chandra Kundu, Upazila Agri. Officer, Rampal	• No running programs, development project and plans of DAE exist in the project area.
	Abdul Haque Kazi, Upazila Forest officer, Rampal	• No afforestation program of Upazila Forest office at present.
	Md. Mohsin Halwar, VFA, Rampal Dr. Sukhendra Shekar Gain, ULO, Rampal	• Discussion about livestock and poultry development. There was no program on the concerned issue in project area
	Upazila Fishery Officer, SUFO, Rampal Mr. Sharif Zoardar, Assist. Fishery Officer, Rampal	• Capture fishery area and production statistic • Fish farmer and open water fisher statistics • Views regarding the project.
	Robin Biswas Malo, ESBN fisher, Rampal Sokomol Malo, ESBN fisher, Rampal	• Collection of ESBN catch composition • Collection of fish hauling rate • Collection of fish biodiversity • Collection of trends of production and biodiversity
DPHE, Rampal	Md. Zahid Emam, Eng. DPHE, Rampal	• Assessment of scarcity of feed and fodder for livestock/ poultry. • The impact of salinity on crops.
	Mr. Md. Kamal Uddin Ahmed, SE, DPHE, Khulna Mr. Md. Zahid Emam, SAE. DPHE, Rampal Mr. Paritush Babu, Office assist. DPHE, Rampal	• Collection of GW level • Collection of GW fluctuation • Collection of GW quality • Collection of Project area maps of GW status
Mongla Port Authority	Mr. Abdul Mannan, Member Finance Commander Anam Ahmed, Harbour Master Md. Helaluddin Bhuiyan, Secretary Md. Masud Ullah, Senior Security Officer Khan Altaf Hossain Chief Engineer, Marine Md. Kaosar Ali Chief Engineer Civil	• If coal terminal would be constructed near the Port, dust and ash to be generated from coal stock yard would be dispersing on Port Area • Port facilities, vessels at jetty, goods etc will be affected for ash dispersion • Coal transportation from Mongla port to Plant site through conveyor belt would be most sustainable and cost effective solution. • Maintenance dredging will be required for keeping navigability of the channel • At present, Port does not have any facilities for handling solid bulk (like coal) • Port Authority will facilitate

Stakeholder	Name	Issues
		implementation of Proposed Power Plant Project by extending all supports
Mr. Shahazan Senior, Deputy Director (C&P) BIWTA, Khulna	• Coal Transportation and Handling • Navigational Facilities • Coal Terminal Development	• At present Passur river has restricted draught and length. • Sibsha River might be a good alternative of Coal transportation but at present complete hydrographic chart is not available. The river has also length restriction and draught limitation. • Siltation rate is high in Chunkuri river, and dredging in Chunkuri river is difficult • Existing lighter available in Mongla Port area are mainly 700 – 1500 DWT and these lighters are not fuel efficient and have draught between 2.5m to 5.5m. Purpose built lighters of shallower draught should be engaged for this project
Statutory authority- Department of Environment, Khulna		
DoE, Khulna	Mr. Sayed Ahmed Kabir, Bio-chemist, DoE, Khulna Mr. Muntasir Rahman, Investigator, DoE, Khulna	• Collection of secondary data for water quality and air quality. • Discussion for primary data analysis through sampling from DoE.
Other stakeholders		
Md. Ferdous Kabir, Proprietor, Trust Shipping, Khulna	• Coal Transportation • Lighterage operation • Lighter availability • Cost of transportation	• Lighter vessels are very limited in Mongla port area and most of the lighters are between 700 to 1500 DWT. • Availability of lighters would be main challenge for this project, at present none of the Shipping agency has such capacity to handle such large volume of coal • Cement industries mainly import clinker by vessel of 28000 DWT that can anchor near Harbaria • The project authority should charter lighters to avoid conflict with Ship Owner Association and Stevedore Association • Basundhara group has their own lighter vessel to transport imported clinker.
Commander M G N Siddquey, (c), psc, BN, Executive Director, Mongla Cement Factory	• Ash utilization • Mode of transportation and lighterage operation for clinker import	• Yearly cement production in Bangladesh is about 14 million metric ton • Ash demand is near 1.5-2 million metric ton that mostly imported from India • Ash demand will be increasing as cement demand is increasing. In future demand of OPC will also increase especially in coastal region as in saline area OPC are more efficient than PC.

Stakeholder	Name	Issues
		• The generated ash from power plant can be transported by open truck (by using bag) or covered truck or by barge. • There is a vast scope of selling ash as there are many cement factories located in and around Khulna region. However, this ash can be transported to any region of the country which will be cost effective than importing ash from another country. • Clinkers for cement production as imported from Thailand and Korea mostly by vessel of 30,000 DWT that can proceed up to Joymonir Gol or Harbaria. Then further transshipment is done by lighterage operation. Lighters are mostly 800 to 1000 tons having draught of 3m to 4.5m • Purpose built lighters of shallower draught should be engaged for this power plant project
Captain Imdadul Haque (H), ndc, psc, Bangladesh Navy	• Sea state data • Admiralty charts • Coal Terminal Development	• Sea state data of Bangladesh coast are not available. Some attempts were made to observe data during conducting feasibility study of Deep Sea Port • British Admiralty Charts and data might be reviewed for information • Coal terminal has to be built for this type of project • Detail study should be carried for sea state, sea bed topography, approach channel development and coal terminal development
Commodore Riazuddin, MD, Khulna Shipyard	• Navigability of Inland rivers • Type and design for purpose build coal carrier • Construction of vessels	• Sibsha River might be a good alternative but the main problems of Sibsha river is that the river has sharp bent at different locations that limit length of the vessel up to 80m – 100m • Purpose built lighter vessel should be engaged for transshipping this large amount of coal. This type of vessel can be constructed in Bangladesh. • Khulna Shipyard does not have such capacity of constructing any vessel over 2500 DWT. Other shipyard like Anando, Trust Shipyard, Western Marine, etc. have such capacity • A ship can be built by 1.5-2 years.

15.5 EIA review and Expert Opinion

Before finalizing the EIA, a series of workshop and meetings were held on the Draft EIA report to gather opinions of different relevant government and Non Government Agencies. Two special meetings were held with JICA experts and NTPC-India experts at BPDB where the Draft EIA report was presented to gather concerns and comments of the experts on the draft EIA. Similarly, Power Division, Ministry of Power Energy, and Mineral Resources arranged a discussion meeting on 27 October 2011 at the Ministry where representatives from Ministry of Environment and Forest, Department of Environment, Mongla Port Authority, IUCN, Department of Fisheries were present where the Draft EIA report was presented. The participants carefully observed and analyzed different environmental issues and provided their valuable comments for improving the EIA. As per suggestion of the meeting, a draft EIA was submitted to DoE and accordingly, DoE distributed the report to different relevant Government Authorities including, Forest Department, Department of Fisheries, BWDB, BIWTA, and Non Government Organization IUCN for careful review of the EIA report. DoE arranged a meeting on 26 February 2012 at Dhaka office on the EIA where presentation of the EIA and open discussion on it was carried out. The participants from different agencies mentioned above provided their official comments and suggestion on the EIA. The Ministry of Power, Energy and Mineral Resources also arranged another knowledge sharing and discussion meeting on the proposed Khulna Thermal power Plant and its Environmental Issues on 09 March 2012 at DC Office Bagerhat where representatives from relevant Government Department and Authority including DoE Khulna, BWDB, BIWTA, REB, WZPDCL, etc were present and provided their valuable comments. Finally, taking care of each comment and suggestion obtained through this series of meetings and discussions, the EIA report has been finalized.

15.6 Public Disclosure

With the aim of awareness growing and disclosing the project related information and different environmental issues of the project to the local people a Public Disclosure Meeting has been organized. The meeting was arranged by the project proponent with the facilitation of Honorable Mayor of the Khulna City Corporation and UNO Rampal. The meeting was chaired by the honorable Mayor Khulna where representatives of DoE Dhaka, DoE, Khulna, BPDB, Khulna, Chairmen of the different Union of the study area. The meeting place was in Gouramba Union. The justifications of the place selection were:

- Most of the affected land owners (affected due to land acquired for the proposed project) and PAPs live in the Gouramba union
- Gouramba union is the only easily accessible nearest union of the project area
- Availability of logistic required for organizing such formal Public Disclosure Meeting

The project proponent has disclosed the project related information and its potential impact on environment and society to the participants through a multimedia presentation. All the mitigation measures adopted to ensure environmental and public safety and to protect ecosystem of Sundarbans have also been clearly briefed by the project proponent. After the presentation, the floor was open to all for discussion. In the meeting the local people raised the following issues which were clearly described by the project proponent:

- Potential impacts of the power plant on environment, society and on the Sundarbans
- Mitigation measures adopted to ensure environmental and socio-economic safety
- Possible benefits from the project for the local people
- Opportunity of local people in project's employment (both technical and non technical positions)
- Sharing of benefits between Bangladesh and India provided in the Agreement (between Bangladesh and India for the proposed power plant)
- Sharing of generated electricity

The local people suggested the following to be considered in the project planning and implementation by the project proponent

- ensure adoption of all appropriate mitigation measures to avoid/control/limit all possible environmental impacts (including impacts on Sundarbans)
- provide opportunity to the PAPs and local people in project related jobs (technical and non-technical)
- prefer local people (if satisfy required qualification) in the project related technical jobs
- provide compensation to the PAPs in a smooth and faster way

Photo Album of Public Disclosure Meeting






The Representative of Project Proponent disclosing project information



The Representative of Project Proponent disclosing project information



Director DoE, Khulna responding to the question of local people about Environmental Clearance of the proposed project



Project Director responding to a question of a local people



SE of the project describing overall technological aspect of the power plant



Environmental Expert, CEGIS briefing the possible environmental impact of the proposed power plant

15.7 Concluding remarks

The local people are very much concerned about the possible impacts of the power plants on Sundarbans and local environment. Frequently Asked Questions (FAQ) of the locals and civil society about the proposed project have been listed with the proper answer for each has been attached with the EIA report in Annex XIII.

The local people have no major objection about the goals and objectives of the project. They propose consideration of their well-being and development for a better future in project planning. The people who had land in the project area, affected agricultural and shrimp farming labors, and other livelihood groups solely depended on the acquired land for their livelihood strongly demanded proper compensation and rehabilitation. Preference of local people in project's employment is another prime demand of the local people that should be considered by the project proponent.

Local people presume that for the great interest of the country the proposed power plant may be constructed in the proposed location but it has to be planned, installed and operated ensuring minimum impact on Sundarbans and surrounding environment.

Photo album of Stakeholder consultations



Plate 15.12: Consultation with DoE



Plate 15.13: Consultation with LAO



Plate 15.14: Consultation with DPHE



Plate 15.15: Consultation with MPA





Plate 15.16: Consultation with Experts of Mongla Port Authority




Plates 15.17: Meeting with BPDB and JICA, the PSMP study team




Plates 15.18: Meeting and Discussion with BPDB and NTPC-India



Plate 15.19: Discussion meeting arranged by MoPEMR at DC office Bagerhat



Plate 15.20: Discussion meeting arranged by MoPEMR at Ministry Office

Chapter 13: Environmental Monitoring Plan

13.1 Introduction

Successful implementation of EMP depends on regular monitoring, documenting and reporting. BPDB should have provision of Environmental quality and safety department for monitoring the EMP implementation during construction and operation phase of the project. The environmental monitoring officer should monitor the EMP implementation and submit a quarterly report to the concerned department. Additionally, another yearly monitoring report with quarterly monitoring data should be submitted to the DoE for renewing the Environmental Clearance Certificate. Key components of environmental monitoring plan are described in the following subsections while a framework of the detail monitoring plan has been presented in Table 13.1.

The baseline data of the suggested locations of environmental monitoring during construction and operation phase, should be collected and recorded with temporal (time, date, seasons, weather, etc) and spatial references (GPS reference) at pre-construction phase. Thence, the monitoring data would be comparable to baseline data. All data should be submitted to the Department of Environment.

Table 13.1: Monitoring Plan

Indicator	Location of data collection	Frequency of data collection	Institution (s)[15]
Physical Environment Monitoring Plan			
Construction			
Monitoring EMP implementation • Mitigation measures • Enhancement measures • Contingency • Compensation	Project area	Daily monitoring and documenting, and quarterly reporting	BPDB/JV Company/ EPC Contractor
Respiratory Particulate matter ($PM_{2.5}$ and PM_{10})	Four samples from four edges of the project boundary, one sample from 1 km downwind from the project boundary	Quarterly	BPDB/JV Company/ EPC Contractor
Noise	One noise level data from middle of the project boundary, Four data from four different locations – • 1 km away from south boundary • 1km away from north boundary • 1 km away from east boundary	Quarterly	BPDB/JV Company/ EPC Contractor

[15] *Note: Here, the role of DoE would be as a regulatory authority on behalf of GOB.*

Indicator	Location of data collection	Frequency of data collection	Institution (s)[15]
	• 1 km away from west boundary ▪ Harbaria ▪ Akram point		
Waste generation • Construction • Domestic	Project area and Labor shed	Quarterly	BPDB/JV Company/ EPC Contractor
Implementation of onsite waste management plan and noise management plan	Within project area	Daily monitoring and documenting, and quarterly reporting	BPDB/JV Company/ EPC Contractor
Post-construction/Operation			
Air quality-concentration of SOx, NOx, $PM_{2.5}$ and PM_{10}	• Stack point • at 1 km, 2 km, 3 km and 4 km distance from the stack point towards windward direction • Coal stockpile • Coal transfer point (Akram point) • Ash disposal pond • Coal stockpile • Ash disposal pond • Harbaria	Quarterly	BPDB/JV Company/DoE
Noise	• Within 100 m of the plant, • immediate outside of the project boundary • 1km away towards different direction from four different side of the project	Quarterly	BPDB/JV Company/DoE
Waste generation • Plant • Domestic	Project area and Labor shed	Quarterly	BPDB/JV Company/DoE
Implementation of Air quality management plan, Noise management plan, Waste management plan	Within project area	Daily monitoring and quarterly reporting	BPDB/JV Company/DoE
Water Resources Monitoring Plan			
Tidal penetration and inundation	Maidara river Ichamoti river	Monthly	BPDB/JV Company/BWDB
Erosion	Passur river Akram point site Mongla port site Project site	Quarterly	BPDB/JV Company/BWDB/BIWTA/MPA
Sedimentation	Passur river	Twice in a	BPDB/JV

Indicator	Location of data collection	Frequency of data collection	Institution (s)[15]
	Akram point site Mongla port site Project site Maidara river: River reach	year (wet and dry season)	Company/BWDB/BIWTA/MPA
Internal drainage network	All creeks of the project area	Twice in a year (wet and dry season)	BPDB/JV Company/BWDB
Surface water pollution monitoring (DO, BOD, COD, Heavy metal, pH, salinity, Total hardness, Nitrate, TDS, TS Temperature, etc)	1. Effluent discharge point • 500 m u/s and d/s from the effluent disposal point • 100 m u/s and d/s from the project plant 2. Maidara River 3. Sundarbans area • Base Creek • Karamjal • Akram Point • Hiron Point All samples should be collected from three points (left, middle and right bank) along the cross section of the river at suggested locations during both ebb and flood tide	Quarterly in a year	BPDB/JV Company/DoE
Ground water table	One point of the project site and five points of the study area	Twice in a year (wet and dry season)	BPDB/JV Company/DoE/DPHE
Ground water pollution monitoring (BOD, COD, Heavy metal, pH, salinity, Total hardness, Nitrate, TDS, etc)	One point of project site and three point of study area.	Quarterly	
Transportation Monitoring Plan			
Traffic management system	• Five points in Khulna to Mongla road. • Three points in access road.	Monthly during post construction/operation period	Roads and Highway, LGED and Mongla Port Authority and District authority
Physical status of road	Overall study area	Twice in a year during operation phase	Roads and Highway and LGED
Navigability	Only Passur river from Akram point to Project jetty	Twice in a year during operation phase	BIWTA and Mongla Port Authority
Land and Agriculture Monitoring Plan			

Indicator	Location of data collection	Frequency of data collection	Institution (s)[15]
Land use	Inside and outside the project	3 (three) Months	DAE, and BPDB
Soil fertility/Nutrient status of soil/Contamination of heavy metal/ Fly ash of burned coal	Inside and outside the project	Yearly	SRDI & BPDB
Crop production	Inside and outside the project	4(four) months	DAE and BPDB
Crop damage	Inside and outside the project	4(four) months	DAE and BPDB
Feed, Fodder and diseases of livestock	Inside and outside the project	Monthly	DLS and BPDB
Implementation of Land and agriculture management plan	Inside and outside the project	Regular monitoring with quarterly monitoring	Joint venture of BPDB and NTPC
Fisheries Monitoring Plan			
Construction			
Fish habitat status	Selected sites within 10 km radius of the project	Pre-dredging, during dredging and post dredging	BPDB/DoF/DoE
Fish biodiversity	Selected sites within 10 km radius of the project	Pre-dredging, during dredging and post dredging	BPDB/DoF
Fish migration (indicative species)	Migration channels within the study area of the project especially Maidara River and Passur River adjacent to project area	Pre-dredging, during dredging and post dredging	BPDB/DoF
Fish-Shrimp culture practice	Selected sites within 10 km radius of the project	Quarterly	BPDB/DoF
Fish production	Selected sites within 10km radius of the project	Quarterly	BPDB/DoF
Post-construction			
Fish habitat status	Selected sites within 10km radius of the project	Quarterly	BPDB/DoF/DoE
Fish biodiversity	Selected sites within 10km radius of the project	3 times/year (pre/monsoon /post-monsoon)	
Fish migration (indicative species)	Migration channels within the study area of the project especially	Quarterly	BPDB/DoF

Indicator	Location of data collection	Frequency of data collection	Institution (s)[15]
	Maidara River and Passur River adjacent to project area		
Fish-Shrimp culture practice	Selected sites within 10 km radius of the project	Biannually	BPDB/DoF
Fish production	Discharge point	Continuously	BPDB/DoF
Monitoring implementation of Fisheries Management plan	Project area	Regular monitoring with quarterly reporting	BPDB/DoE
Ecosystem Monitoring Plan			
Construction			
Bird Colony, feeding and nesting ground	Within 10 km radius of the project	Quarterly	BPDB/DoE
Benthos	Passur river- within the dredging area	Pre-dredging, during dredging and post dredging	BPDB/DoE
Limiting of vegetation clearance	Within project area	Daily during base stripping activities	BPDB/DoE
Dolphin activities	Maidara River and Passur River adjacent to project area	Quarterly	BPDB/DoE
Implementation of Ecosystem management plan	Within project area	Regular monitoring and quarterly reporting	BPDB/DoE
Post-construction			
Air quality monitoring in Sundarbans • SO_2, NOx, PM	Sundarbans near • Karamjal • Akram Point • Hiron Point	Quarterly	JV Company/DoE
Water quality monitoring (BOD, COD, Heavy metal, pH, salinity, Total hardness, Nitrate, Suspended Solid, Total solid, Temperature, Oil and grease, etc)	Sundarbans near: • Base Creek • Karamjal • Akram Point • Hiron Point All samples should be collected from three points (left, middle and right bank) along the cross section of the river at suggested locations during both ebb and flood tide	Quarterly	JV Company/DoE
Bird Colony, feeding and nesting ground	Within 10km radius of the project	Quarterly	JV Company/DoE
Benthos community	Adjacent to the project area 500 m u/s and d/s from the effluent disposal point	At least 15" of bottom sediments of the river are	Dredging implementing agency

Indicator	Location of data collection	Frequency of data collection	Institution (s)[15]
	Sundarbans areas Nearest point of Sundarbans Akram Point Heron Point	collected quarterly in a year.	
River bed pollution monitoring (Coal dust, Heavy metal, Oil and grease)	Adjacent to the project area 500 m u/s and d/s from the effluent disposal point Sundarbans areas Nearest point of Sundarbans Akram Point Heron Point	Top 15'' of the river bottom sediments are analyzed quarterly in a year.	
Ecosystem health of the surrounding: • Fly ash deposition on plant leaves • Plant health • Productivity of fruiting plants	5 samples from Homestead ecosystem (at least 2 at down wind direction) within 5 km radius 5 Samples from Road side plantation including 2 at downwind direction within 5 km radius 5 samples from each of the following locations of Sundarbans: • Base Creek • Karamjal • Akram Point • Heron Point	Quarterly	BPDB/DoE
Monitoring activities of Water vessels (Ballast water dumping, oil spillage, waste dumping, beaming of searchlight, noise generation etc) engaged in coal transportation	Heron Point, Akram Point, Monkey point, Karamjal, Mongla port, Jetty location of Project site	Regular monitoring	Coast Guard, MPA, Department of Forest, DG Shipping
Water quality of Passur river • Oil • Heavy metal • Sulfur content • pH	Hiron Point, Akram Point, Monkey point, Karamjal, Mongla port, Jetty location of project site	Quarterly	DoE, JV Company
Socioeconomic Environment Monitoring Plan			
Have the displaced people losing their land received proper compensation?	Villages at new location, DC office	Before and during construction	DC Office Bagerhat/ BPDB
How many displaced households relocated and built their new structure at new location?	Villages at new location	Twice in a year	DC Office Bagerhat/ BPDB

Indicator	Location of data collection	Frequency of data collection	Institution (s)[15]
How many people are recruited for construction and other activities under the project	Project area	During and after construction	BPDB/ JV Company
Whether people and workers suffer from health risk	Project site and surrounding the area	Quarterly	JV Company
Groundwater level, and salinity intrusion	Surrounding the project area	Twice a year	JV Company

13.2 Compliance Monitoring

Compliance monitoring is the prudent element of Environmental Monitoring Plan that ensure effective implementation of the Environmental Management Plan, compliance of all project related activities with relevant environmental rules and regulations and safety procedure. Monitoring of the compliance may be carried out by the Environmental Personnel of the Project Management Unit but should be audited yearly by the external auditor. The monitoring activities and results should be well documented and followed by the standard monitoring checklist.

The principle approach of the step by step monitoring involves:

- Walkthrough inspection : quick survey of the activities, operations, equipments, and facilities
- Through inspection: visual observation activities, operation, equipments and facilities and review of related documents, previous records, reports, etc
- Interview of relevant personnel: interviewing of related employees, key personnel, etc
- Consultation with local people: consultation with local people to understand community perception on the project related activities and to identify social issues related with the project

The inspection, observation, consultation and reporting should be followed by a organized checklist. The checklist of the monitoring should be developed during preparation of Environmental and Social Action Plan at the stage of detail design of the project.

The target areas of monitoring are:

- Compliance of project related activities (including coal transportation activities) with national and international (if required) environmental rules and regulation as described in chapter 2 during preconstruction, construction and operation phases
- Compliance of the project related activities (including coal transportation) with the Suggested EMP during pre-construction, construction and operation phases
- Compliance of the Plant operation (noise, emission, waste disposal, waste water discharge, etc) with relevant national and international (if required) standards

- Compliance of the Environmental Monitoring Activities with suggested Environmental Monitoring Plan
- Record of incidents

The compliance monitoring report along with the checklist should be indexed and annexed with the monthly and annual monitoring report. It may be required to submit the annual monitoring report to Department of Environment for renewing of the Environmental Clearance Certificate each year.

13.3 Implementation of EMP and Environmental Monitoring Plan

Main purpose of this environmental assessment is to delineate correct measures to enhance the environmental sustainability of the proposed project through providing suggestion on design consideration, implementation, management and operation as suggested in the EMP. The effective implementation and operation of EMP depends on regular monitoring. The power production company-joint venture of BPDB and NTPC should establish a directorate headed by a Director, Environment and Safety. The organogram of the proposed monitoring directorate may be as Figure 13.1.

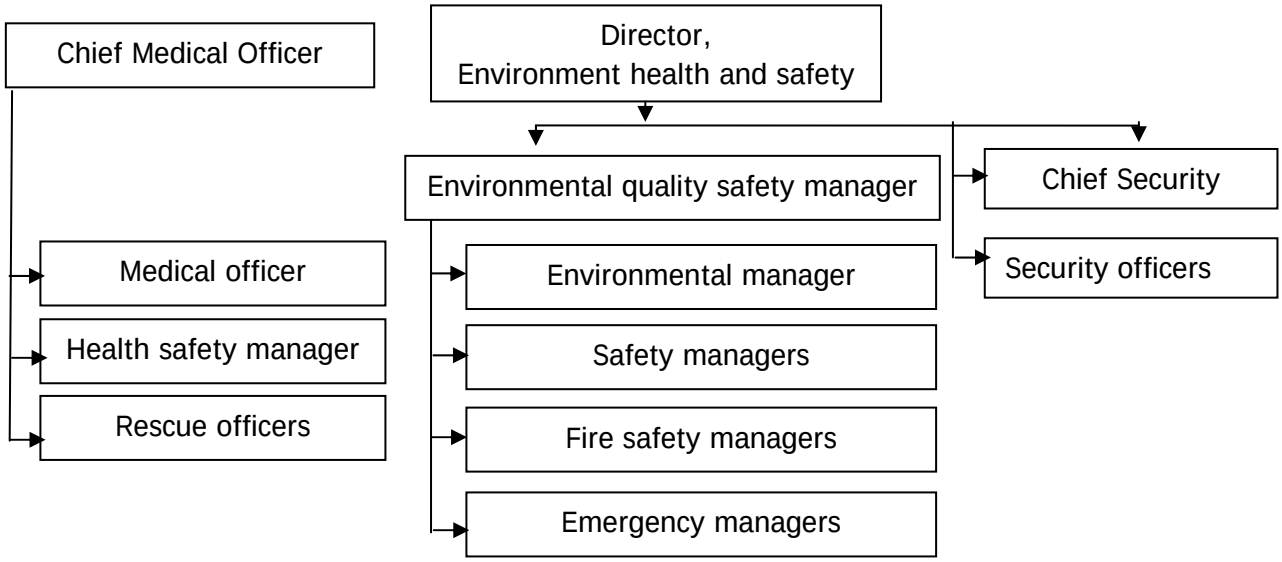


Figure 13.1: Organogram of proposed environment and safety directorate

The environmental manager will be responsible for monitoring of the implemented EMP. The safety manager will be responsible for occupational health and safety and implementation of hazard management plan while the emergency manager will be responsible for emergency plan implementation. However, this is an indicative organogram; the project authority may change the hierarchy of the team and make necessary addition if required for smooth implementation of the monitoring works.

Chapter 14: Cost and Benefit Assessment

14.1 Introduction

The feasibility is a process of checking technical feasibility, economical viability, social accountability and environmental sustainability of a project. The cost-benefit analysis (CBA) is usually carried out to examine the project feasibility and is widely used for financial and economic appraisal tool of a project. It is particularly useful when a choice has to be made out of several alternatives and when the project involves a stream of benefits and costs over time. Other issues like achieving national goal, reducing regional imbalance, national strategic planning, environmental externalities etc. are also significantly important for the project feasibility studies.

In the power sector, CBA is used as an essential tool for the policy formulation and decision making in multiple aspects like site selection, construction, operation, decommissioning, fuel quality and selling prices. The basic idea here is to evaluate whether the investment in construction, operational and maintenance costs of the power plant is justified in terms of a higher electricity production with lower external cost. Cost- Benefit is a standardized tool, but can take several forms, and is usually complemented with a number of processes. The process of cost- benefit assessment is estimated on the following process.

Financial and Economic analysis

- *Benefit Cost Ratio (BCR)* – Ratio of the present value (PV) of total incremental benefits over the PV of total incremental costs
- *Net Present Value (NPV)* – the difference between the PV of total incremental benefits and the present value of the total incremental costs
- *Internal Rate of Return (IRR)* – The discount rate at which the PV of benefits equals the PV of costs
- *Sensitivity analysis* – This is done considering specific boundaries that will depend on one or more input variables, such as the effect of changing coal cost and gross calorific value (GCV) on the production cost.

The financial and economic analysis has been carried out in feasibility report (FR). Environmental and social protection and improvement cost are also integrated in this feasibility to assess the ultimate CBA ensuring environmental and social protection for making it acceptable. However, the environmental and social cost and benefit assessment are attempted to estimated in tangible and intangible forms as bellows.

- *Externalities – Potentially to affect the third parties*
- *Categorize for valuation of the potential affected resources*
- *Environment, social protection and enhancement cost estimation*
- *Opportunity cost - Include the value of forgone opportunities*
- *Benefits of the projects – both for tangible and intangible benefits*

14.2 Financial and economic analysis

The NTPC, India has carried out financial and economic analysis and prepared the feasibility report. According to the feasibility about BDT. 2233,689.0 million will be the total project cost (*e.g.* including about BDT. 145,086 million for capital investment cost in 3 years and BDT. 2088,603 million for operation and maintenance cost over 25 years) where the total benefit BDT. 2519,045.1 million will be acquired relatively distributed over 25 years. In the feasibility report, financial analysis has been carried out at 12%, 8% and 9% discounted rate for 28 years. The project feasibility study has included lease rent BDT. 50,000 per acre of project land and maintenance dredging will be at US $ 4 million or equivalent in BDT per year is considered for financial analysis. Only the compensation cost approximate BDT. 625 million has not been included in financial analysis. The main objective of financial analysis is to determine the requirements of funds/timing and the expected returns on investment from the points of view of the various parties involved in the financing the project. This 1320 MW power plant project will generate about 1056 MW electricity per hour (considering 85% plant factor and plant internal consumption). From this analysis, judgment can be made on the project's financial efficiency, incentives, credit-worthiness and liquidity. In the financial analysis, cost and benefits are calculated using current market prices (Table-14.1).

Table 14.1: Financial analysis for 1320 MW power plant (plant factor 85%)

Discount Rate	12%	8%	9%
NPV (BDT in million)	-32510.5	6746.6	-593.04
BCR	0.94	1.009	0.992
IRR		8.53%	

Source: Feasibility Report, NTPC 2012

The economic analysis has been carried out in feasibility report. The concept of financial profit is not the same as economic profit. The economic profit deals with only the profit accruing to the project operating entity or to the project participants. However, economic analysis measures the effect of the project on the national economy. Therefore, an economically viable project must be financially sustainable as well as efficient.

The feasibility report has estimated 1st full year Costs of Energy (COE) and Levelised Cost of Energy at discounted rate of 12% and 11% for 28 years. Analysis from the economic aspect, assesses the desirability of an investment proposal in terms of its effect on the economy. According to the economic analysis, input and output prices are adjusted to reflect true social or economic values. These adjusted prices are often termed as shadow or accounting prices. According to the feasibility study about BDT. 2,865,996.6 million will be the total project cost where the total benefit BDT. 3,337,673.8 million will be relatively distributed over 25 years. The taxes and duties are treated as transfer payments and are included from the capital and operating cost. The economic analysis of the power plant is shown in Table-14.2.

Table 14.2: Economic analysis for 1320 MW power plant (plant factor 85%)

Discount Rate	11%	12%
NPV (BDT in million)	11156.2	-1217.0
BCR	1.01	1.00
IRR	11.90%	

Source: Feasibility Report, NTPC 2012

However, the cost of electricity production has been estimated as BDT. 8.49 per kwh for first full year and BDT. 8.04 per kwh for levelised cost of energy. In this calculation, the fixed charges is BDT 3.38 per kwh and variable charge is BDT 5.12 kwh rounding of the charges.

Sensitivity analysis

Sensitivity analysis evaluates how a single variable of production will affect on the total production process. According to the feasibility study, two sensitivity analyses have been conducted to identify which variables have the most impact on the success of a new power plant project and to assess the degree of sensitivity for each variable.

The coal parameters in base model have been considered as USD 145 per Ton and 6000 Kcal/kg as GCV. The sensitivity has been done for coal cost varying from USD 165 – 105 per Ton. The results are as follows in Table-14.3.

Table 14.3: Sensitivity analysis considering the coal cost

Description	Unit	Option 1	FR base model	Option 2	Option 3
Total Project cost	Million in BDT/MW	110.40	109.91	109.40	108.90
	Million (USD/MW)	1.28	1.27	1.27	1.26
Cost of Energy	Levellised (BDT/kwh)	8.79	8.04	7.29	6.55
	Variable (BDT/kwh)	5.83	5.12	4.42	3.71
Coal Cost (Base+ Transshipment)	Variable (USD/MT)	165	145	125	105

Source: Feasibility Report, NTPC 2012

The coal parameters are coal cost as USD 145/MT and GCV AS 6000 kcal/kg is considered as base model. The sensitivity has also been done for GCV of 5200 Kcal/kg. The results are represented in Table 14.4.

Table 14.4: Sensitivity analysis considering the gross calorific value (GCV)

Description	Unit	FR base model	Option 1
Total Project Cost	Million in BDT per MW	109.91	110.50
	Million in USD per MW	1.27	1.28
Cost of Energy	Levellised (BDT/kwh)	8.04	8.87
	Variable (BDT/kwh)	5.12	5.91
Coal GCV	Kcal/kg	6000	5200

Source: Feasibility Report, NTPC 2012

14.3 Environmental and social cost – benefit assessment

Environmental and social cost – benefit is related to the externalities of the project. Carrying out this Environmental Impact Assessment (EIA) is mandatory for any power plant project in order to impede the negative externalities[16] and promote the benefit of the project. Therefore, attempts have been made to identify externalities. The importance of externalities are required for the following aspects

- Specification of power stations and related facilities
- Setting of regulations in terms of technology or emissions standards and regulations based on fiscal incentives (e.g. emissions charges or laws, emissions caps etc)
- Planning and development of power systems at the state and regional level, taking account of the environmental costs

14.4 Assessment of the externalities

The approach followed for assuming external costs is illustrated through the 'impact pathway' (Table 14.5). The impacts are assessed not just for generation stage but also for the full life cycle of the implementation process (*e.g.* Pre, during and post construction), including the extraction of the fuel, its transportation, transformation into electric energy, disposal of the waste, and the transport of the electricity. Emissions from a source are traced when they disperse in the environment, following which the impacts of the dispersed pollutants was estimated. The dispersion modeling takes account of the distance dispersion of the pollutants especially SOx, NOx and SPM from the power plant that causes noticeable health impacts, ecosystem impacts and aesthetic impacts. Finally, these impacts are valued both in tangible and intangible forms. All the primary, secondary and tertiary impacts are evaluated at the respective phases of the power plant projects.

Table 14.5: Impacts pathways included in the analysis of the electricity generation

Impact Category	Pollutant/Burden	Effects
Human health mortality	PM_{10}, $PM_{2.5,}$ SOx, NOx, O_3	Reduction in life expectancy
Morbidity for the living beings	PM_{10}, $PM_{2.5,}$ SOx, NOx, $O_{3,}$ CO Accidental risk	Fatal risk from transport of materials Respiratory problem, heart failure, hypertension, asthma attacks Risk of injuries from traffic and work place accidents

[16] External costs arise when the actions of one party have impacts on another and the first party does not account for these impacts. These are normally considered to include the direct and indirect effects of air and water pollution as well as some consequences of waste disposal, land degradation, forest loss, loss of biodiversity etc.

Impact Category	Pollutant/Burden	Effects
Detrimental to building materials	Acid rain deposition, combustion particles ,shoot, accidents	Ageing galvanized steel, limestone, paint, soiling of the building and accidental damage
Crops and fisheries production	Loss of land, SOx, NOx, Acid deposition	Reducing production , Change in yield of wheat, tobacco, rye, sunflower seed Increased expenditure on liming
Amenity losses	Noise, visibility, artificial structure	Disturbing the natural habitats, ecosystems, tourisms
Ecosystem damage	Land loss, water and air pollution, anthropogenic activities, accidents	Decreasing the natural resources, Pressure on other resources, reduces eco-protection, increasing living cost
Global warming	Emission of CO_2	Sea level rise, increasing the intensity and magnitude of natural hazards, shifting regime, salinity intrusion
Social unrest	Land acquisition, employment process, benefit sharing among the whole society, accidents, livelihood security	Migration, production failure, crime or terrorisms, political agitation etc

14.5 Categorize for valuation of the potentially affected resources

The potential impacts can be categorized depending on different valuation process. The valuation process is important to determine the cost includes to harness the potential benefits, are expressed bellow.

- *Direct values:* These are related to the production and consumption of goods and services (*e.g.* primary, secondary) that could be easily traded (so that the value becomes visible) Example: Land, crops, fish, fire wood, wage labor, dredging, electricity etc

- *Indirect values:* These are derived more from the ecological functions of the forest, which support and protect other economic activities Example: watershed protection, cyclone and storm surge protection, health, carbon sequestration, dredging spoil management, tourism, social improvement etc.

- *Option values:* This describes the potential values that can be accrued from both direct and indirect use of the potential affected areas. Example: Medicinal values of the forests, ground water resources, benthos communities, soil microbes etc.

- *Non-use values:* The value derived from the conserving things from for existing satisfaction and future generations. People may place an implicit value on this without any direct or indirect use. Example: Sundarbans mangrove forest, heritage, archeological site, spiritual or sacred places etc.

- *Intrinsic value:* The value of living resources in its own right, unrelated to human utilization. Example: Royal Bengal Tiger, Irrawaddy dolphin etc.

Monetary valuation is generally difficult for ecosystems, including forest damages. A number of effects including neonatal mortality, morbidity, behavioral effects, neurological disorders, allergies, innovations, life loss and intra-generational views are the major limitations of the valuation process. Not any single valuation process could count the total values of the cumulative impacts and benefit from a power plant. Moreover, valuation of environmental externalities is very difficult considering its multidimensional aspects like determination of statistical life loss, willingness to pay for developing countries etc. Therefore, this report has the limitation in valuation of the intangible variables into monetary terms.

14.6 Measures to control pollution and enhance the benefits

The use of technology and measures are clearly very important as technologies differ in the emissions generated from the power plant and finally the location of the plant remains a key factor. Air and water pollutants disperse quite widely and over long period of time, resulting the risk of damages occurring outside the normally considered range. To avoid any kind of damages and keep the environment clean as present, a number of modern technologies have been strictly adopted and multiple measures have been taken care of. Supercritical boiler, de-NOx burner, ESP, high stack height, desalination plant, cooling tower, effluent management plan, ash management plan, ecosystem conservation and socio-economic development program, ambient air, water and acoustic monitoring and management, health and safety management plan, environmental institutional set up, integrated water and river management etc will be the major pollution abatement /benefit enhancement measures of this project. Those have been elaborated in the respective sections of the project description and environment management plan appended in earlier chapters.

14.7 Cost of the environmental measures

The project covers 1834 acres of land that is mainly occupied with shrimp farms, agricultural land, smaller homesteads and community forest etc. The process of compensation to the affected people has been carried out following the Immovable Property Ordinance, 1982 (Ordinance II of 1982). District Commissioner (DC) office estimated a total compensation cost BDT 625 million.

Advanced technical measures have been adopted to control the pollution from the power plant and regular monitoring of the ambient environment will be carried out for ensuring a health environment for the living bodies. A number of management plans will be implemented for sustainable operation of the project in association with ecosystem and social sustainability. However, the estimated costs for environmental protection, monitoring, and management plans are outlines in the Table 14.6a and Table 14.6b respectively.

Table 14.6a: Estimated cost for environmental abatement measures considered in Feasibility Study

Measures		Approx. Cost (BDT-million)
1.	Electrostatic Precipitator (ESP)	2535.00
2.	Stack of 275 m height	942.00
3.	Cooling Tower	2465.00
4.	Desalination plant	2116.00
5.	Effluent Management System Treatment (Effluent & Sewage Plant, CMB etc.)	126.00
6.	Ash Management & Utilization	4377.00
	Total	12561.00

Table 14.6b: Estimated cost for additional environmental management plan (EMP) in EIA Study

Broad categories of the EMP		Approx. Cost BDT in million
1	Socio economic development program	65.0
2	Ecosystem development program	66.0
3	Land and agriculture development program	13.0
4	Fisheries improvement program	5.0
5	Integrated water resources and river management	61.0
6	Ground water management	12.0
7	Surface water quality monitoring and management	20.0
8	Air quality monitoring and management	23.0
9	Waste load monitoring and management	18.0
10	Ambient acoustic environment monitoring and management	11.0
11	Ash management program	15.0
12	EMP for Coal Transportation, Transshipment and Handling	60.0
	Total	369.0

About BDT 12,930 million in total cost of environmental protection and enhancement of socio-economic and ecological development has been estimated for this power plant project. The environmental equipment cost will be BDT 1965.7 million and the environmental operation and maintenance cost will be BDT 294.9 million per year according to the feasibility report. Moreover, about BDT 24.7 million per year of construction period (e.g. 3 years)and BDT 11.8 million per year of operation period (e.g. 25 years) has been considered as additional measures and improvement program (*e.g.* EMP measures) for the adjacent ecosystem conservation and social development according to the EIA study. The Government of Bangladesh decides to spend 0.03 BDT/kWh for the fund of CSR (Corporate Social Responsibility) in order guide social protection as well as regional social development activities.

14.8 Opportunity cost

The opportunity cost is the "cost" (as a lost benefit) of a forgone product after making a choice. It is the sacrifice of benefit related to the second best choice through the use of resources. Existing use 1834 acres of land resources for shrimp farms, agriculture, households and other purposes are the main alternatives instead of the power plant project. Thus, opportunity costs are not restricted to monetary or financial costs: the real cost of output forgone, lost time, pleasure or any other benefit that provides utility should also be considered opportunity costs. However, leasing cost BDT. 50,000 per acre of land in a year (according to feasibility report) will cover the entire opportunity cost satisfactorily. This cost has been included in project financial and economic analysis.

14.9 Benefit of the projects

The benefit of the project has been estimated into tangible and intangible terms. The prime objective of this power plant project is to ensure reliable supply of electricity and enhance the energy scenario of the country. This project will add 1320 MW electricity to the national grid. Coal has been selected as fuel in consideration to reduce pressure on the national natural gases reserve and lowering the production cost of electricity. The project site has been selected through considering the techno-economic feasibility and all environmental relevant concern.

In order to capture all relevant benefits associated with electricity generation, the externalities will be categorized in life cycle subcategories, including construction; fuel acquisition and transportation; operations and maintenance; and waste and decommissioning. Benefits have also been organized into three broad categories e.g. environmental, socioeconomic and national energy security.

Proper monitoring and proposed control measures will ensure a healthy environment around the project site. Other associated activities, control measures and programs will ensure the sustainability of the ecosystem and regional social development. The positive externalities or benefits are pointed out bellow.

14.9.1 National energy security

This power plant project will generate net 9238996.8 MW in a year as per feasibility study. This production will add BDT. 74281.5 million revenue per year (through selling of this electricity). National energy security externalities include the potential benefits associated with increasing energy independence in contrast to import direct electricity or virtual electricity. Our national economy will be based on human capital and natural capital which simultaneously will be influenced by the regional economies. Ensuring the supply of electricity may trigger the regional development directly or indirectly.

- *Industrial development:* Reliable supply of electricity will revive the Khulna industrial zone (e.g. jute, paper industries etc), fish processing industries, Mongla port zone as well as new industries, factories, EPZ etc.

- *Development of irrigation system:* At present, the irrigation facility is not well developed in the south-west region of Bangladesh because of electricity shortage. Supply of sustainable electricity will facilitate increasing irrigation coverage, cropping intensity, more crop production and agro-based industries significantly.

- *Quality of life improvement:* Availability of power supply will promote accessibility of the mass population to standard quality of life. Generation of electricity will increase the domestic household coverage as well as per capita rate of energy consumption. Other accessories facilities, cultural values and recreation activities are likely to be enhanced after reliable electricity supply.

14.9.2 Socio-economic benefits

Socioeconomic externalities associated with the electricity generation include a wide range of social, cultural, and direct economic impacts. During one or more phases of an electricity generation life cycle there can be impacts related to view sheds, infrastructural development, regional tourism, recreational activities, and cultural resources etc. In general, well-established methodologies exist to measure or estimate the magnitude of these impacts.

- *Aesthetic resources:* The Net impacts are considered since intangible benefits may be derived from perceived visual improvements (e.g. planned industrial area, green belt development etc.).

- *Social development program:* The Government of Bangladesh decides to spend 0.03 BDT/kWh from the said power plant generation against CSR (Corporate Social Responsibility) fund for regional social development activities. GoB has taken a decision to spend about BDT 277.2 million (e.g. 0.03 BDT/kWh) per year on the following sectors for regional development.

    - Construction of roads
    - Improvement of water supply and sanitation
    - Regional electricity supply
    - Establishment and development of educational institutions
    - Initiation of educational scholarships
    - Improvement of health and Medicare facilities
    - Development of cultural and sports facilities
    - Skill or capacity build up training program
    - Livelihood development
    - Improvement of the quality of life style

- *Infrastructure development:* High investment projects like power plant projects generates a number of secondary benefits. It will be tempting to include as many of them as possible. Enough secondary benefits calculation will support to accept this project remarkably. In regional macro-economic investment, a certain development will result in such sectors as roads, railways and waterways, hotels, health complexes, institutions, industries, communication and service sector improvement etc. A large project has linkages to the rest of the economy, buying materials and inputs, paying workers etc. Therefore, national product continues to increase through this multiplier effect.

- *Employment opportunity:* It is evident that the increasing supply of electricity directly or indirectly promote the economic productivity. It will be not only for the power plant related services but also for other industries. Factories, farms, organizations, business house will create opportunity which will reduce regional unemployment as well as disguised employment.

- *Health improvement:* Development of employment opportunities, quality of life and ambient environmental monitoring will ultimately improve the health facilities of the project area remarkably.

- *Urbanization:* Development of new townships, industrial zone, infrastructures, institutions etc will promote the project area towards urbanization and improve the facilities of existing urban areas.

- *Institutional development:* High investment for a particular development projects will influence multiple sectors to share the benefit. A number of institutions will be created related to the project activities over the year. Creation of service sectors will assist the population in achieving standard quality of life. However, this project will indirectly assist to achieve the important national goal especially Education for all and quality of health facilities.

- *Improve communication facilities:* Development of existing roads and dredging of Passur river will facilitate the regional communication systems. Construction of new roads and maintaining navigation of Passur river. Through dredging for coal import, will play a crucial role in the regional development.

14.9.3 Environmental benefits

Positive and negative externalities associated with the environment fall into two general categories. A second category of environmental impact involves benefits and costs associated with the generation of atmospheric emissions and waste streams released to the natural environment, particularly during operation of a generation facility. Utilization of plant abatement measures and monitoring the ambient environment (e.g. air, water, acoustic) will keep a pollutant free environment. Green house gas, CO_2 will be sequestrated by the forest.

- Benefit of the abatement measures
    - ESP will be used to clean the exit flue gas
    - Higher (275m) stack height will disperse the exit flue gas over wider area
    - Cooling tower will be used for reducing discharge water temperature
    - Desalination plant will produce fresh water from brackish water; thus exploitation of ground water can be avoided.
    - Effluent management system treatment will minimize effluent
    - Ash management system will ensure utilization and safe disposal

- *Ecosystem improvement facilities:* The afforestation program, fisheries management program, dolphin conservation program etc will mitigate the negative impact of the project and ensure enhancement of the ecosystem.

- *Disaster management program:* Structural development and creating awareness program will enrich the disaster management system in the south western region.

- *Ambient environmental quality:* Regular monitoring of air, water and acoustic environment at specific locations will ensure the quality of the Sundarbans ecosystem vis-à-vis any kind of anthropogenic interventions.

- *Improve aquatic environment:* Capital dredging of the coal import route may initially impact on the benthic community of Passur river. However, this navigation

improvement will create a long-term benefit for hydro-morphological as well as aquatic environment of the Passur river regime.

- *Green development:* Afforestation, community forestry, buffer zone creation are aimed at developing a green belt around the projects. Moreover, bank protection works and regular monitoring will indirectly reduce the deforestation around the project areas.

- *Market development:* Development of any project invariably increases market facilities, communities, infrastructure etc. Therefore, enhanced facilities of value chain for the products, reduction of transportation costs and regional industries and business development will be significant.

However, this power plant project will generate a productive surge to the industrial, agriculture, domestic and service sectors. Sufficient supply of energy will assist to fulfill our domestic demand as well as stir each of the productive sectors to compete in international markets in order to improve the national growth rate. Otherwise, import of electricity will increase pressure to the national economy as well as dependency on the imported countries.

Chapter 16: Conclusions and Recommendations

16.1 Conclusions

Following conclusions are being made after the comprehensive study with detail investigation. Government of Bangladesh has taken a plan of installing a new mega project of 1320 MW coal based thermal power plant in Rampal of Bagerhat in order to reach the goal of reliable electricity supply for all. It is contemplatively planned to construct under Joint venture of BPDB and India state run NTPC. With the purpose of obtaining Environmental Clearance Certificate from Department of Environment under Environment Conservation Act, 1995 and through the procedure defined in Environment Conservation Rules, 1997, BPDB entrusted CEGIS (a public trust under Ministry of Water Resources) the responsibility of Environmental Impact Assessment study.

As per procedure, the IEE report submitted to DoE and Site Clearance Certificate has already obtained. The scope of this report is to present the Environmental Impact Assessment study. The study has been carried out following the Environmental Impact Assessment Guideline of DoE and World Bank that includes multidisciplinary tools and techniques of Physical, Water resources, Agriculture, Land and soil, Fisheries, Ecology and Socio-economic surveys and investigation. Participation of local people was ensured through RRA and PRA approach. Therefore, it is complete participatory study.

Considering the recommendation of IEE report, BPDB has selected the site of Rampal covering Sapmari-Katakhali, and Kaigar Daskati Mauza of Rajnagar and Union. The project area has also been reconciled optimizing the land requirement after the findings of IEE report to ensure minimum displacement of local people. The final area is 1,834 acre that may evacuate around 150 households. The Rampal site satisfies all the criteria of site selection in compare to other site like Labanchara, Khulna. However, the existing navigability of the Passur river might not allow the mother vessel to anchor near site. It may require engagement of purpose built coal carrier (barge) or lighterage of shallower draught for coal transportation from Deep Draught Anchorage (Akram point) to project site.

The proposed coal based thermal power plant will be of two units (2x660 MW) of supercritical pulverized coal boiler type with another extension of 1,320 MW in future. Besides, it also includes residential and social facilities, water treatment plant, sub-station, Jetty, coal handling system and coal silo, ash handling and disposal facilities, and switchyard including substation. The project design and technology to be used will be reconciled with the DoE standard. As per findings and recommendation of the EIA study, the feasibility study team-NTPC, will prepare the final plan and design of the project.

In order to fulfill objectives, the existing environmental and socio-economic condition, detail assessment was made to prepare environmental and socioeconomic baseline condition. Flat topography with some low lying areas, tidal flushing, exposure to cyclone and storm surge, rural setting with dominating shrimp aquaculture land, scattered mangrove, and migratory routes of Dolphin are the noteworthy aspect of existing environmental condition of the study

area. Poor transportation and road network, vulnerability to cyclone, and shrimp farming the primary occupation are the key socioeconomic characteristics of the study area.

Attempts were made to assess all the predicted environmental and social impacts with evaluating the nature, temporal and spatial extent, reversibility and likelihood of the predicted impacts. Finally, the predicted impacts were summarized in a qualitative scale of consequence. The assessment includes impacts on physical setting, impacts on air quality, impacts on water resources, impacts on land and agricultural resources, impacts on fisheries, impacts on ecosystem resources, and impacts on socio-economic environment.

Displacement of households for land acquisition, acquisition of shrimp farming pond and agricultural land, discharge of thermal plume and emission of pollutant gaseous within the standard limit are the key predicted impacts.

Acquisition of agricultural land (shrimp farming and rice cultivation land) and some homestead settlements are the key impacts during pre-construction phase that requires proper compensation, resettlement and rehabilitation.

Negative impact during construction phase includes air and noise pollution, disruption to water resources, disturbance to fisheries habitat, removal of existing mangrove along the Passur river at site and disturbance to society due to increase of noise level. On the contrary, the construction works will create employment opportunity and better livelihood to local people. The sediment concentration of the Passur river might be increased if the suggested sedimentation runoff measures are not adopted and proper dredging are not carried out during construction phase.

The proposed project has been planned with compliance to ECR, 1997. The stack height shall be 275 m as per the rule. The emission rate for Particulate Matter (100 µg/Nm^3), SO_2 (819 g/s) and NO_X (490 g/s) shall satisfy the emission standards. The dispersion model (SCREEN 3.0.0) estimates that the maximum ground level concentration (after 24 hour) for SO_2 and NO_X would be 107.56 µg/m^3 and 64.2 µg/m^3 respectively at 1.5 km downwind from the stack point. The resultant concentration in the air satisfy MoEF's standard and it would not be significant to cause air pollution. The resultant concentration of the SO_2 and NO_2 in the ambient air of Sundarbans has estimated to be miniscule which would not be significant causing any impact on the ecosystem of Sundarbans.

It is not very likely that the long term ground level concentration of the SOx, NOx, SPM will increase during operational phase of the thermal power plant as the pollutant concentration in emission is very low and depression and cyclone is very regular phenomenon in this region. Unstable atmosphere will dilute the possibility of acid rain.

The plant adopts closed cycle cooling system. It has been accounted that power plants will intake about 9,150 m^3/hr in total and discharge about 5,150 m^3/hr after treatment. Hence, no thermal plume shall be discharged to the river. The project has been planned provided with an integrated water management including central effluent treatment plant, recycling and reuse of water, sludge and slurry disposal system, etc. No waste water shall be discharged to river without satisfying MoEF's Standard (ECR 1997). Hence, there may not be any major impact on surface water quality. The required water can easily be taken from Passur river which only 1% at the river lowest ebb tide. Therefore, it causes no significant

impact on aquatic flora and fauna. There is no anticipated significant impact on ground water resources during plant operation as the domestic and other activities will be fulfilled from the supply of Passur River after treatment. The project also plans rain water harvesting system for the use of domestic and other plant purposes.

The proposed project will have certain adverse impact on the fish habitat in the project area due to the direct alteration of physical setup of habitats. Minor impact on fish might be noticed only during dredging activities. During plant operation, there may not be any major impact on fish of Passur river as the plants adopt 'No Discharge of Thermal Plume and No Discharge of Waste Water without satisfying MoEF's Standard Strategy'. Fish mortality may hardly be noticed at water intake structure due to installation of fish saving devices. In addition, EMP implementation and public awareness growing and declaration of fish sanctuary may conserve and protect the fishes.

Impact on ecosystem will also be minimum due to adoption of different pollution abatement measures. No thermal plume shall be discharged to the river which is the major issue in case of any thermal power plant. Ash collection and management system comprise of Electrostatic Precipitator (ESP) that have 99.9% efficiency to arrest fly ash. Hence, ash deposition on the surrounding ecosystem habitat and components may be minor. Nevertheless, there may be risk of accidental release of ash particles, chemical and fire explosion for which the safety measure and hazard management plan have been prescribed in the hazard and risk assessment sections.

With the purpose of identifying environmental concern needed to consider during planning and designing of the plant, hazard and risk assessment has also been carried out in the scope of EIA. The risk of potential hazards includes mechanical, electrical, chemical, fire and explosion, and risk of failure mode. The assessment has been made with identifications of specific safety measures. Besides, occupational health and safety assessment has been carried out with extensive safety plan. At the end a hazard management plan including Fire safety, Explosion safety, Electrocution safety, Health safety, Hazardous material management plan with emergency preparedness have been established. The study also recommends setting up of a team for safety monitoring and emergency preparedness.

Impact of plant operation on Sundarbans Ecosystem may be minor as the forest is located 14 km southwestwards of the plant. The world heritage site is 70 km south of the plant location. The prevailing wind mostly flows northward. Only, during November to February, wind flows southeastwards. Hence, emissions reach the Sundarbans will remain within the MoEF standard and likelihood of any negative impact on the forest is insignificant.

Coal transportation route from source country to project site may cross Sundarbans areas, have minor impact on Sundarbans ecosystem. During transportation and transshipment across the Sundarbans, noise, oil spillage, discharge of ballast water, dropping of coal during transshipment, which are strictly prohibited by the ECR 1997 and IMO conventions signed by the GOB which should be inspected and spot checked properly by the relevant authority to control the pollution causing activities. Management plan and mitigation measures as suggested in the EMP have to be implemented to mitigate the impact and to limit the pollution causing activities.

Coal transportation may have impact on Dolphins and their activities. However, the impact would be minor as the shipping and barging activities shall be operated along the existing navigational route. Management plan has been formulated to avoid impacts on Dolphin communities as minimum as possible that shall be followed during coal transportation.

In contrary, the proposed coal based power generation will reduce the dependency of power generation on our limiting natural gas reserve. The proposed project will create enormous potentiality of economic and social development of the region. The present electricity crisis and rising electricity demand urge installation of new power plant. It will offer large number of job opportunity during its life time where the local people will get priority. The potential benefits of the project will compensate the negative impact if the prescribed EMP were implemented and compensation were paid to the affected person.

16.2 Recommendations

Finally, the following recommendations are made on the basis of IEE and EIA study that should be considered for achieving the goal of optimum minimum environmental impact and optimum benefits:

- Proper Resettlement and Rehabilitation plan is necessary for proper compensation to Project Affected People
- People (not owner) dependent on the land to be acquired should also be compensated and created scope for alternative livelihoods
- Findings and suggestion of EIA study in project planning, design and operation should be considered and implement with strong monitoring
- FGD system should be installed in case coal having high sulfur content (more than 0.6%) where the cost will be compensated by environmental and social benefit
- All activities (pre-construction, construction and post-construction stage) should be implemented according to EMP
- Environmental Management Plan and, Hazard and Safety Management Plan should be implement at every suggested steps of plant construction and operation
- Establishing Institutional arrangement with proper logistic and training for Environment, Health and Safety in Project Management Unit during pre-construction, construction and operation phases of the project
- The surrounding and inter tidal area of the project area should be brought under green-belt activities trough afforestation
- Special care should be taken for Dolphin community protection as per EMP
- Relevant national laws and IMO conventions signed by the GOB should be enforced properly by the relevant authorities (MPA, DG Shipping, BIWTA, etc); accordingly, the Coal Transportation Agency should oblige the relevant laws and conventions
- Environmental Management Plan has been formulated considering anticipated impacts. However, further updating of impact management procedure must be made with respect to spatial and temporal regularly based on monitoring of impacts during construction and operation of the project

- It is suggested to conduct a further detail study to prepare an Environmental Action Plan (EAP) and Environmental Management Framework (EMF) for Sundarbans Ecosystem and Biodiversity during detail design of the project (after engagement of the EPC contractor). EMP implementation during construction and operation of the power plant shall be followed by the EAP and EMF
- The plant should be operated ensuring all pollution abatement measures e.g. ESP, FGD (in case of Sulphur contain more than 0.6%), Low NOx burner, effluent treatment plant, etc are in order and regular monitoring has to be done to evaluate their performance

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Appendix I: Schedule 2 to 11 of ECR, 1997

SCHEDULE – 2

Standards for Air
[See Rule 12]

Density in microgram per cusec meter

Sl. No.	Categories of Area	Suspended Particulate Maters (SPM)	Sulphur-dioxide	Carbon Monoxide	Oxides Nitrogen
a.	Industrial and mixed	500	120	5000	100
b.	Commercial and mixed	400	100	5000	100
c.	Residential and rural	200	80	2000	80
d.	Sensitive	100	30	1000	30

Notes:

(1) At national level, sensitive area includes monuments, health center, hospital, archeological site, educational institution, and government designated areas (if any).

(2) Industrial units located in areas not designated as industrial areas shall not discharge pollutants which may contribute to exceeding the standard for air surrounding the areas specified at Sl. nos. c and d above.

(3) Suspended Particulate Matter means airborne particles of a diameter of 10 micron or less.

SCHEDULE – 3

Standards for Water
[See Rule 12]

(A) Standards for inland surface water

Best Practice based classification	Parameter			
	pH	**BOD mg/l**	**DO mg/l**	**Total Coliform number/100**
a. Source of drinking water for supply only after disinfecting:	6.5-8.5	2 or less	6 or above	50 or less
b. Water usable for recreational activity :	6.5 – 8.5	3 or less	5 of more	200 or less
c. Source of drinking water for supply after conventional treatment :	6.5 – 8.5	6 of less	6 or more	5000 or less
d. Water usable by fisheries:	6.5 – 8.5	6 of less	5 or more	---
e. Water usable by various process and cooling industries :	6.5 – 8.5	10 or less	5 or more	5000 or less
f. Water usable for irrigation:	6.5 – 8.5	10 or less	5 or more	1000 or less

Notes:

1. In water used for pisiculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.
2. Electrical conductivity for irrigation water – 2250 μmhoms/cm (at a temperature of 25°C); Sodium less than 26%; boron less than 0.2%.

(B) Standards for drinking water

Sl. No.	Parameter	Unit	Standards
1	2	3	4
1.	Aluminum	mg/l	0.2
2.	Ammonia (NH_3)	,,	0.5
3.	Arsenic	,,	0.05
4.	Balium	,,	0.01
5.	Benzene	,,	0.01

1	2	3	4
6.	BOD_5 20°C	,,	0.2
7.	Boron	,,	1.0
8.	Cadmium	,,	0.005
9.	Calcium	,,	75
10.	Chloride	,,	150 – 600*
11.	Chlorinated alkanes		
	carbontetrachloride	,,	0.01
	1.1 dichloroethylene	,,	0.001
	1.2 dichloroethylene	,,	0.03
	tetrachloroethylene	,,	0.03
	trichloroethylene	,,	0.09
12.	Chlorinated phenols		
	- pentachlorophenol	mg/l	0.03
	- 2.4.6 trichlorophenol	,,	0.03
13.	Chlorine (residual)	,,	0.2
14.	Chloroform	,,	0.09
15.	Chromium (hexavalent)	,,	0.05
16.	Chromium (total)	,,	0.05
17.	COD	,,	4
18.	Coliform (fecal)	n/100 ml	0
19.	Coliform (total)	n/100 ml	0
20.	Color	Hazen unit	15
21.	Copper	mg/l	1
22.	Cyanide	,,	0.1
23.	Detergents	,,	0.2
24.	DO	,,	6
25.	Fluoride	,,	1
26.	Hardness (as $CaCO_3$)	,,	200 – 500
27.	Iron	,,	0.3 – 1.0
28.	Kjeldhl Nitrogen (total)	,,	1
29.	Lead	,,	0.05

1	2	3	4
30.	Magnesium	,,	30 – 35
31.	Manganese	,,	0.1
32.	Mercury	,,	0.001
33.	Nickel	,,	0.1
34.	Nitrate	,,	10
35.	Nitrite	,,	<1
36.	Odor	,,	Odorless
37.	Oil and grease	,,	0.01
38.	pH	,,	6.5 – 8.5
39.	Phenolic compounds	,,	0.002
40.	Phosphate	,,	6
41.	Phosphorus	,,	0
42.	Potassium	,,	12
43.	Radioactive materials (gross alpha activity)	Bq/l	0.01
44.	Radioactive materials (gross beta activity)	Bq/l	0.1
45.	Selenium	mg/l	0.01
46.	Silver	,,	0.02
47.	Sodium	,,	200
48.	Suspended particulate matters	,,	10
49.	Sufide	,,	0
50.	Sulfate	,,	400
51.	Total dissolved solids	,,	1000
52.	Temperature	°C	20-30
53.	Tin	mg/l	2
54.	Turbidity	JTU	10
55.	Zinc	mg/l	5

SCHEDULE – 4

Standards for Sound
[See Rule 12]

Sl. No.	Category of areas	Standards determined at dBa unit Day	Night
a.	Silent zone	45	35
b.	Residential area	50	40
c.	Mixed area	60	50
	(mainly residential area, and also simultaneously used for commercial and industrial purposes)		
d.	Commercial area	70	60
e.	Industrial area	75	70

Notes:

1. The time from 6 a.m. to 9 p.m. is counted as daytime.

2. The time from 9 p.m. to 6 a.m. is counted as night time.

3. Area up to a radius of 100 meters around hospitals or educational institutions or special institutions/ establishments identified/to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.

SCHEDULE – 5

Standards for Sound originating from Motor Vehicles or Mechanized Vessels

[See Rule 12]

Category of Vehicles	Unit	Standards	Remarks
*Motor Vehicles (all types)	dBa	85	As measured at a distance of 7.5 meters from exhaust pipe.
		100	As measured at a distance of 0.5 meter from exhaust pipe.
Mechanized Vessels	dBa	85	As measured at a distance of 7.5 meters from the vessel which is not in motion, not loaded and is at two thirds of its maximum rotating speed.
		100	As measured at a distance of 0.5 meter from the vessel which is in the same condition as above.

* At the time of taking measurement, the motor vehicle shall not be in motion and its engine conditions shall be as follows:-

(a) Diesel engine – maximum rotating speed.

(b) Gasoline engine –at two thirds of its maximum rotating speed and without any load.

(c) Motorcycle – If maximum rotating speed is above 5000 rpm; two-thirds of the speed, and if maximum rotating speed is less than 5000 rpm, three-fourth of the speed.

SCHEDULE – 6

Standards for Emission from Motor Vehicles
[See Rule 12]

Parameter	Unit	Standard Limit
Black Smoke	Hartridge Smoke Unit (HSU)	65
Carbon Monoxide	gm/k.m. percent area	24 04
Hydrocarbon	gm/k.m. ppm	02 180
Oxides of Nitrogen	gm/k.m. ppm	02 600

* As measured at two thirds of maximum rotating speed.

SCHEDULE – 7

Standards for Emission from Mechanized Vessels
[See Rule 12]

Parameter	Unit	Standard Limit
Black Smoke*	Hartridge Smoke Unit (HSU)	65

* As measured at two thirds of maximum rotating speed.

SCHEDULE – 8

Standards for Odor

[See Rule 12]

Parameter	Unit	Standard Limit
Acetaldehyde	ppm	0.5 – 5
Ammonia	,,	1 – 5
Hydrogen Sulfide	,,	0.02 – 0.2
Methyl Disulfide	,,	0.009 – 0.1
Methyl Sulfide	,,	0.01 – 0.2
Styrene	,,	0.4 – 2.0
Trim ethylamine	,,	0.005 – 0.07

Notes :

(1) Following regulatory limit shall be generally applicable to emission/exhaust outlet pipe of above 5 meter height:

$Q = 0.108 \times He^2Cm$ (Where Q = Gas Emission rate Nm^3/hour)
He = Height of exhaust outlet pipe (m)
Cm = Above mentioned limit (ppm)

(2) In cases where a special parameter has been mentioned, the lower limit shall be applicable for warning purposes, and the higher limit shall be applicable for prosecution purpose or punitive measure.

SCHEDULE – 9

Standards for Sewage Discharge
[See Rule 12]

Parameter	Unit	Standard Limit
BOD	miligram/l	40
Nitrate	,,	250
Phosphate	,,	35
Suspended Solids (SS)	,,	100
Temperature	Degree Centigrade	30
Coliform	number per 100 ml	1000

Notes :

(1) This limit shall be applicable to discharges into surface and inland waters bodies.
(2) Sewage shall be chlorinated before final discharge.

SCHEDULE – 10

Standards for Waste From Industrial Units or Projects Waste
[See Rule 13]

Sl. No.	Parameter	Unit	Places for determination of standards		
			Inland Surface Water	Public Sewerage system connected to treatment at second stage	Irrigated Land
1	2	3	4	5	6
1	Ammonical Nitrogen (as elementary N)	mg/l	50	75	75
2	Ammonia (as free ammonia)	,,	5	5	15
3	Arsenic (as)	,,	0.2	0.05	0.2
4	BOD_5 at 20°C	,,	50	250	100
5	Boron	,,	2	2	2

1	2	3	4	5	6
6	Cadmium (as CD)	,,	0.50	0.05	0.05
7	Chloride	,,	600	600	600
8	Chromium (as total Cr)	,,	0.5	1.0	1.0
9	COD	,,	200	400	400
10	Chromium (as hexavalent Cr)	,,	0.1	1.0	1.0
11	Copper (as Cu)	,,	0.5	3.0	3.0
12	Dissolved Oxygen (DO)	,,	4.5 – 8	4.5 – 8	4.5 – 8
13	Electro-conductivity (EC)	micro mho/ cm	1200	1200	1200
14	Total Dissolved Solids	,,	2,100	2,100	2,100
15	Fluoride (as F)	,,	2	15	10
16	Sulfide (as S)	,,	1	2	2
17	Iran (as Fe)	,,	2	2	2
18	Total Kjeldahl Nitrogen (as N)	,,	100	100	100
19	Lead (as Pb)	,,	0.1	1.0	0.1
20	Manganese (as Mn)	,,	5	5	5
21	Mercury (as Hg)	,,	0.01	0.01	0.01
22	Nickel (as Ni)	,,	1.0	2.0	1.0
23	Nitrate (as elementary N)	mg/l	10.0	Not yet Fixed	10
24	Oil and Grease	,,	10	20	10
25	Phenolic Compounds (as C_6H_5OH)	,,	1.0	5	1
26	Dissolved Phosphorus (as P)	,,	8	8	15
27	Radioactive substance	To be specified by Bangladesh Atomic Energy Commission			
28	pH		6 – 9	6 – 9	6 – 9
29	Selenium (as Se)	mg/l	0.05	0.05	0.05
30	Zinc (as Zn)	Degree	5	10	10

1	2	3	4	5	6
31	Total Dissolved Solids	,,	2,100	2,100	2,100
32	Temperature	Centig rade	40	40	40-Summer
			45	45	45-Winter
33	Suspended Solids (SS)	mg/l	150	500	200
34	Cyanide (as Cn)	,,	0.1	2.0	0.2

Notes:

(1) These standards shall be applicable to all industries or projects other than those specified under the heading "Standards for sector-wise industrial effluent or emission."

(2) Compliance with these standards shall be ensured from the moment an industrial unit starts trial production, and in other cases, from the moment a project starts operation.

(3) These standards shall be inviolable even in case of any sample collected instantly at any point of time. These standards may be enforced in a more stringent manner if considered necessary in view of the environmental conditions of a particular situation.

(4) Inland Surface Water means drains/ponds/tanks/water bodies/ ditches, canals, rivers, springs and estuaries.

(5) Public sewerage system means treatment facilities of the first and second stage and also the combined and complete treatment facilities.

(6) Irrigable land means such land area which is sufficiently irrigated by waste water taking into consideration the quantity and quality of such water for cultivation of selected crops on that land.

(7) Inland Surface Water Standards shall apply to any discharge to a public sewerage system or to land if the discharge does not meet the requirements of the definitions in notes 5 and 6 above.

SCHEDULE – 11

Standards for Gaseous Emission from Industries or Projects

[See Rule 13]

Sl.No.	Parameters	Standard present in a unit of mg/Nm^3
1	2	3
1.	Particulate	
(a)	Power plant with capacity of 200 Megawatt or above.	150
(b)	Power plant with capacity less than 200 Megawatt.	350
2.	Chlorine	150
3.	Hydrochloric acid vapor and mist	350
4.	Total Fluoride F	25
5.	Sulfuric acid mist	50
6.	Lead particulate	10
7.	Mercury particulate	0.2
8.	Sulfur dioxide	kg/ton acid
(a)	Sulfuric acid production (DCDA* process)	4
(b)	Sulfuric acid production (SCSA* process)	10
(* DCDA: Double Conversion, Double Absorption; SCSA: Single Conversion, Single Absorption.)		
Lowest height of stack for dispersion of sulfuric acid (in meter).		
(a)	Coal based power plant	
(1)	500 Megawatt or above	275
(2)	200 to 500 Megawatt	220
(3)	Less than 200 Megawatt	$14(Q)^{0.3}$
(b)	Boiler	
(1)	Steam per hour up to 15 tons	11
(2)	Steam per hour more that 15 tons	$14(Q)^{0.3}$
[Q = Emission of Sulfur dioxide (kg/hour)].		

1	2	3
9.	Oxides of Nitrogen	
(a)	Nitric acid production	3 kg/ton acid
(b)	Gas Fuel based Power Plant	50 ppm
	(1) 500 Megawatt or above	50 ppm
	(2) 200 to 500 Megawatt	40 ppm
	(3) Below 200 Megawatt	30 ppm
(c)	Metallurgical oven	200 ppm
10.	Kiln soot and dust	mg/Nm^3
(a)	Blast Furnace	500
(b)	Brick Kiln	1000
(c)	Coke oven	500
(d)	Lime Kiln	250

Appendix II: No Objection Certificate from Civil Aviation Authority of Bangladesh

সংশোধিত

বাংলাদেশ বেসামরিক বিমান চলাচল কর্তৃপক্ষ
সদর দপ্তর, কুর্মিটোলা, ঢাকা
এটিএস এন্ড এরোড্রম বিভাগ

নং- সিএএবি/এ-এ/এটিএস/১৫০১/২১-৫/০৯(অংশ-১)/ ৯৬২ তারিখঃ ২২/১০/২০১০খৃঃ।

প্রতি,
প্রকল্প পরিচালক,
(অতিঃ প্রধান প্রকৌশলী),
বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড,
চট্টগ্রাম ও খুলনা ১৩০০x২ মেঃ ওঃ কয়লাভিত্তিক
তাপ বিদ্যুৎ কেন্দ্র নির্মাণ প্রকল্প,
বিউবো, ঢাকা।

বিষয়ঃ প্রস্তাবিত চট্টগ্রাম ও খুলনা ১৩০০x২ মেঃ ওঃ কয়লা ভিত্তিক তাপ বিদ্যুৎ কেন্দ্রের চিমনী নির্মাণে উচ্চতার ছাড়পত্র প্রসংগে।

সূত্র ঃ (ক) স্মারক নং- ১১/প্রঃপ্রঃচঃখুঃ/কভিতাবিকেনিঃপ্রঃ/বিউবো/২০১০, তারিখ- ০৩/০৫/২০১০খ্রিঃ।

(খ) নং- সিএএবি/এ-এ/এটিএস/১৫০১/২১-৫/০৯(অংশ-১)/৯০৯, তারিখ- ০৭/১০/২০১০খ্রিঃ।

উপরোক্ত বিষয়ে সূত্রে বর্ণিত স্থানদ্বয়ের মধ্যে 'ক' বাগেরহাট জেলার রামপাল উপজেলাধীন (অবস্থান ২২ ৩৬ ০৫.৭৬ উত্তর ৮৯ ৩৩ ৪২.২৬ পূর্ব) সাপমারি কাটাখালি ও কৈগরদাসকাটি মৌজা-এর উপর চাহিদাকৃত অর্থাৎ ভু-পৃষ্ঠ হইতে ২৭৫মিটার (৯০২ফুট) উচ্চতায় চিমনী নির্মাণে কোন আপত্তি নাই।

চট্টগ্রাম জেলার কর্ণফুলী উপজেলার (অবস্থান ২৩° ১৩´ ৪১.৯৪´´ উঃ, ৯১° ৪৯´ ১০.৫৯´´পূঃ) মাঝেরচর, পশ্চিম তুলাতলী, গোবাদিয়া ও ফুলতলী মৌজা ও আনোয়ারা উপজেলাধীন দুদকোমড়া মৌজা-এর অবস্থানে ভূ-পৃষ্ঠ হইতে সর্বোচ্চ ৫০০(পাঁচশত)ফুট উচ্চতার চিমনী তৈরীর অনুমোদন দেওয়া যায় তবে চাহিদাকৃত উচ্চতা প্রদান করিতে হইলে বর্তমান অবস্থানের পরিবর্তে বিমান বন্দর হইতে দক্ষিণ পূর্ব দিকে কমপক্ষে ২০কিঃ মিঃ দুরে সরাইয়া চিমনী নির্মাণ করিতে হইবে।

উভয় চিমনীদ্বয়কে সমান সাতভাগ করতঃ নীচু হইতে পর্যায়ক্রমে লাল/ সাদা রং করিতে হইবে এবং নিচু হইতে ৪৫মিঃ বা ১৫০ফুট অন্তর অন্তর হাই ইনটেনসিটি বাতি এবং চিমনীর চুড়া হইতে ১০ফুট নিচে চারপাশে প্রতিবন্ধক বাতি সূর্যাস্ত হইতে সূর্যোদয় পর্যন্ত এবং খারাপ আবহাওয়ায় জ্বালাইয়া রাখিতে হইবে। এতদসংগে সূত্র 'খ' বাতিল বলিয়া গন্য হইবে।

(আজাদ জহিরুল ইসলাম)
পরিচালক(এটিএস এন্ড এরোঃ)চঃ দাঃ
বেসামরিক বিমান চলাচল কর্তৃপক্ষ।

অনুলিপি ঃ

১। বিমান বন্দর ব্যবস্থাপক, শাহ আমানত আন্তর্জাতিক বিমান বন্দর, চট্টগ্রাম।
২। জেলা প্রশাসক, বাগেরহাট।

Appendix III: Photo Album





Dhaka-Mongla highway which is about 15 Km from project area





Mongla port Area





Typical Landscape in Sapmari Katakhali





Typical landscape in Sapmari katalkhali



Grazing land in Sapmari katakhali



Weeds and reeds growing in fallow land





Typical landscape in Kaigar Daskati occurs in project area



Typical Mangrove bushes along the Maidara River



Typical Mangrove in road side





Typical Mangrove strip along the Passur river



Fisher man boating in Maidara river near project sit at Sapmari katakhali



Navigation in Passur river near Sapmari katakhali



ESBN[18] hauling in Passur river near Sapmari katakhali



ESBN hauling in Maidara river near Sapmari katakhali



Hilsa Net hauling in Passur river Near Sapmari katakhali



Catch net fishing in Maidara river near Sapmari katakhali



Buffalo grazing on river bank of Maidara river



Buffalo grazing in fallow land in Sapmari katakhali

[18] ESBN - Estuary Set Bag Net





Bhaga to Sapmari katakhali road to be reconstructed for project purpose by LGED



Dolphin surfacing in Maidara river near Sapmarikatakhali



Heron feeding on agricultural land in Sapmarikatakhali

Appendix IV: Design, Layout Plans Implementation Schedule and Organogram of the Proposed Thermal Power Plant

- General Layout Plan
- Equipment Layout Plan
- Equipment Layout Plan
- Main Plan Cross-Section
- Water Balance Diagram
- Project Implementation Schedule
- Organogram of the Power Plant

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Other buildings
Village
Huts
Graves, Tomb
Mosque, Idgah, Church, Temple
Hospital, Dispensary
Educational institution
Tidal river
River bank, high
Undefined bank
Marsh
Irrigation canal a
Mud
Perennial/non-per
Well
Lake or pond

Kaigardaskati
Kapasdanga
Rajnagar
Sapmari Katakhali
Sapmari Katakhali

MAIDARA NADI
MAIDARA RIVER

APPROACH ROAD
APPROACH ROAD

TOWNSHIP
AREA=50 ACRE
RL(+)5.00M

ASH POND
AREA=100 ACRE

COAL UNLOADING JETTY

P A S S U R R I V E R

Launch Service
Khulna - Morolia

Sluice Gate

250 M
250 M

NOTES:–

1. ALL DIMENSIONS AND LEVELS AREA IN METRES.
2. FOR DETAILS IN MAIN PLANT BLOCK REFER MAIN PLANT LAYOUT DRAWING NO. 9561–999–POM–F–001.
3. FORMATION LEVEL OF PLANT IS RL(+) 5.00M ABOVE MSL.
4. EL(±)0.00M i.e. PLINTH LEVEL OF MAIN PLANT SHALL BE RL(+)6.00M ABOVE MSL.
5. NATURAL GROUND LEVEL AS SHOWN IN THE DRAWING ARE BASED ON TOPOGRAPHICAL SURVEY DETAIL FURNISHED BY CEGIS/BPDB.

LEGEND:

1. ROADS (DOUBLE LINE) . . . .
   ROADS (SINGLE LINE) . . . .
2. BOUNDARY WALL . . . . . .
3. FENCING . . . . . .
4. LAND BOUNDARY . . . . . .
5. FORMATION LEVEL (PROPOSED) . . . . . RL(+)5.00M
6. SLOPE LINE . . . . . .

AREA STATEMENT	
MAIN PLANT	375 ACRE
TOWNSHIP	50 ACRE
ASH POND	100 ACRE
COAL CONVEYOR CORRIDOR & JEETY	50 ACRE
MW INTAKE	5 ACRE
TOTAL	580 ACRE

N

0 50 100 150 200 250 M
SCALE

FOR FR PURPOSE ONLY

एन टी पी सी NTPC

NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: KHULNA THERMAL POWER PROJECT (2X660MW)

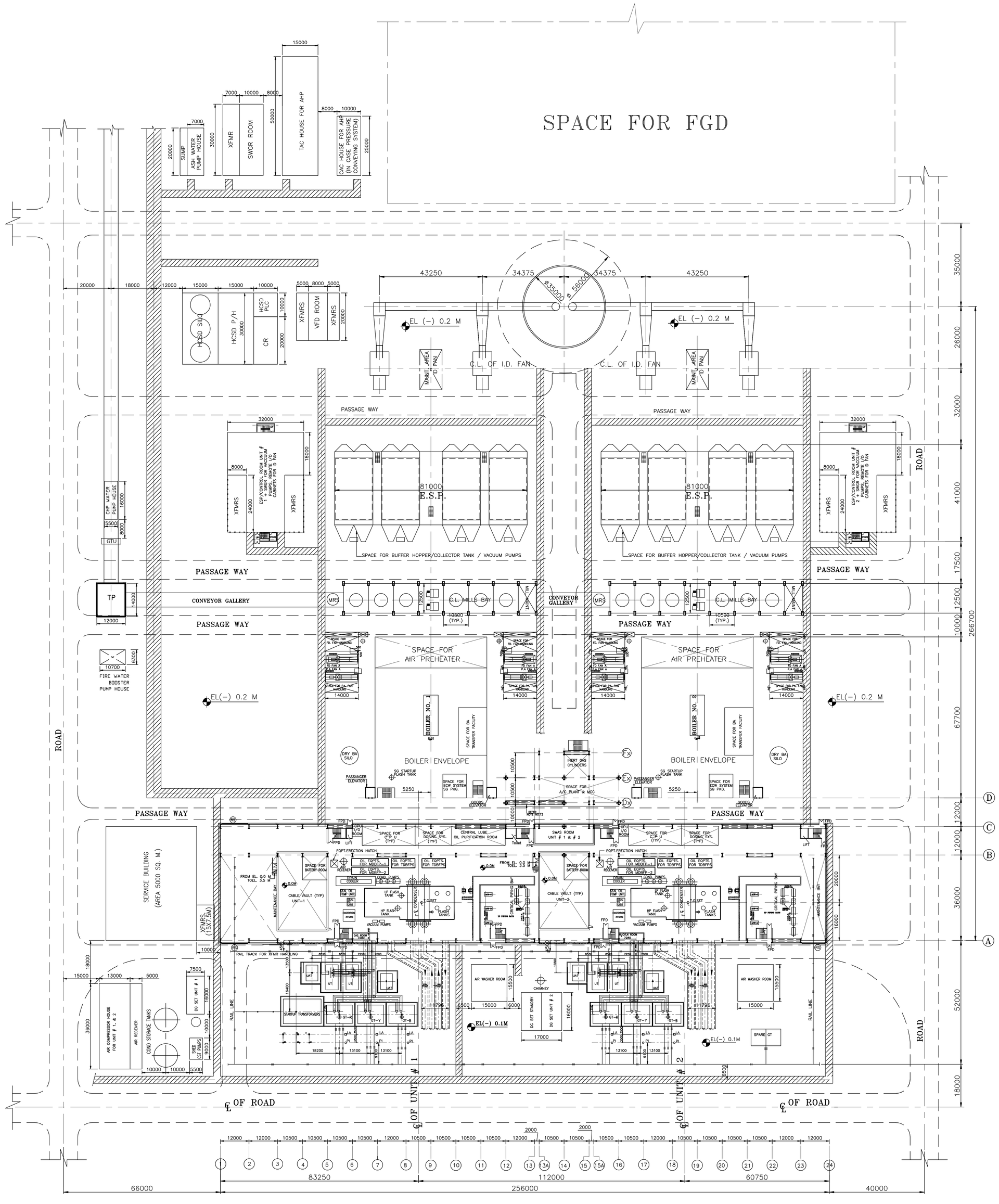
TITLE: GENERAL LAYOUT PLAN

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ES	APPD	DATE
1	REVISED FOR FR PURPOSE BASED ON DISCUSSION WITH BPDB	Raj K.									30.12.11
0	FOR FR PURPOSE ONLY	Raj K.	AP								14.03.11

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A0	1 : 5000	9635–999–POC–F–001	1

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LEGEND

- PIPE HATCH
- VERTICAL BRACING
- FPD — FIRE PROOF DOOR
- GRATING
- CHEQUERED PLATE
- R — REMOVABLE
- HAND RAILING
- PIPE & CABLE TRESTLE
- FIRE BARRIER WALL

NOTES:-

1. THE EQUIPMENT SHALL BE GENERALLY IN ACCORDANCE WITH THE LAYOUT AND DIMENSIONAL REQUIREMENTS INDICATED IN THESE DRAWINGS. HOWEVER BUILDING SIZES INDICATED ARE MINIMUM REQUIREMENT AND ACTUAL SIZE SHALL BE AS PER FUNCTIONAL REQUIREMENT BUT NOT LESS THAN THOSE INDICATED IN THESE DRAWINGS.
2. NO PIPES, CABLES, STRUCTURES ARE TO BE PLACED BELOW 8.0M (BOP, BOC OR BOS) IN FRONT OF BOILER BETWEEN THE 12.0M CORRIDOR SEPERATING MAIN PLANT AND FIRST ROW OF BOILER COLUMNS (i.e. CD BAY)
3. ALL DOORS ON C– ROW PROVIDED AT 8.5M & 17.0M, INTERCONNECTING WITH BOILER ARE OF DOUBLE DOOR TYPE TO AVOID INGRESS OF DUST TO MAIN PLANT BUILDING.
4. LOCATION OF DOORS/REMOVABLE COVERS SHOWN IN THE DRAWINGS ARE INDICATIVE AND SHALL BE FINALISED DURING DETAILED ENGINEERING.
5. ALL DIMENSIONS ARE IN MM'S AND LEVELS ARE IN METRES.
6. FIRE BARRIER WALL IS PROVIDED ON A–ROW BETWEEN AXIS NO. 3–8, & 13A–18.
7. ALL ELEVATIONS INDICATED IN THE DRG ARE w.r.t. T.G. BUILDING GROUND FLOOR ELEVATION AS(±)0.00M.
   i) FINISHED FLOOR OF PAVING SLAB IN BOILER/ESP/ID FAN AREA SHALL BE (−)0.2M
   ii) FINISHED FLOOR ELEVATION IN MILL BAY AT GROUND LEVEL SHALL BE 0.00M.
   iii) FINISHED FLOOR LEVEL IN X–FMR YARD SHALL BE (−) 0.10M.
   iv) FINISHED FLOOR LEVEL INSIDE CHIMNEY SHALL BE 0.00M.
   v) FINISHED FLOOR LEVEL IN THE VARIOUS BUILDINGS IN MAIN PLANT AREA SHALL BE 0.00M.
8. ALL CABLE SPREADER ROOMS TO BE PROVIDED WITH DRAINAGE ARRANGEMENT.
9. BOTTOM OF STEEL OF PIPE / CABLE RACK IN MILL BAY AREA SHALL BE MINIMUM EL 17.0M.
10. FOR FLY ASH HANDLING EITHER VACUUM PUMPS OR EXTRACTION AIR COMPRESSORS SHALL BE PROVIDED.
11. IN CASE OF VACUUM PUMPS FOR DRY ASH SYSTEM, THESE SHALL BE LOCATED BELOW ESP NEAR IT'S 1ST FIELD. IN CASE OF EXTRACTION AIR COMPRESSORS, THESE ALONG WITH SWGR. ROOM SHALL BE LOCATED ACROSS THE ROAD BEHIND CHIMNEY AS SHOWN IN THE DRAWING.
12. VERTICAL BRACING BETWEEN AXIS NO. 12–13 AT Dx–ROW SHALL BE DESIGNED SO AS TO PROVIDE CLEAR OPENING OF 6000X6000MM FOR MOVEMENT OF EQUIPMENTS.
13. BRICK WALL REQUIREMENTS :
   i) ALL STAIRCASES AT 'A' ROW & 'C' ROW SHALL BE PROVIDED WITH 230 mm THICK BRICK ENCLOSURE.
   ii) ALL CABLE SPREADER ROOM WALLS.
   iii) WALLS OF SWAS ROOM, CPU RIO ROOMS.
   iv) HT/LT SWITCH GEAR ROOMS, BOILER MCC ROOM.
   v) AIR HANDLING UNITS(AHU).
   vi) OIL EQUIPMENT ROOM .
14. RCC WALL : 250 mm THK RCC WALL FROM EL 0.0M TO 0.6M FOR LUBE OIL ROOM.
15. D–ROW IS THE FIRST ROW OF BOILER AND MILL BAY COLUMNS.
16. FOR EXACT LOCATION AND SIZES OF TRANSFORMERS SHOWN IN TRANSFORMER YARD REFER ELECTRICAL LAYOUT DRG. NO. 0000–000–POE–F–003, REV–0.
17. RAIN WATER PIPES SHALL BE ROUTED INSIDE THE COLUMN DEPTH IN ELECTRICAL BAYS AND IP BUSDUCT BAY.

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REV.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	APPD	DATE
		PKL	PA	AG	SC	CLEARED BY			JD	07.03.11
0	RELEASED FOR FR PURPOSE									

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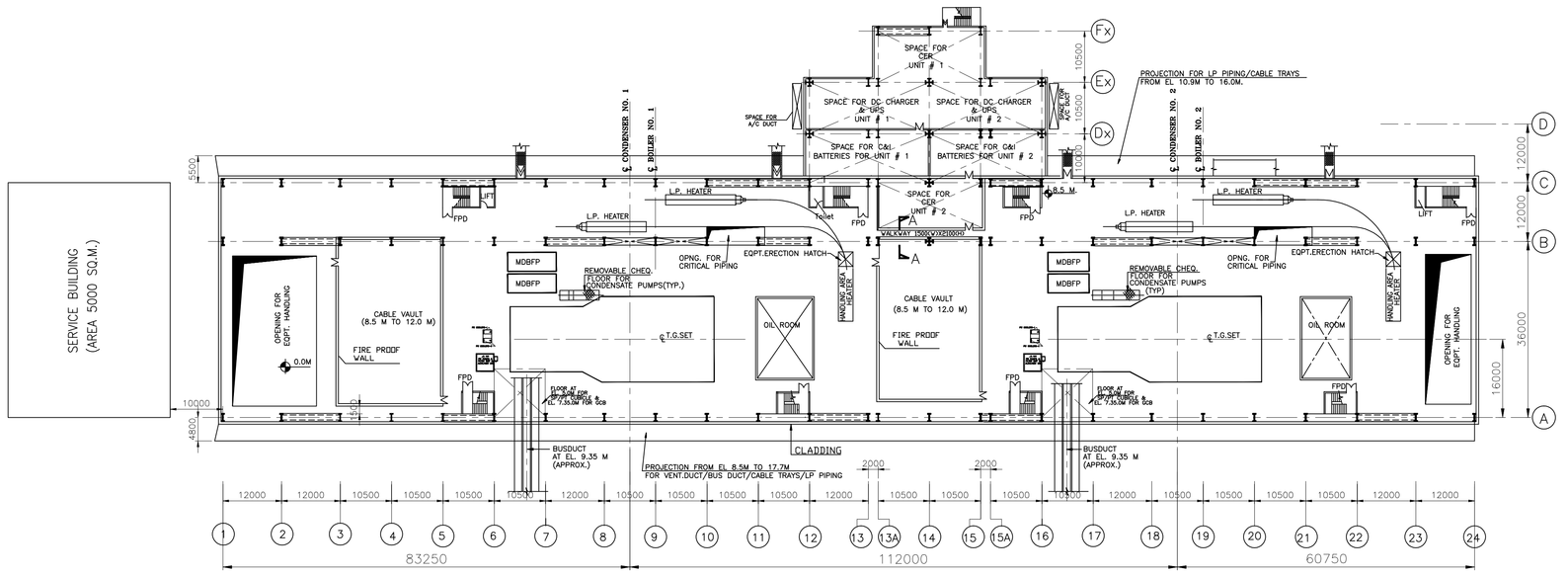
PROJECT: KHULNA THERMAL POWER PROJECT (2x660 MW)

TITLE: EQUIPMENT LAYOUT PLAN AT EL 0.00M.

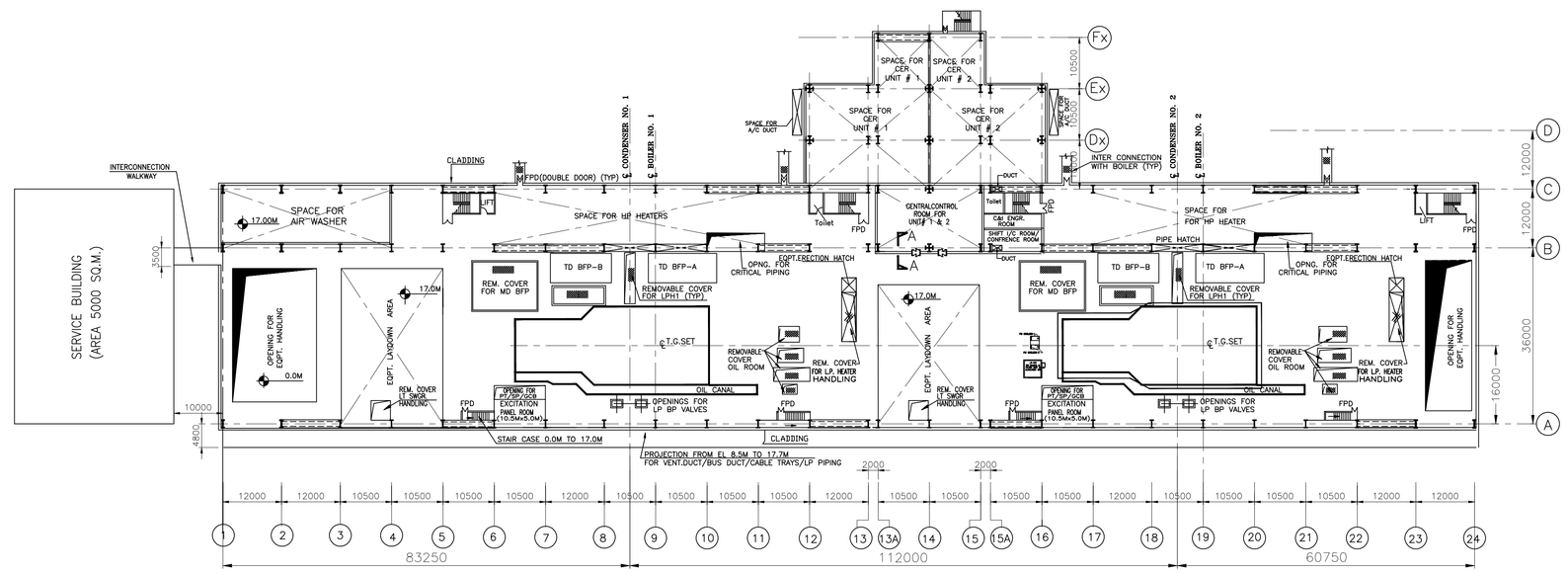
SIZE	SCALE	DRG.NO.	REV.
A–0		9635-999-POM-F-001	0

cad file name : KHULNA TPP–LAY001–2x660MW–FR, 07.03.2011

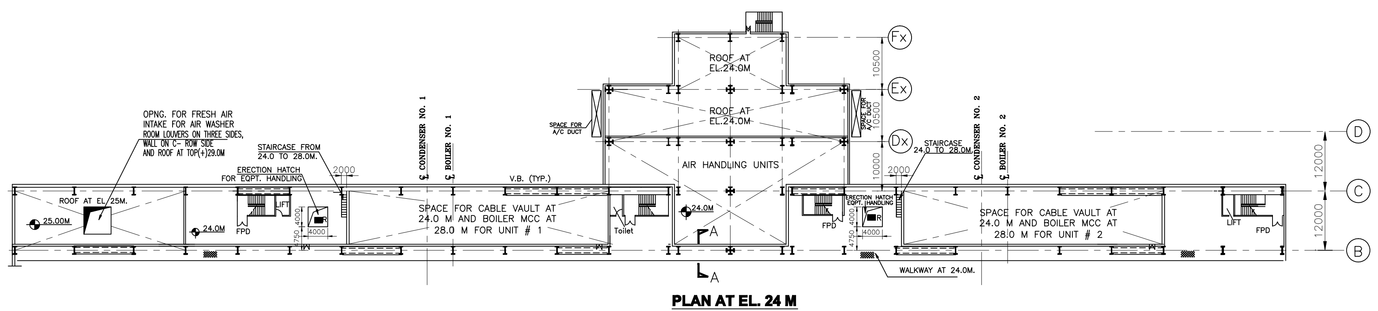
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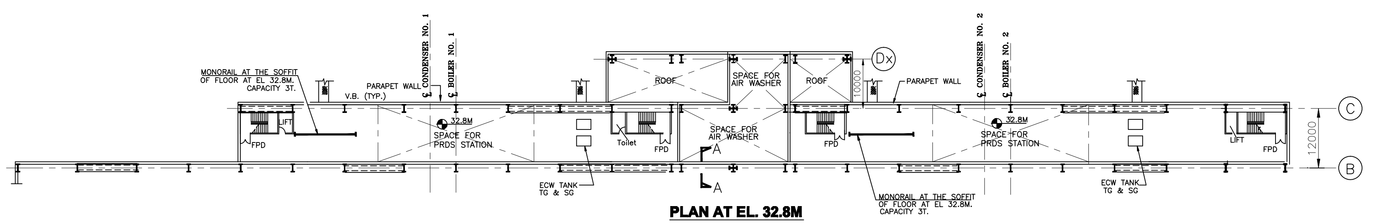
PLAN AT EL. 8.5 M



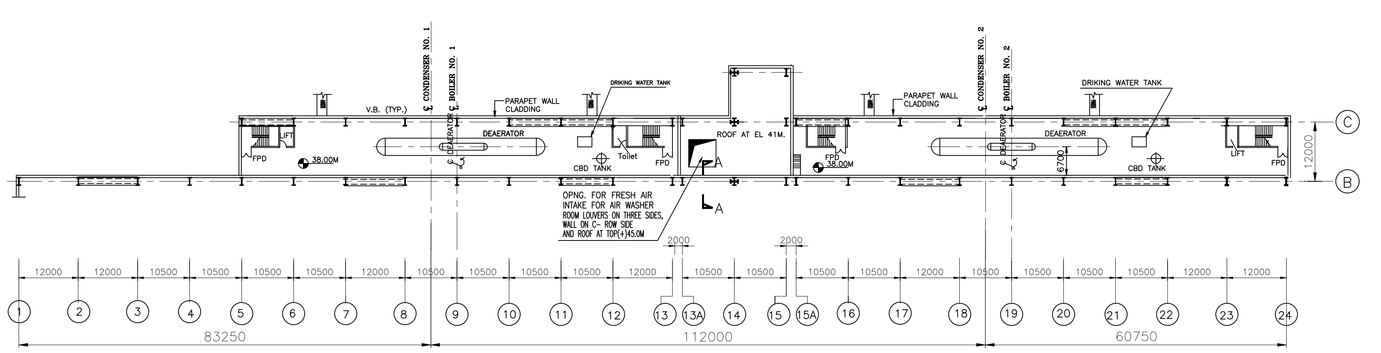
PLAN AT EL. 17.0M



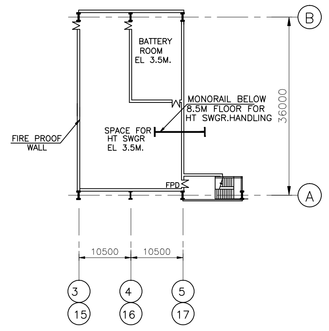
PLAN AT EL. 24 M



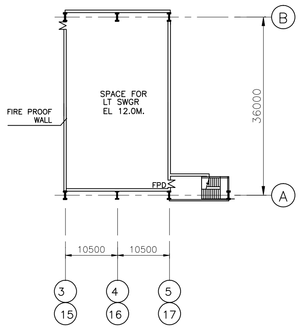
PLAN AT EL. 32.8M



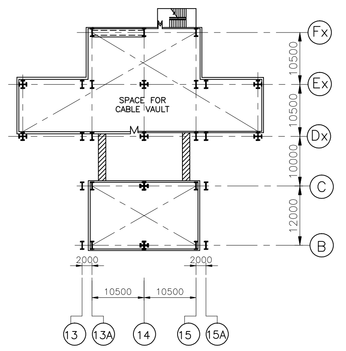
PLAN AT EL. 38.0/41.0 M



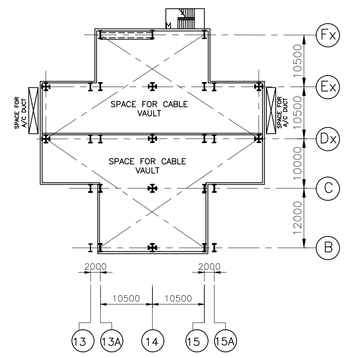
PLAN AT EL. 3.5M



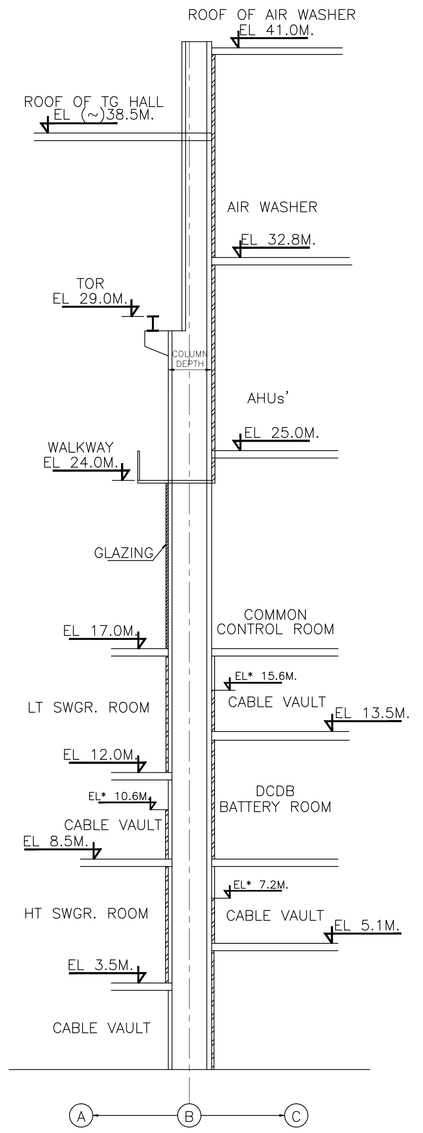
PLAN AT EL. 12.0M



PLAN AT EL 5.1 M



PLAN AT EL. 13.5 M



SECTION A-A (NTS)

*** - ABOVE THESE ELEVATIONS WALL SHALL BE CONSTRUCTED AFTER CABLE ERECTION.**

LEGEND

	PIPE HATCH
	VERTICAL BRACING
FPD	FIRE PROOF DOOR
	GRATING
	CHEQUERED PLATE
R	REMOVABLE
	HAND RAILING
DD	DOUBLE DOOR

NOTES :

1. FOR OTHER NOTES REFER DRG. NO. 9635-999-POM-F-001.
2A. FALSE CEILING LEVEL IN UPS AND BATTERY CHARGER AREA SHALL BE EL 11.50 M i.e. 3.0 M ABOVE THE 8.5 M FLOOR LEVEL.
2B. FALSE CELLING HEIGHT IN CENTRAL CONTROL ROOM AREA SHALL BE 3.65 M. AND FALSE CELLING HEIGHT IN CER AREA SHALL BE 3.0M.
3. BRICKWALL ABOVE FALSE CEILING AT 'B' ROW IN CCR AREA TO BE PROVIDED.
4. NO WATER/STEAM PIPES INCLUDING RAIN WATER DOWNCOMER SHALL BE ROUTED IN CCR/CER/BATTERY/BATTERY CHARGER ROOMS.
5. TO AVOID DUST INGRESS IN THE CCR/CER/UPS ROOM, FOLLOWING SHALL BE ENSURED:
* DOUBLE DOOR ENTRANCE FOR AHU ROOM/ UPS ROOM/CR/CER.
* FRESH AIR FAN FOR AHU ROOM SHALL HAVE SUCTION FROM TG HALL SIDE.
* VENTING DAMPER FOR INERT GAS SYSTEM SHALL BE LOCATED TOWARDS TURBINE HALL SIDE/HEATER SIDE AND NOT ON BOILER SIDE.
6. NO VERTICAL BRACING SHALL BE PLACED INSIDE CER/CCR.
7. EXTENSION/PROJECTION OF CR IN AB BAY SHOULD BE AVOIDED TO THE EXTENT POSSIBLE SO AS TO AVOID OBSTRUCTION IN MOVEMENT OF MATERIAL THROUGH EOT CRANE.
8. DIRECT SUNLIGHT FALLING ON LVS & OWS SHOULD BE AVOIDED BY PROVIDING TINTED GLASS TOWARDS TG HALL(B ROW).
9. ADEQUATE SPACE SHALL BE PROVIDED FOR MAINTAINANCE ENGINEER/C&I ENGINEER ROOM NEAR CONTROL ROOM.
10. FACILITIES LIKE TOILET (LADIES/GENTS) AND CONFERENCE ROOM SHALL BE PROVIDED NEAR THE CONTROL ROOM AS PER NORMS.
11. DEAREATOR ROOF SHALL BE PROVIDE BY OWNER BETWEEN AXIS 7-11 & 19-23. HOWEVER NO ENCLOSURE ON SIDE SHALL BE PROVIDED.
12. LAYOUT OF HP, IP, LP CYLINDERS FOR STEAM TURBINE SHOWN HERE ARE INDICATIVE ONLY.
13. ALL INTERCONNECTION PLATFORM BETWEEN BOILER & TURBINE HALL WHICH ARE LOCATED IN BRACED BAY AT C-ROW SHALL BE CONSIDERED AS LOCATED IN THE CENTRE OF THE BAY.
14. LOCATIONS OF VERTICAL BRACINGS SHOWN HERE ARE INDICATIVE ONLY AND THE SAME SHALL BE FINALIZED DURING DETAIL ENGINEERING.
15. COLUMNS AND MAIN BEAMS IN CRITICAL PIPING BAY SHALL BE PROVIDED TO SUPPORT THE PIPING.

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REV.	DESCRIPTION	DRAWN	DESIGN	CHKD.	L/O	W/S	LPP	MH	SG	E	C	APPD	DATE
		PKL	PA	SC	CLEARED BY								
a	RELEASED FOR FR PURPOSE											JO	03.03.11

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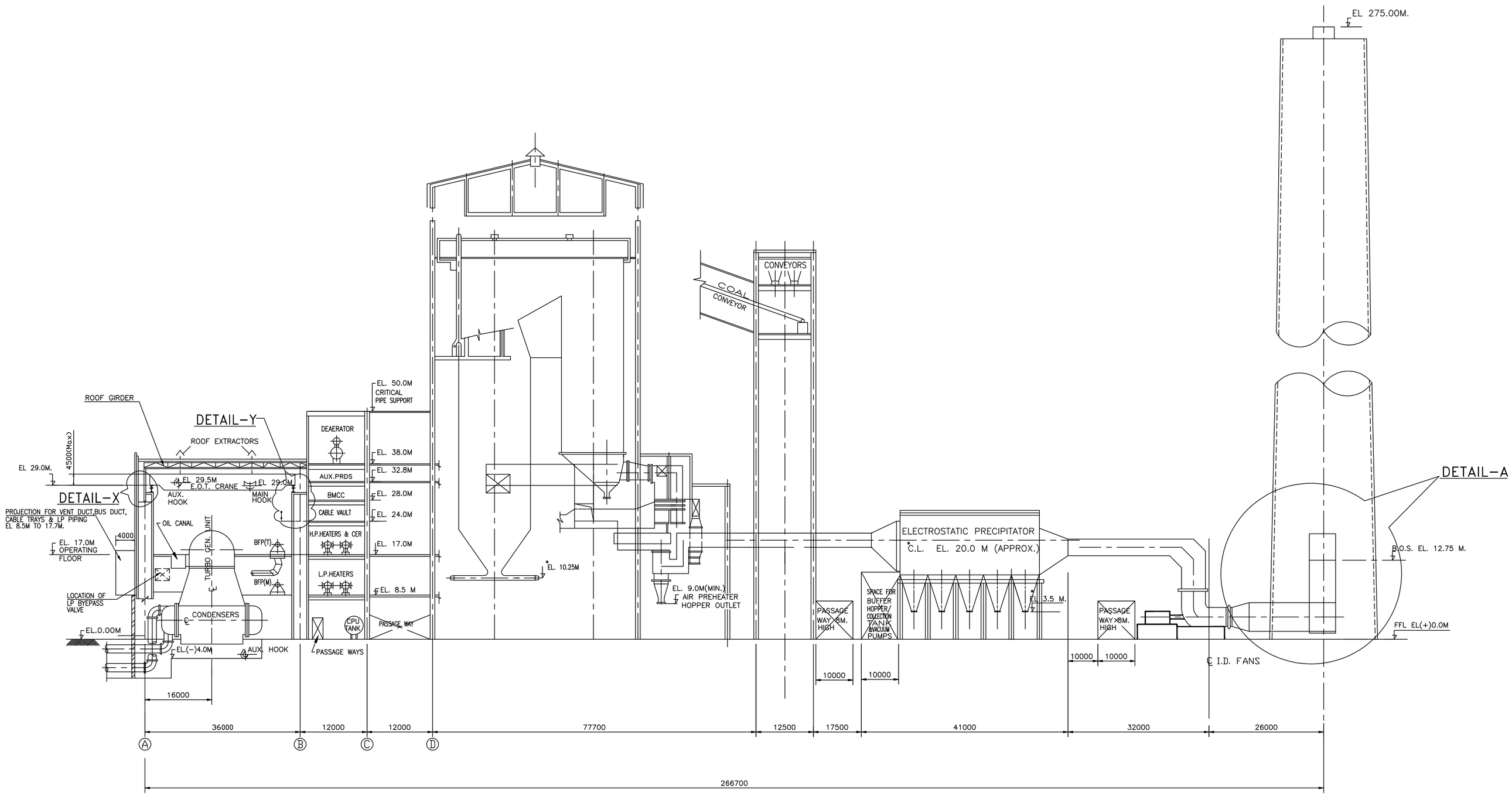
PROJECT: KHULNA THERMAL POWER PROJECT (2x660 MW)

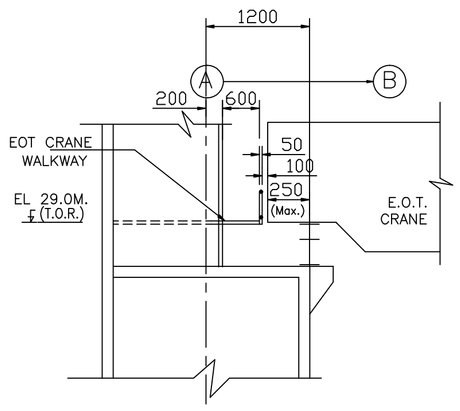
TITLE: EQUIPMENT LAYOUT PLAN AT EL 8.50M./17.0M./24.0M./32.8M./38.0M.

SIZE	SCALE	DRG.NO.	REV.
A0		9635-999-POM-F-002	a

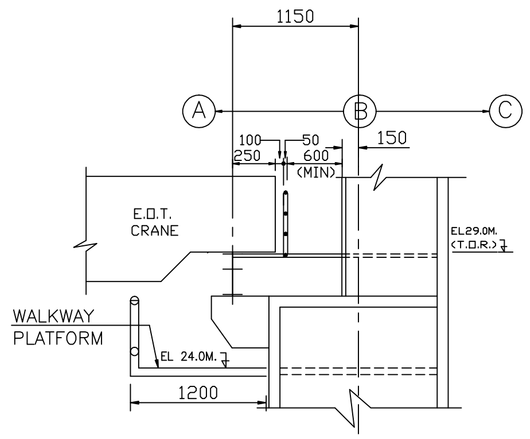
cad file name : 9635-999-POM-F-002.dwg, 03.03.11

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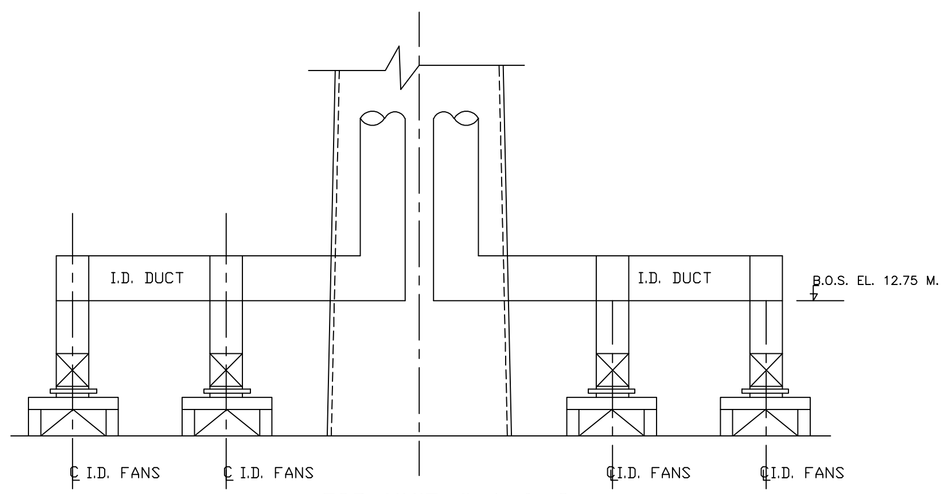




DETAIL-X



DETAIL-Y



FOR UNIT # 1 & 2
(LOOKING TOWARDS TG BUILDING)
(INDICATIVE VIEW- NOT TO SCALE)

DETAIL-A

NOTES

1. THE LAYOUT & TYPE OF BOILER AND CONDENSOR SHOWN HERE IS INDICATIVE ONLY. HOWEVER THE ELEVATIONS MARKED (*) ARE THE MINIMUM LEVELS & TO BE FOLLOWED BY THE BIDDER.
2. E.O.T. CRANE OPERATOR'S CABIN SHALL BE ON B – ROW SIDE AND D.S.L. FOR THE CRANE SHALL BE ON A– ROW SIDE.
3. FOR OTHER NOTES REFER DRG. NO. 9635–999–POM–F–001.
4. NUMBER OF HP HEATERS SHOWN HERE ARE INDICATIVE ONLY. ACTUAL NUMBER OF HP HEATERS SHALL BE AS PER CYCLE OPTIMISATION BY THE BIDDER.
5. MAIN/AUX. HOOK LEVELS OF EOT CRANE INDICATED IN THE DRAWING ARE TENTATIVE. BIDDER SHALL CONFIRM THESE LEVELS AFTER CHECKING THE ACTUAL REQUIREMENTS OF EQUIPMENT HANDLING OVER OPERATING FLOOR.
6. B.O.S. FOR THE FLUE GAS DUCT FROM THE I.D. FAN (PERPENDICULAR TO BOILER AXIS) TO CHIMNEY SHALL BE MINIMUM EL 12.75M.

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REV.NO.	DESCRIPTION	PKL DRAWN	PA DESIGN	AG CHKD.	SC M	E	C	C&I	N/A ARCH.	JD APPD	DATE
0	RELEASED FOR FR PURPOSE				CLEARED BY						03.03.11

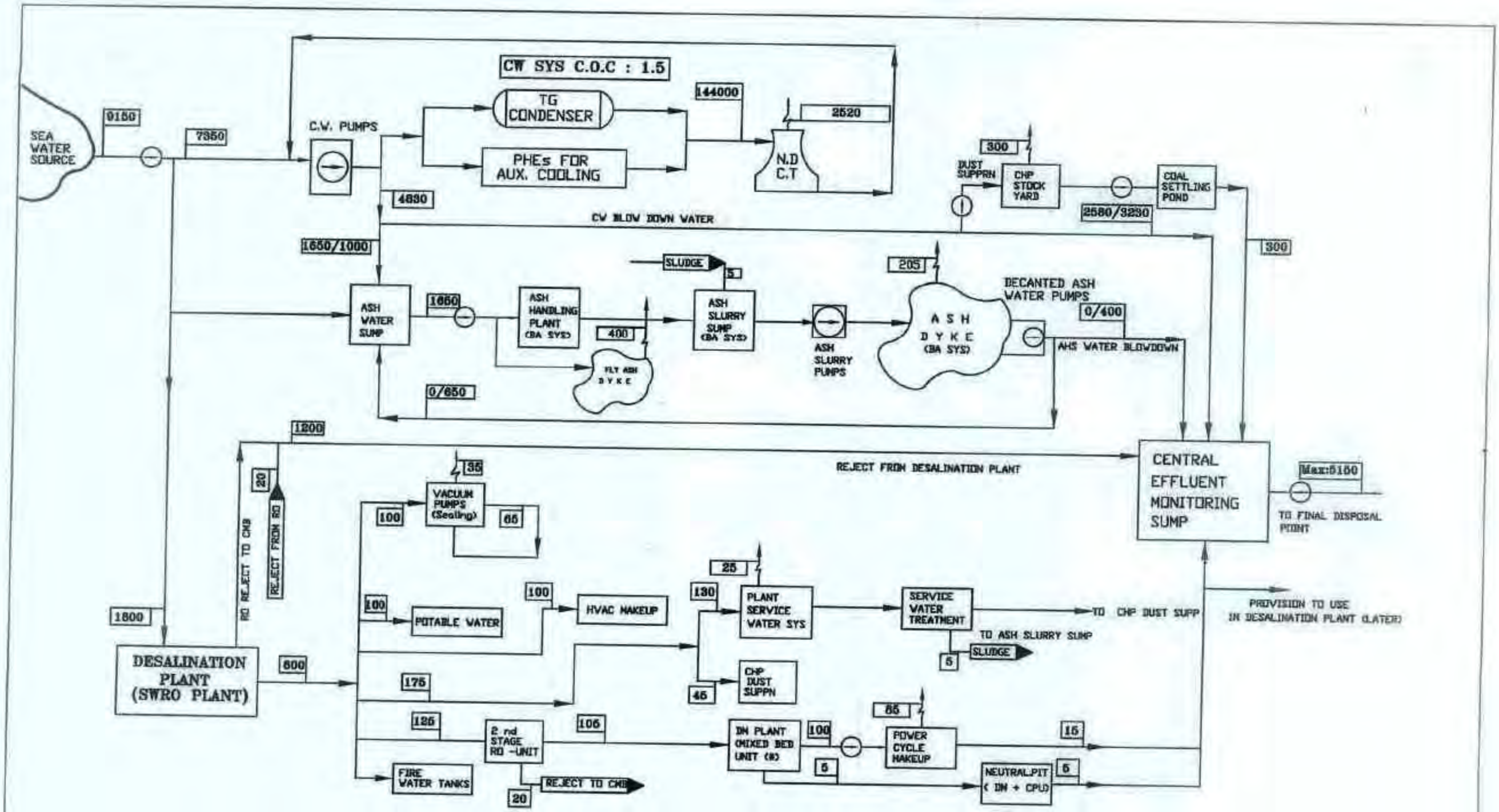
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PROJECT: KHULNA THERMAL POWER PROJECT (2 x 660 MW)

TITLE: MAIN PLANT CROSS–SECTION

SIZE	SCALE	DRG NO.	REV. NO.
A–1		9635–999–POM–F–003	a

AUTOCAD DRG. NO. KHULNA TPP–LAY03–2x660MW–FR 03.03.11



NOTES

1. FLOW INDICATED IS IN Cum/hr.
2. WHEREVER TWO (FLOW) FIGURES ARE INDICATED, FIRST ONE CORREPONDS TO ASH WATER SYSTEM IN ONCE THRU MODE & THE SECOND ONE FOR ASH WATER WATER IN RECIRCULATION MODE.
3. QUANTITY OF TOTAL EFFLUENT (#)INDICATED IS CONSIDERING NO LOSS FROM SERVICE WATER OF VARIOUS SYSTEMS.

REV.	DESCRIPTION	DRAWN/DESIGN	REVIEWED BY			APPRD BY	DATE
A	FOR STUDY PURPOSE	SS	AKM	UKM	DB	GPO	AKS

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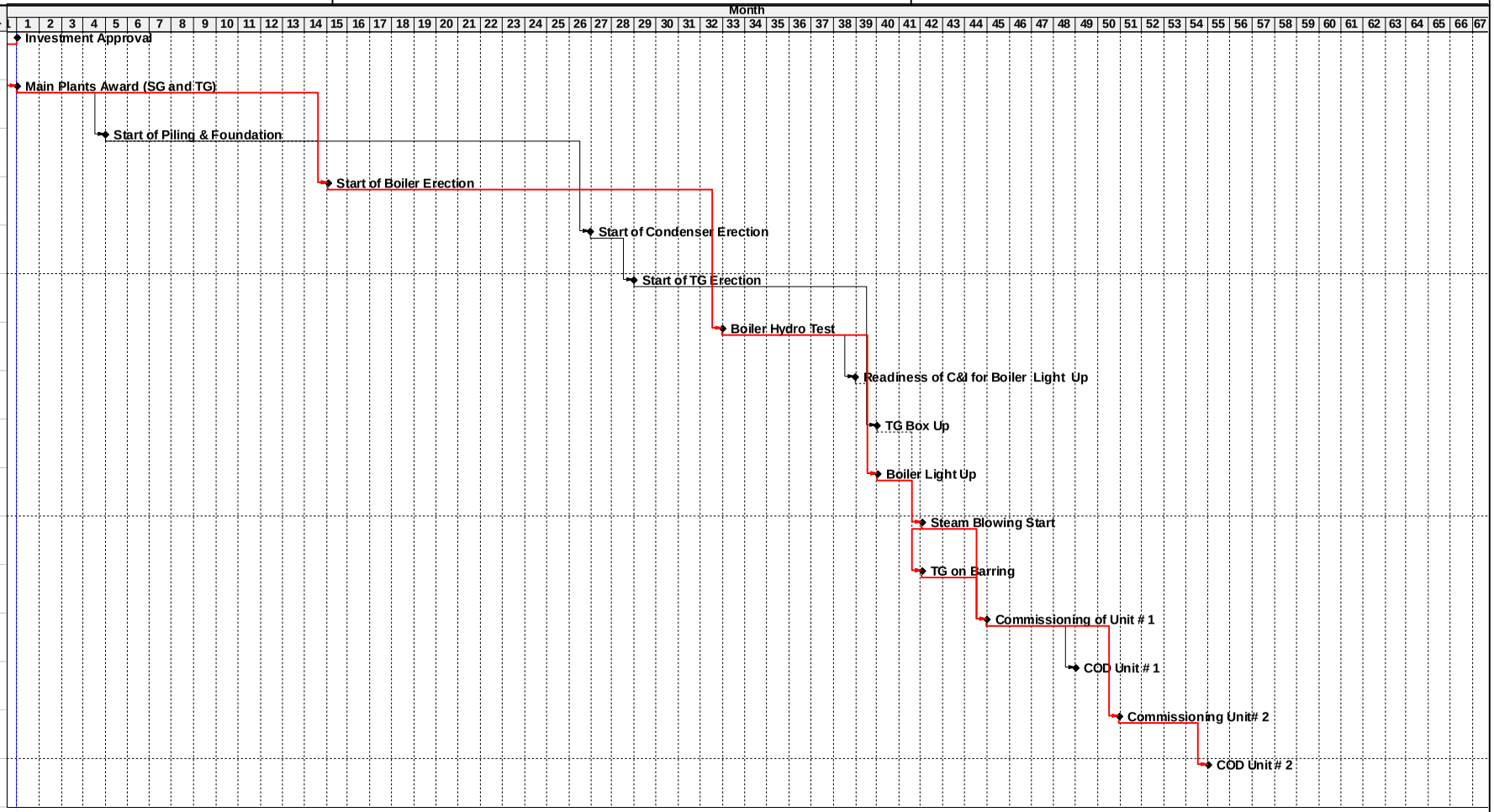
ENGINEERING DIVISION

PROJECT: KHULNA SUPER THERMAL POWER PROJECT 2 x 660 MW

TITLE: WATER BALANCE DIAGRAM

SIZE | SCALE | DRGNO: 0000-000-PDM-W-001 | REV. A

Activity ID	Activity Description	Mth from MP Order
KH005	Investment Approval	0
KH010	Main Plants Award (SG and TG)	0
KH020	Start of Piling & Foundation	4
KH030	Start of Boiler Erection	14
KH040	Start of Condenser Erection	26
KH050	Start of TG Erection	28
KH060	Boiler Hydro Test	32
KH070	Readiness of C&I for Boiler Light Up	38
KH080	TG Box Up	39
KH090	Boiler Light Up	39
KH100	Steam Blowing Start	41
KH110	TG on Barring	41
KH120	Commissioning of Unit # 1	44
KH130	COD Unit # 1	48
KH140	Commissioning Unit# 2	50
KH150	COD Unit # 2	54



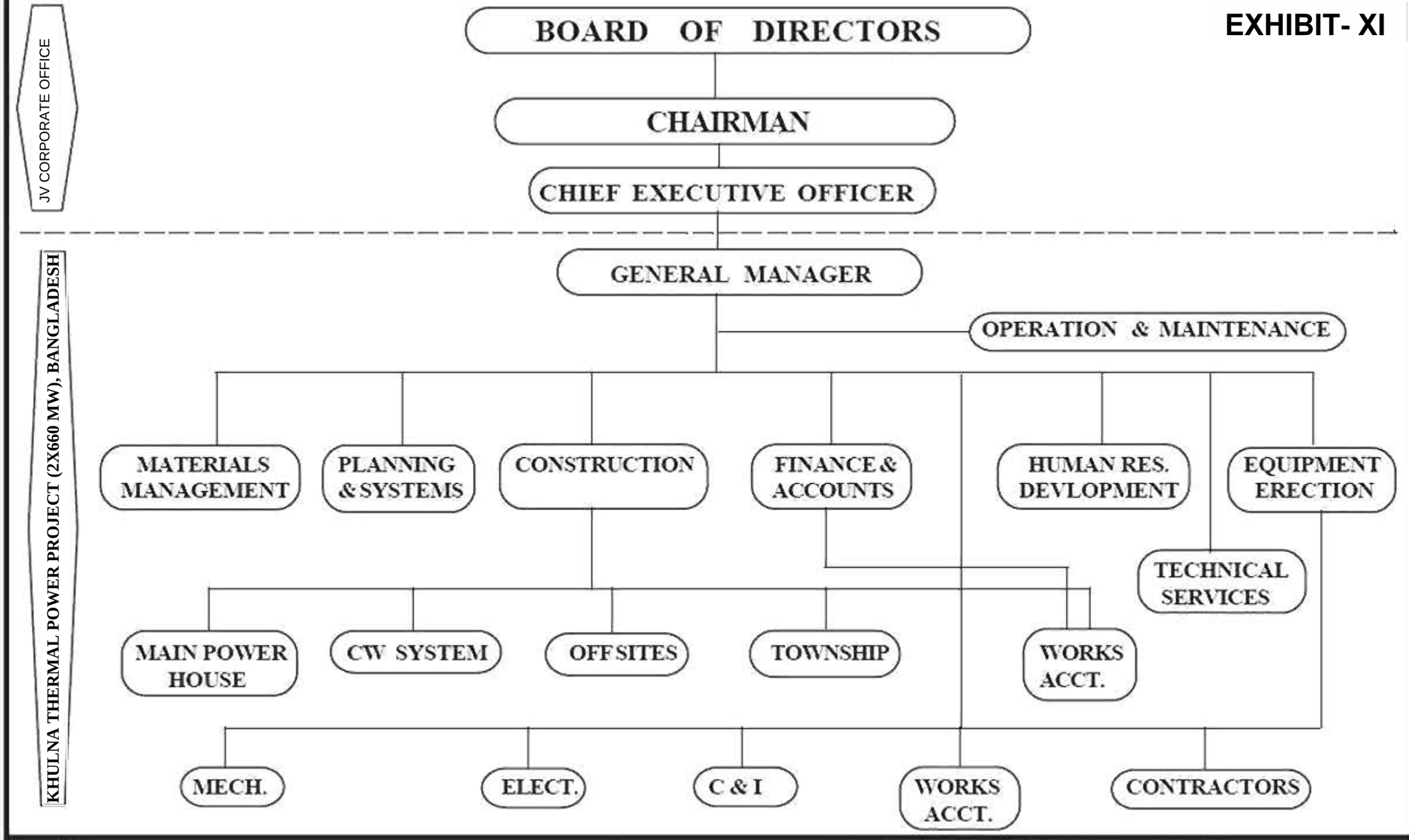
NTPC LIMITED

KHULNA TPP (2x660 MW) - BANGLADESH

IMPLEMENTATION SCHEDULE

Date	Revision	Checked	Approved
11.03.11	REV 0 (ISSUED FOR FR)		
24.03.11	Rev 01 (CORRECTED AS ADVISED BY ENGG)		

EXHIBIT- XI



CONSULTANT

एनटीपीसी NTPC

NTPC LIMITED
(A Government of India Enterprise)

ORGANISATION STRUCTURE OF
KHULNA THERMAL POWER PROJECT (2X660 MW), BANGLADESH

Appendix V: Location Clearance Certificate

প্রাকৃতিক সম্পদ সমৃদ্ধ নির্বাচনে সুন্দরবনকে ভোট দিন
সপ্ত ইন করুন : www.new7wonders.com
ফোন করুন : ০০৪৪৭৫৮৯০০১২৯০ (৭৭২৪)

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর
পরিবেশ ভবন, ই-১৬, আগারগাঁও
শেরেবাংলা নগর, ঢাকা-১২০৭।
www.doe-bd.org

স্মারক নং - পঅ/ছাড়পত্র/৫০৬২/২০১১/১১৯

তারিখ ঃ ০৯ / ০২ /১৪১৮ বঙ্গাব্দ।
২৩ / ০৫ / ২০১১ খ্রিস্টাব্দ।

বিষয় ঃ খুলনা ১৩০০ মেগাওয়াট কয়লা ভিত্তিক তাপ বিদ্যুৎ কেন্দ্র নির্মাণ প্রকল্পের অবস্থানগত ছাড়পত্র।
সূত্র ঃ বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড-এর ০৫/০৫/২০১১ তারিখের পত্র।

উপর্যুক্ত বিষয় ও সূত্রের ধরাতে আপনার আবেদনের প্রেক্ষিতে পরিবেশ অধিদপ্তর, সদর দপ্তরের ছাড়পত্র বিষয়ক কমিটির গত ১৫/০৫/২০১১ ও ১৮/০৫/২০১১ তারিখে অনুষ্ঠিত ৩০৪তম সভার ঘ-০১ নম্বর ক্রমিকে বর্ণিত সিদ্ধান্তের আলোকে বাগেরহাট জেলার রামপাল উপজেলায় প্রস্তাবিত খুলনা ১৩০০ মেগাওয়াট কয়লা ভিত্তিক তাপ বিদ্যুৎ কেন্দ্র নির্মাণ প্রকল্পের অনুকূলে নির্দেশক্রমে নিম্নবর্ণিত শর্তে অবস্থানগত ছাড়পত্র প্রদান করা হলো ঃ

ক) ইতোপূর্বে পরিবেশ অধিদপ্তর কর্তৃক অনুমোদিত TOR- এর ভিত্তিতে বিস্তারিত ইআইএ প্রতিবেদন প্রণয়ন করতে হবে এবং উক্ত ইআইএ প্রতিবেদন পরিবেশ অধিদপ্তরের অনুমোদনের নিমিত্তে পেশ করতে হবে।
খ) সংশ্লিষ্ট বিষয়ে অভিজ্ঞ মাল্টিডিসিপ্লিনারী টীমের মাধ্যমে ইআইএ প্রণয়ন করতে হবে।
গ) প্রস্তাবিত ইআইএ প্রতিবেদনে Baseline Information এর জন্য Primary Data ব্যবহার করতে হবে। এলক্ষ্যে ইআইএ প্রতিবেদনে নিজস্ব লোকবল ও ইকুইপমেন্ট-এর সমন্বয়ে ইন-হাউজ এনভায়রনমেন্টাল মনিটরিং সিস্টেম পড়ে তোলার বিষয়ে প্রয়োজনীয় কারিগরী ও আর্থিক প্রস্তাবনা অন্তর্ভুক্ত করতে হবে।
ঘ) উদ্যোক্তা কর্তৃক ইআইএ প্রতিবেদন দাখিলের পর অত্র অধিদপ্তর কর্তৃক তা পর্যালোচনাকালে প্রস্তাবিত প্রকল্পের অবস্থান, কার্যক্রমের পরিবেশগত প্রভাব, Environmental Costs, কারিগরী ও অর্থনৈতিক সম্ভাব্যতা এর আর্থ-সামাজিক দিক বিবেচনায় গ্রহণযোগ্য বলে বিবেচিত না হলে এই ছাড়পত্র বাতিল করা হবে। এর ফলে এ সংক্রান্ত সকল ক্ষয়ক্ষতির দায় উদ্যোক্তা কর্তৃক বহন করতে হবে।
ঙ) ইআইএ অনুমোদন না হওয়া পর্যন্ত আমদানীতব্য যন্ত্রপাতির অনুকূলে L/C খোলা যাবে না।
চ) ইআইএ অনুমোদন না হওয়া পর্যন্ত বিদ্যমান জলাভূমি ভরাট করা যাবে না।
ছ) প্রস্তাবিত প্রকল্পের আওতায় জলাভূমি ভরাটের প্রয়োজন হলে সেক্ষেত্রে বাংলাদেশ পরিবেশ সংরক্ষণ (সংশোধন) আইন, ২০১০ অনুযায়ী জলাভূমি ভরাটের জন্য বিধি মোতাবেক পরিবেশ অধিদপ্তরের ছাড়পত্র গ্রহণ করতে হবে।
জ) পরিবেশ অধিদপ্তরের এনফোর্সমেন্ট টীম, পরিদর্শক ও পরিদর্শনের ক্ষমতাপ্রাপ্ত অন্যান্য কর্মকর্তাগণ প্রকল্প এলাকা পরিদর্শনকালে প্রকল্প কর্তৃপক্ষ কর্তৃক পরিদর্শন কার্যক্রমে সর্বাত্মক সহযোগিতা প্রদান করতে হবে।
ঝ) উদ্যোক্তা কর্তৃক ইআইএ দাখিলের সময় জমির মালিকানা দলিল ও স্থানীয় কর্তৃপক্ষের অনাপত্তিপত্র দাখিল করতে হবে।
ঞ) আলোচ্য প্রকল্পের অবস্থান বিষয়ে মহামান্য হাইকোর্ট কর্তৃক নিষেধাজ্ঞা আরোপ করা হলে এ ছাড়পত্র স্বয়ংক্রিয়ভাবে বাতিল বলে গণ্য হবে।
ট) আলোচ্য প্রকল্পের বিষয়ে মহামান্য হাইকোর্টের নির্দেশনাসমূহ যথাযথভাবে প্রতিপালন করতে হবে।
ঠ) এ ছাড়পত্র ইস্যুর তারিখ হতে আগামী ০১ (এক) বছর পর্যন্ত বহাল থাকবে এবং মেয়াদ শেষ হওয়ার অন্ততঃ ৩০ (ত্রিশ) দিন পূর্বে উহা পরিবেশ অধিদপ্তর, সদর দপ্তর, ঢাকা থেকে নবায়ন করতে হবে।
ড) উপর্যুক্ত ক-ঠ অনুচ্ছেদে বর্ণিত যে কোন শর্ত ভংগ করলে এ ছাড়পত্র বাতিল বলে গণ্য হবে এবং আলোচ্য প্রকল্পের বিরুদ্ধে বাংলাদেশ পরিবেশ সংরক্ষণ আইন ১৯৯৫, পরিবেশ সংরক্ষণ বিধিমালা ১৯৯৭ এবং শব্দ দূষণ (নিয়ন্ত্রণ) বিধিমালা ২০০৬ অনুসারে আইনগত ব্যবস্থা গ্রহণ করা হবে।

২৩/০৫/২০১১
(সৈয়দ নজমুল আহসান)
উপ-পরিচালক (পরিবেশগত ছাড়পত্র)
ফোনঃ ০২-৮১২১৭৯৩

প্রকল্প পরিচালক
(প্রধান প্রকৌশলী)
চট্টগ্রাম ও খুলনা ১৩০০ মেগাওয়াট x ২ কয়লা ভিত্তিক তাপ বিদ্যুৎ কেন্দ্র নির্মাণ প্রকল্প
বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড
বিদ্যুৎ ভবন (৯ম তলা), ১ নং আঃ গণি রোড, ঢাকা-১০০০।

অনুলিপি ঃ

১। পরিচালক, পরিবেশ অধিদপ্তর, খুলনা বিভাগীয় কার্যালয়, খুলনা।
২। মহাপরিচালক মহোদয়ের স্টাফ অফিসার, পরিবেশ অধিদপ্তর, সদর দপ্তর, ঢাকা।

চেয়ারম্যান, বিউরো এর দপ্তর		
সদস্য (প্রঃ)	জিএম (প্রশিক্ষণ)	* প্রয়োজনীয় ব্যবস্থা নিন
সদস্য (অর্থ)	তঃ প্রঃ (এআই)	* পরীক্ষাপূর্বক উপস্থাপন করুন
সদস্য (উৎ)	সচিব, বিউরো	* বর্তমান অবস্থা অবহিত করুন
সদস্য (বিউরো)	পরিচালক (নিরাঃ)	* জরুরীভিত্তিতে ব্যবস্থা নিন
সদস্য (পওউ)	পরিঃ (জনসংযোগ)	* আলোচনা করুন
সদস্য (কোং এ্যাফেয়ার্স)	নং- ২৮২৯	
জিএম	তাং- ২৩/৫	* স্বাক্ষর

Appendix VI: No Objection Certificate from Local Authority

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
উপজেলা পরিষদ কার্যালয়
রামপাল, বাগেরহাট।

সূত্রঃ.....উচে:তর:/রাপা/বাবেব/৪৮ তারিখঃ ২১/৩/১২

অবস্থানগত/পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কর্তৃপক্ষ কর্তৃক প্রদয় অনাপত্তিপত্রের ছক

১। আবেদনকারীর নাম ঃ প্রকল্প পরিচালক (অতিঃ প্রধান প্রকৌশলী), চট্টগ্রাম ও খুলনা ১৩০০ মেঃওঃ × ২ কয়লা ভিত্তিক তাপ বিদ্যুৎ কেন্দ্র নির্মান প্রকল্প, বিডবো, ঢাকা।

২। পিতা/স্বামী/স্ত্রীর নাম ঃ প্রযোজ্য নয়।

৩। আবেদনকারীর ঠিকানা ঃ বিদ্যুৎ ভবন (৯ম তলা), ১ নং আঃ গনি রোড, ঢাকা-১০০০

৪। কারখানা/প্রকল্পের অবস্থানগত ঠিকানা ঃ বাগেরহাট জেলার রামপাল উপজেলা।

৫। কারখানা/প্রকল্পের অফসিল ঃ

জেলার নাম	থানার নাম	মৌজার নাম	খতিয়ান নং	দাগ নং	জমির ধরণ	মোট জমির পরিমাণ
বাগেরহাট	রামপাল	সাপমারি, কটাখালী, কেওরদাসকাঠি	সংযুক্ত	সংযুক্ত	বিলান	১৮৩৪ একর

৬। কারখানা/প্রকল্পের উৎপাদিত/উৎপাদিতব্য পণ্যের নাম ঃ বিদ্যুৎ

উপরোক্ত তথ্যাদির আলোকে খুলনা ১৩২০ মেঃওঃ কয়লা ভিত্তিক তাপ বিদ্যুৎ কেন্দ্র নির্মান প্রকল্পকে নিম্ন বর্নিত শর্তাপেক্ষে অনাপত্তিপত্র প্রদান করা হলো।

শর্তাবলী ঃ

১. প্রকল্প/কারখানা স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরণ করতে হবে।
২. পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহণ করতে হবে।
৩. কর্মরত শ্রমিকদেও পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে।
৪. উপযুক্ত অগ্নি নিরাপত্তা ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দুর্ঘটনার সময় জরুরী নির্গমন ব্যবস্থা থাকতে হবে।
৫. বায়ু ও শব্দদূষণ করা যাবে না।
৬. কারখানা/প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উল্লেখিত যে কোন শর্ত লঙ্ঘন করলে যথোপযুক্ত কর্তৃপক্ষ কর্তৃক কারখানা/প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

আরিখ ঃ .....

২১/৩/১২
স্থানীয় কর্তৃপক্ষের স্বাক্ষর ও সীল ঃ
মোস্তা [illegible]
চেয়ারম্যান
উপজেলা পরিষদ
রামপাল, বাগেরহাট

Appendix VII: Letter of Land Takeover

" দখল হস্তান্তর প্রত্যয়নপত্র"

এল. এ কেস নং-০১/২০১০-১১

প্রত্যয়ন করা যাচ্ছে যে, নিম্ন তফসিলভুক্ত স্থাবর/অস্থাবর সম্পত্তি ১৯৮২ সনের ২নং অধ্যাদেশের আওতায় ভূমি মন্ত্রণালয়ের অধি শাখা-৫ এর বিগত ২৭-১২-২০১০ খ্রিঃ তারিখের ভূঃমঃ/শা-৫/অধি/বাগের-০৮/২০১০/২৬৩ নং স্মারকের আদেশ মোতাবেক ০১/২০১০-১১ নং এল. এ কেসে কয়লাভিত্তিক তাপ বিদ্যুৎ কেন্দ্র নির্মাণ প্রকল্প এর উদ্দেশ্যে অধিগ্রহণ করা হয়েছে। উক্ত সম্পত্তির দখল জেলা প্রশাসক, বাগেরহাট এর পক্ষে ভূমি অধিগ্রহণ কর্মকর্তা, বাগেরহাট ০২-০১-২০১২ খ্রিঃ তারিখে গ্রহণ করেছেন। অদ্য ০২-০১-২০১২ খ্রিঃ তারিখ সচিব, বিদ্যুৎ উন্নয়ন বোর্ড, কেন্দ্রীয় সচিবালয়, ওয়াপদা ভবন, মতিঝিল, বা/এ, ঢাকা এর প্রতিনিধির নিকট উক্ত সম্পত্তির দখল হস্তান্তর করা হলো।

"তফসিল"

জেলা-বাগেরহাট, উপজেলা-রামপাল, মৌজা-০৯ নং কৈগরদাসকাঠি, জে. এল. নং-

দাগ নম্বর (আংশিক) : ৫০৮, ৫৪০, ৫৪২, ৫৪৯, ১০০১ এবং ১০০২।

দাগ নম্বর (পূর্ণ) : ৫০৯, ৫১০, ৫১১, ৫১২, ৫১৩, ৫১৪, ৫১৫, ৫১৬, ৫১৭, ৫১৮, ৫২১, ৫৪৪, ৫৪৫, ৫৪৬, ৫৪৭, ৫৪৮, ৫৫০, ৫৫১, ৫৫২, ৫৫৩, ৫৫৪, ৫৫৫, ৫৫৬, ৫৫৭, ৫৫৮, ৫৫৯, ৫৬০, ৫৬১, ৫৬২, ৫৬৩, ৫৬৪, ৫৬৫, ৫৬৬, ৫৬৭, ৫৬৮, ৫৬৯, ৫৭০, ৫৭১, ৫৭২, ৫৭৩, ৫৭৪, ৫৭৫, ৫৭৬, ৫৭৭, ৫৭৮, ৫৭৯, ৫৮০, ৫৮১, ৫৮২, ৫৮৩, ৫৮৪, ৫৮৫, ৫৮৬, ৫৮৭, ৫৮৮, ৫৮৯, ৫৯০, ৫৯১, ৫৯২, ৫৯৩, ৫৯৪, ৫৯৫, ৫৯৬, ৫৯৭, ৫৯৮, ৫৯৯, ৬০০, ৬০১, ৬০২, ৬০৩, ৬০৪, ৬০৫, ৬০৬, ৬০৭, ৬০৮, ৬০৯, ৬১০, ৬১১, ৬১২, ৬১৩, ৬১৪, ৬১৫, ৬১৬, ৬১৭, ৬১৮, ৬১৯, ৬২০, ১০০৩, ১০০৪, ১০০৫ এবং ১০০৬। মোট জমি =৩৫০.৮০ একর।

জেলা-বাগেরহাট, উপজেলা-রামপাল, মৌজা- ১০ নং সাপমারিকাটাখালী, জে. এল নং-

দাগ নম্বর (আংশিক) : ৬৭৬।

দাগ নম্বর (পূর্ণ) : ১, ২, ৩, ৪, ৫, ৬, ৭, ৮, ৯, ১০, ১১, ১২, ১৩, ১৪, ১৫, ১৬, ১৭, ১৮, ১৯, ২০,২১, ২২, ২৩, ২৪, ২৫, ২৬, ২৭, ২৮, ২৯, ৩০, ৩১, ৩২, ৩৩, ৩৪, ৩৫, ৩৬, ৩৭, ৩৮, ৩৯, ৪০, ৪১, ৪৩, ৪৪, ৪৬, ৪৭, ৪৮, ৪৯, ৫০, ৫১, ৫২, ৫৩, ৫৪, ৫৫, ৫৬, ৫৭, ৫৮, ৫৯, ৬০, ৬১, ৬২, ৬৩, ৬৪, ৬৬, ৬৭, ৬৮, ৬৯, ৭০, ৭১, ৭২, ৭৫, ৭৬, ৭৭, ৭৮, ৭৯, ৮০, ৮২, ৮৩, ৮৪, ৮৫, ৮৬, ৮৭, ৮৮, ৮৯, ৯০, ৯২, ৯৩, ৯৪, ৯৫, ৯৬, ৯৭, ৯৮, ৯৯, ১০০, ২০২, ২০৩, ২০৪, ২০৫, ২০৬, ২০৭, ২০৮, ২০৯, ২১০, ২১১, ২১২, ২১৩, ২১৪, ২১৫, ২১৬, ২১৭, ২১৮, ২১৯, ২২০, ২২১, ২২২, ২২৩, ২২৪, ২২৫, ২২৬, ২২৭, ২২৮, ২২৯, ২৩০, ২৩১, ২৩২, ২৩৩, ২৩৪, ২৩৫, ২৩৬, ২৩৭, ২৩৮, ২৩৯, ২৪০, ২৪১, ২৪২, ২৪৩, ২৪৪, ২৪৫, ২৪৬, ২৪৭, ২৪৮, ২৪৯, ২৫০, ২৫১, ২৫২, ২৫৩, ২৫৪, ২৫৫, ২৫৬, ২৫৭, ২৫৮, ২৫৯, ২৬০, ২৬১, ২৬২, ২৬৩, ২৬৪, ২৬৫, ২৬৬, ২৬৭, ২৬৮, ২৬৯, ২৭০, ২৭১, ২৭২, ২৭৩, ২৭৪, ২৭৫, ২৭৬, ২৭৭, ২৭৮, ২৭৯, ২৮০, ২৮১, ২৮২, ২৮৩, ২৮৪, ২৮৫ ২৮৬, ২৮৭, ২৮৮, ২৮৯, ২৯০, ২৯১, ২৯২, ২৯৩, ২৯৪, ২৯৫, ২৯৬, ৬০১, ৬০২, ৬০৩, ৬০৪, ৬০৫, ৬০৬, ৬০৭, ৬০৮, ৬০৯, ৬১০, ৬১১, ৬১২, ৬১৩, ৬১৪, ৬১৫, ৬১৬, ৬১৭, ৬১৮, ৬১৯, ৬২০, ৬২১, ৬২২, ৬২৩, ৬২৪, ৬২৫, ৬২৬, ৬২৭, ৬২৮, ৬২৯, ৬৩০, ৬৩১, ৬৩২, ৬৩৩, ৬৩৪, ৬৩৫, ৬৩৬, ৬৩৭, ৬৩৮, ৬৩৯, ৬৪০, ৬৪১, ৬৪২, ৬৪৩, ৬৪৪, ৬৪৫, ৬৪৬, ৬৪৭, ৬৪৮, ৬৪৯, ৬৫০, ৬৫১, ৬৫২, ৬৫৩, ৬৫৪, ৬৫৫, ৬৫৬, ৬৫৭, ৬৫৮, ৬৫৯, ৬৬০, ৬৬১, ৬৬২, ৬৬৩, ৬৬৪, ৬৬৫, ৬৬৬, ৬৬৭, ৬৬৮, ৬৭১, ৬৭২ এবং ৬৭৩।

মোট জমি =১৪৮৩.২০ একর।

দু'টি মৌজায় সর্বমোট জমির পরিমাণ : (১৪৮৩.২০একর + ৩৫০.৮০একর) =১৮৩৪.০০(এক হাজার আটশত চৌত্রিশ) একর কম/বেশী

ভূমি অধিগ্রহণ কর্মকর্তা, বাগেরহাট এর নিকট হতে ১৮৩৪.০০(এক হাজার আটশত চৌত্রিশ) একর জমিসহ জমির উপর অবস্থিত যৌথ ফিল্ড সিডিউল মোতাবেক অন্যান্য সম্পত্তির দখল বুঝে পেলাম।

02/02/12

দখল গ্রহণকারীর স্বাক্ষর

পদবী সীল XEN

Chief Engr. 800MWX2 Coal based thermal Power Station Contruction Project PDB, Dhaka.

02/02/12

(মোহাম্মদ রাশেদ ওয়াসিফ)
ভূমি অধিগ্রহণ কর্মকর্তা
বাগেরহাট।

Appendix VIII: Comments Response Matrix

Comments and Responses on Environmental Impact Assessment of 2x (500-660) MW Coal based Thermal Power Plant to be Constructed at the Location of Khulna

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
1	**Comments from IUCN(International Union for Conservation of Nature) Bangladesh Country Office**			
1.1	Title: Final report on….location of Khulna	1. Title said that the location is in Khulna, but most of the data presented inside are for Rampal site and Executive summary mentioned that the final selected site in Rampal, Bagerhat. If so, title should be changed.	1. The title of the EIA consulting services were formed before selecting the final site for the proposed power plant. Primarily selected two alternative sites were located within the Khulna Division; as such the title of the EIA was named as Khulna 1320 MW Thermal Power Plant. Government will finalize a Name for the proposed power plant soon. Before that, the EIA, the feasibility study and other relevant studies have been carried out under the title Khulna 1320 MW Coal Based Thermal Power Plant.	1. During selecting the name for the proposed power plant the project proponent may consider this comment
1.2	Executive Summary-Approach and Methodology (Paragraph 2:the study….envisaged) and Chapter 3: Approach and Methodology –section 3.2	2. As no final plan has been envisaged on the coal sources, coal transportation and coal handling system, how could a complete EIA study be conducted?	2. During preparation of the Draft Final EIA Report, the study on Coal Sourcing and Transportation was in progress, assumptions were thus made on potential coal sources and transportation system for the purpose of the EIA study. Now, the study is completed and accordingly the Final EIA has been prepared incorporating the findings of Coal Sourcing, Transportation and Handling Study.	2. The coal sources and transportation system have been incorporated in Section 5.15 under Chapter 5 of the Final EIA Report
		3. As mentioned, major operational procedures are unclear to the EIA team and they have	3. The Feasibility Study and other relevant studies were under progress during preparation	3. The Final EIA report is based on the Feasibility Study

Sl. No.	Section / Description as enumerated in the Final report	Comments	Responses	Action
		done the study based on their assumptions. Does it worthwhile to accept the impact assessment, EMP and monitoring plan that done based on only assumptions?	of the EIA study as such some assumptions were made with the consents of the BPDB and the relevant study team. Nevertheless, the principal plans and project components as mentioned in Chapter 4 were final. Now, the studies have been completed. Hence the Final EIA report has been updated on the basis of completed Feasibility Study and other relevant studies. Please note that the engaged study team was completely clear about the operational procedure of power plant as the study was conducted by a team of highly skilled multidisciplinary project team including power plant expert. So it is worthwhile to accept the impact assessment, EMP and monitoring plan that done based on only assumptions is not valid.	and other Relevant Studies
		4. Beside, duration of the study has not been furnished in this part, which is obvious.	4. Initially, six months were provided for completion of the IEE/EIA. Later, in the interest of the EIA and comprehending the importance of the environmental issues, the study period has been extended upto 1.5 year. The major field investigations were carried out during August 2010 to August 2011. The Draft EIA report was prepared and submitted in September 2011.	4. The Approach and Methodology Chapter has been updated incorporating details of the Study Periods in section 3.4.
1.3	Executive Summary – Stakeholder consultation outcomes (However the Project Affected	5. These highlighted statements giving the notion of some kind of dissatisfaction exist among the affected land owners and also in the local area. Informing local people through	5. Following the DoE approved ToR, a wide range of public consultations was carried out during EIA study. The mentioned statements depict acknowledgement of the local people	5. The lists and inventory of stakeholders has been updated further for the Final

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
	People……would make them cooperative towards the project	different kind of media and publicity is one of the major tasks of any EIA team. It's not clear from this section whether this has been done or not.	about the possible benefits of the power plants and their request of being properly compensated for land acquisition. Initially there were dissatisfaction among the land owners. Subsequently due to consultation and appropriate action taken by BPDB and the district administration during acquisition of land, dissatisfaction gradually disappeared.	EIA Report in chapter 15.
		6. If done then question come how and at what intensity? Is there any list attached in support of that?	6. Chapter 14 details out stakeholder consultations processes, methodology, time of consultation. A list of the participated local people in different stakeholder meetings and an inventory of stakeholder consultations are provided in Table 15.2 and 15.3 in Chapter 15.	6. The comments have already been taken care of in section 15.1, Table 15.2 and 15.3 in Chapter 15.
1.4	Executive Summary – Background (Paragraph 3: The IEE study….power plant) and also Table A: Comparison matrix and Chapter 5: Alternative site selection – Table 5.1-5.2	7. It has been mentioned that the IEE study advocated Rampal as the best site for the proposed power plant based on the comparison matrix. But the comparison matrix included only the comparative facilities in between two places without having any comparison of projected impacts.	7. Site selection is a screening process that usually carried out considering a set of relevant indicator but not comparing the projected impact. Following the methodology suggested in DoE Guideline of EIA and ToR approved by DoE the alternative evaluation for site selection was carried out comparing 33 indicators including site selection criteria as mentioned in the ECR 1997. Comparison matrix is provided in section 4.3	7. For better interpretation, the Alternative Evaluation Matrix (Table 4.2) and its concluding remarks have been further elaborated for the Final EIA Report.
		8. Most of the activities of this kind of power plant depend on water. Two important rivers (which are rich in aquatic diversity) i.e. Passur and Maidara are situated adjacent to the	8. Most of the activities related to the power plant construction and operation will be land based. Water will be required for cooling purpose, steam generation, Environmental	8. Furthermore, Final EIA report has been updated highlighting the water related issue. The mentioned

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
		selected site in Rampal, on the contrary only a small river adjacent to the discarded site. So a comparative matrix of the impacts between these two sites should be furnished and should consider as the major criteria for site selection.	Management and for domestic purposes. Giving proper importance to the water resources nine indicators including river navigability, erosion, accretion, fisheries habitat, navigation, river flow, etc were considered to ensure minimum disruption to water resources as per requirement of the ECR 1997.	comparison matrix is provided in section 4.3.
1.5	Executive Summary – Environmental and social baseline condition and Chapter 6	9. The area fall under the high risk zone of salinity, cyclone and sea level rise area. So climate change impact assessment should be carried out and furnished in the baseline condition.	9. The climate change issues were considered in setting design conditions for site establishment and plant operation principles.	9. EIA has been updated addressing the climate change issues which may be seen in section 6.10.
1.6	Executive Summary-Impacts on landscape; Chapter 8	10. Only scenic beauty has been evaluated, but coal transportation would change soil surface color which also should be included, if assessed.	10. The landscape issue has been considered for pre-construction, construction and operation of the power plant. There will be no land based transportation and handling of the coal outside the project area. Accordingly, there will be no chances of changing color of soil surface of the surrounding area. Hence, the issues of landscape and scenic beauty do not come in case of coal transportation.	10. No action required
	Executive Summary-Impacts on air quality; Chapter 8	11. A matrix would be appropriate to compare the emission levels with the standard DoE/EU recommendation.	11. Table 8.1 presents a matrix showing emission levels and different applicable standards.	11. The Final EIA report has been updated transforming the matrix (Table 8.1) in more understandable format.
1.7	Executive Summary- Impacts	12. Quantity of solid waste generation is not mentioned. It is required both for	12. EIA identifies all possible sources of solid waste in Sub-Section 8.2.7 and 8.3.8. As per the	12. Quantity of the Solid Waste has been incorporated

Sl. No.	Section / Description as enumerated in the Final report	Comments	Responses	Action
	of Solid waste; Chapter 8	understanding the impact level taking protection measures.	comments, the Final Report has been prepared identifying the category and estimating the possible quantity of solid waste.	in the sub-section 8.3.8 of Final Report.
1.8	Executive Summary-Impacts on water resources ; Chapter 8	13. Quantity of waste water discharge, cooling water temperature and dust materials and its impact on biological resources especially on the aquatic species, river water quality, soil quality and its impact on the adjacent Sundarbans situated in downstream are not mentioned in this section. These are vital to assess the overall impact level.	13. The water to be discharged after treatment shall satisfy standard of MoEF (ECR 1997) ,hence the said impacts may be minor.	13. Sub-Section 8.3.9 discusses about the impact on water quality.
		14. Seasonal impacts on river water especially during dry season is also absent.	14. The issue has been assessed in the Final EIA Report.	14 Seasonal Impacts on Water Resources are detailed in sub-section 8.3.9.
		15. Impact of water resources should be conducted more intensively and carefully.	15. Water related issues are carefully examined and properly addressed in the Draft EIA. Nevertheless, further analysis has been made and has been incorporated in the Final EIA Report.	15. Considering importance to the comment, the analysis has further been examined and the findings have been incorporated in the Final EIA Report in section 8.3.9.
		16. Chemical reaction of waste water (both liquid waste and boiled water) to the both aquatic and terrestrial species should be mentioned specifically, as most of the people living at that region of Bagerhat depend on fishing throughout the year.	16. No waste water shall be discharged to the river without fulfilling the MoEF defined standard. (Sub-section 4.17.4 and 8.3.9 please refer). The water quality standard for effluent has been defined in the ECR 1997 ensuring no harmful and long term changes of water quality due to discharge of effluent satisfying the	16. No further action is required.

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
			standard.	
		17. Carcinogenic impact of waste water on aquatic species e.g. fish should also be assessed and presented in this section clearly.	17. After a series of reuse, the waste water shall be discharged to river with appropriate treatment and satisfying MoEF's standard for effluent. (Sub-section 4.17.4 and 8.3.9 please refer) Hence there will be no carcinogenic effect of the discharged treated waste water.	17. No further action is required.
1.9	Executive Summary-Impacts on fisheries; Chapter 8	18. It has mentioned that the proposed power plant will have substantial impact on fish biodiversity, open water fish habitat and fish migration. But loss of fisheries production, loss of income by fishermen, length of distance of impact on Sundarbans fish breeding and nursing ground, etc. are not discussed properly.	18. The issues of fish habitats, migration, biodiversity, production, etc have been discussed providing proper merit. The EIA concluded that the impact on Fisheries would be minor as the proposed power plant will be operated satisfying all relevant standards of MoEF and the suggested Environmental Management Plant.	18. and 19. Considering importance to the comments, the Final EIA report has been updated with further careful examination of the fisheries issues in sub-section 8.3.14 and 8.2.12.
		19. The proposed site is only 1-2 km away of the ECA boundary, so these questions are to be solved beforehand. Otherwise, fisheries reserve of the Sundarbans would be greatly impacted.	19. The proposed plant location is 4 km away from ECA boundary and about 14 km away from the nearest point of Sundarbans. In addition the plant will be operated satisfying ECA 1995 & ECR 1997. Hence, it is very unlikely that fisheries reserve of the Sundarbans will be affected for the operation of the plant.	
1.10	Executive Summary-Impacts on ecosystem; Chapter 8-different sections	20. It is mentioned that the proposed power plant would have great impact on ecosystem, especially on the Sundarbans by many ways. What should be the appropriate compensation for allowing destruction of mangrove forest	20 and 21. The EIA examined all Environmental issues and issues of Sundarbans relevant to the proposed Power Plants, and finally concluded that the impact of the proposed power plant will be minor as it is 14 km away from the	20 & 21 Further careful examination has been carried out and chapter 8 has been updated accordingly.

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
		which is also declared as world Heritage and countries 1st Ramsar site as well as ECA.	Sundarbans, 70 km away from the world heritage site, adaptation of efficient technologies (low sulfur content coal, super critical boiler, 275 m chimney etc) and operation of the plant fulfilling the guideline of ECA 1995 and ECR 1997. The operation of the power plant will not have any impact on the function of the Sundarbans as a protector from cyclone. Hence, there will be no such impacts for which, economic analysis will be required.	
		21. The forest is also a national protector from cyclone and storm surges. Its deterioration should not be allowed by the cost of economical benefit. A comparative matrix should be furnished to access the economical benefit of Sundarbans vs. economical benefit that would be derived from power plant.		
		22. It seems good that dispersion of air pollutants will not affect Sundarbans. But it's not clear what will happen during any accidental cases as the site is only 10-14 km from the Sundarbans. Answer should be there	22. The plant adopts computer based automatic monitoring and control system to prevent any accidental hazard. The EIA report details out hazard and risk assessment in Chapter 11 and prepared a Hazard and Risk Management Plan.	22. Addressed in chapter 11.
		23. Again transport of coal through Sundarbans is also a risky exercise. If any accidental incidences happen then entire Sundarbans will suffer from coal and oil contamination and even accidental fire may happen. These questions should be resolved by the EIA team.	23. The coal shall not be transported by land. The existing navigational routes of Mongla Port Authority (MPA) and BIWTA will be used from transportation of coal. All the vessels as well as agencies to be engaged for coal transportation shall be obliged by national laws and IMO Conventions (Port Acts, Ordinances, CER 1997, IMO Conventions signed by Bangladesh, Rules and Regulations of Shipping Ministry) described	23. The Final EIA report has been updated addressing rules and regulations for ensuring safety of Sundarbans as well as environment, responsible institute/agencies to control and monitor the vessel activities, and Environmental Management

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
			in Chapter 2 for ensuring Environmental and Ecosystem Safety. As per the Rules of GOB, DG Shipping, MPA, and BIWTA shall control, inspect and monitor the activities of the coal carrying vessels to ensure all rules and Conventions are to be followed.	Plan for coal transportations activities. Table 11.2 and 11.4 may be seen.
		24. The study has suggested dolphin conservation program at operation period. But didn't mention how and at what probability this EMP measure will protect dolphins of the Passur river where water quality will not be within optimum range (as mentioned in impact on fisheries part) for dolphin and also without reducing river traffic?	24. Due to operation of the power plant there may not be effect of the Passur river water quality. As such there may be no effect on Dolphin habitat in the Passur river. Moreover the EIA suggests and mentions Dolphin Conservation Program to be adopted by GOB for ensuring conservation of the Dolphin in Passur river.	24. The Final EIA Report has been updated incorporating necessary details of the suggested Dolphin Conservation Programs in Section 12.4.
		25. A comparative matrix of water quality during baseline condition vs. during operation (change condition) and also the optimum habitat quality for dolphin and other aquatic species should be furnished before commenting any impact and EMP.	25. No waste water shall be discharged to the river without fulfilling the MoEF defined standard (ECA 1995 &ECR 1997) so there may be no change in water quality of Passur river. Hence, the project may not affect Dolphin and other aquatic species.	25. No further action required.
1.11	Executive Summary-Impact on socio-economic; Chapter 8	26. A separate SIA study should be carried out as the power plant has regional impact not only in Bagerhat district but also in the greater division and as well as to the country.	26. The proposed project will bring regional development in Bagerhat as well as Khulna and possible socio-economic impacts of the Proposed Power Plant have briefly been addressed in the EIA. As per requirement of the ECR 1997, no separate SIA is necessary for obtaining Clearance Certificate from the DoE.	26. No action required under this EIA.

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
		27. It seems that the EIA study only considered the impact on local people living around and those will be displaced. But not looked into the impact of the coal based power plant on the other people's livelihoods that depend on greater Sundarbans area as well as Passur river. It is necessary, as the proposed plant has clear environmental impacts on fisheries and Sundarbans ecosystem and its resources. So the impacts on the livelihood of the depending people must be studied.	27. The proposed project will only directly affect the livelihood group dependent on the land acquired for the project. The project has been planned satisfying all requirements of the national environmental regulations and will be operating satisfying the same, it may not have any significant impact on Sundarbans ecosystem as well as the livelihoods dependent on the Sundarbans.	27. Impact of Sundarbans livelihood group has been discussed in section 8.4.6.
		28. Considering these, impact on socio-economy is falling short of a standard SIA. So it recommended that a full pledged SIA should be conducted.	28 The EIA has covered the socio-economical part of the impact assessment following the ToR approved by the DoE and the Guideline of DoE for EIA. As per ECR 1997, separate SIA is not required for obtaining clearance from DoE	28. No action required under this EIA.
1.12	Chapter 8: Environmental Impacts	29. Most of the pollution level, pollutants and associated impacts are not quantified e.g. ambient noise, waste water discharge, dust particles, hot water discharge, emission of green house gases, etc.	29. According to EIA guideline of DoE, World Bank and the approved ToR attempts were made to quantify the impacts where possible. The mentioned impacts were quantified in Chapter 8. Some of the impacts which are not possible to quantify were assessed on the basis of qualitative scale following world standard practices.	29. Considering importance to the comment, the Final EIA has been updated rechecking the impacts and taking attempts for further quantification.
		30. Only qualitative comments and assessment of which mostly assumption basis done by the experts without having any literature reference in support of their assessments. It is necessary	30. Following the approved ToR , the EIA Guidelines of DoE and world standard practice, the qualitative assessments were made. The detail methodology of the assessment is	30. The details of the adopted methodology has been described in sections 3.15

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
		to assess impacts of such pollutants especially when any project has fallen near the world heritage site.	described in Chapter 3 and Chapter 9. It is to be mentioned here that the proposed project is about 70 km away from the world heritage site.	
1.13	Chapter 1: Introduction-sec 1.7	31. No power plant expert was included in the EIA team. The team has no experts for water quality assessment and mangrove specialist. A separate air quality experts would be good to assess the ambient air quality measurement.	31. Mechanical Engineer and Electrical Engineer having more than thirty years of experience in power plant planning, construction and supervision were engaged in the EIA as power plant expert. Water Resources Specialist and Environmental Specialist were engaged among others for water quality assessment. . Ecologist involved in this EIA has vast experience in Mangrove related research and ecological assessment. Air quality assessment is the task of the Environmental experts.	31. However, according to comments, area of experience of each professional has been incorporated in section 1.7 under Chapter 1 additionally for clarification.
1.14	Chapter 2: Policy ,legal and administrative framework-sec 2.1.3	32. Standard accepted pollution limit for most of the pollutants mentioned in this section i.e. SOx, NOx, cooling water discharge, liquid waste, noise level are undefined. So without setting any standard limit of pollution how could the impact be assessed.	32. Table 2.2 describes relevant standards for emissions. GOB has not defined any standard for emission of SOx and NOx from the power plant. Hence, it is suggested to consider ambient air quality standard and World Bank standard (mentioned in the same table) for plant design. Accordingly, the impacts were assessed comparing with the aforementioned standards	32. Please refer Table 8.1
1.15	Chapter 9: Impact evaluation, Table 9.1	33. The impact matrix is again qualitative; Is there any specific rule applied to produce this matrix? A standard impact scoring matrix using appropriate scale would give logical standard and improve the acceptance of this matrix rather giving any assumption base	33 Following the approved ToR , the EIA Guidelines of DoE and world standard practice, the qualitative assessments were made. The word scale defined and used for this EIA is more effective than the mentioned conventional	33. More details of the adopted methodology have been described in sections 3.15 and the scale is defined in at footnote of Table 9.1.

Sl. No.	Section / Description as enumerated in the Final report	Comments	Responses	Action
		matrix.	numeric scale (score based).	
1.16	Chapter 10: Mitigation of impacts	34. Most of the mitigations placed in the table 10.1 are just statements. But those measures did not elaborate the techniques/methods to follow the mitigation measures. Without recommending the techniques listing a huge number of mitigation measures has no meaning. Will these be implemented and taken care of by the investors? How? What will be the mitigation cost?	34. All the mitigations measures mentioned in Table 10.1 are not only statement, those are based on International Standard practice and self explanatory. The techniques of mitigation have been elaborated in EMP measures. Responsible institution(s) mentioned in the table would bear the cost. The project cost includes mitigation cost.	34. Considering the importance to the comments, the Final EIA report has been updated rechecking the mitigation measures and describing the EMP accordingly.
1.17	Chapter 11: EMP	35. No reflection of EMP cost in the chapter?	35. As above.	35. Now, the EMP Costs have been addressed in Section 12.8
1.18		36. Where is the contingency plan (the impact those could not be mitigated)?	36. All the contingency measures have been incorporated with mitigation measures in Table 10.1. In addition, a separate Hazard and Mitigation Measures and Plan are described in Chapter 11.	36. No further action required
		37. Where is the accidental impact assessment?	37. All the potential hazards from the power plant including accidental event have been identified and evaluated in Chapter 11	37. No further action required
1.19	Chapter 13: Env. Monitoring plant	38. Cost of the monitoring plan missing?	38. Responsible institution would bear the cost of monitoring.	38. Please refer to section 13.1.
	Chapter 15: Conclusion and	39. This chapter likely to be toned down the potential negative impacts intentionally.	39. CEGIS is a public trust under the Ministry of Water Resources and conduct the EIA unbiased.	39. No further action

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
	Recommendations		Each potential impact noted and mentioned with proper explanations. Final remarks of the EIA team were made in the conclusion chapter re-stating the major findings (major positive and negative impacts, mitigation measures, and EMP) of EIA.	required.
		40. Impacts on Sundarbans during coal transportation are not mentioned.	40. The paragraph 16 of the section 15.1 concludes the impacts on Sundarbans during coal transportation.	40. No further action required.
		41. Recommendations are not specific and not answering the major issues related to this project such as" a. Transshipment through Sundarbans b. Thermal cooling water discharge c. Waste water effluent d. Standard limit of air, water and sound pollution for Sundarbans and Passur river e. Compensation for the Impact on fisheries f. Compensation for the Impact of livelihood of those people who depends on Sundarbans and Passur river g. Impact on dolphin, etc.	41. On the basis of the detail field investigations, comprehensive analysis of project planning and design, evaluation of impacts and mitigation measures, specific recommendations have been made. The issues mentioned in the comments are properly addressed in Policy and Legal Analysis (Chapter 2), Impact Evaluation and Mitigation Measures (Chapter 9 and 10) Environmental Management Plan (Chapter 12), Hazard and Risk Management Plan (Chapter 11) and Environmental Monitoring Plan (Chapter 13).	41. The recommendations have further been checked and updated through discussions and expert knowledge for the Final EIA Report.

Sl. No.	Section / Description as enumerated in the Final report	Comments	Responses	Action
2.	**Comments from Md. Salim Bhuiyan, Chief Planning, Bangladesh Water Development Board**			
2.1	Chapter -8: Environmental Impact Art. 8.3.8.1: Impact on water bodies & water resources: Page -201, Drainage Congestion & water logging "The project area of 1834 Acre……. Village. However Drainage Congestion might arise in the Kaigar Daksati village, only if the reach of the Kaigar Daskati canal is obstructed.	In impact evaluation chapter 9, the canal obstruction matter has not been mentioned or taken care.	The issue has been taken care in the relevant sections.	Table 9.1 heading 'C' sub heading '2' disruption drainage.
2.2	Page -201, Erosion and Accretion "There will be no significant…. Project. However Construction of jetty and movement of large vessel for coal transportation may cause wave erosion at the time of ebb tide in same places.	Same as above. Furthermore this is also not been addressed in Chapter-12: EMP	The issue has been taken care in the relevant chapter-12.	Relevant measures have been addressed in Chapter 10 (under Coal transportation, transshipment and handling heading of the Table 10.1, sub-heading erosion and accretion.

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
2.3	Page -201, Maintenance Dredging "Maintenance dredging for maintaining navigability of the river for coal transportation may require. The dredging activities.....site. Unplanned dredging may also cause erosion in some places.	Same of above.	The Required Maintenance Dredging Work shall be implemented by the relevant agencies (to be decided by GOB). The relevant agency shall comply with all the rules and regulations related with Environmental Protection, Dredging Activities, Dredging Spoil Management, etc.	In the Final Report, impact of dredging has been addressed in sub-section 8.2.8 and 8.3.9. Accordingly, appropriate EMP for dredging has also been addressed in section 12.3.6 and 12.3.7
2.4	Chapter-11 EMP, Art-11.3 EMP During constructing phase Sub Art. 11.3.6 Dredging Activities Management plant ,page-247 (Last bullet) " Proper management of dredged spoil must be assessed;	The dredged spoil management plan has not been narrated or presented in the report.	The dredging spoil shall be managed by the implementing agency (either MPA, BIWTA of BWDB, to be decided by the GOB) following the Dredging Spoil Management Policy of Bangladesh (Draft).	In Final Report, Section 8.2.8 and 8.3.9 discussed about the impacts of dredging. However the EMP for dredging has also been addressed in section 12.3.6 and 12.3.7
2.5	Chapter -15. Conclusion and Recommendation Art 15.1 Conclusion, page-285, para-8, line 4-5: On the other hand disposal of sludge and slurry would be major issue. No management plan has been planned for slurry and sludge	It is not clear why a major issue though envisaged is not taken care in the EMP	The project plan and design have been updated and consider the sludge, slurry, and waste water to be generated from desalinization plant, R.O. plant, ash disposal, etc. shall be discharged after series of re-use and recycling system to the central effluent treatment sump to Passur river considering DoE standard. Process of Sludge	Incorporated in chapter-5 of the Final Report.

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
	disposal.		treatment has been discussed in Section 4.17.4	
3	**Comments from Chief Forest Conservator, Department of Forest**			
3.1	Chapter 7: Important Environmental and Social Components Art 7.8.1 Habitat Art 7.8.2 Terrestrial flora Art 7.8.3 Terrestrial fauna Art 7.8.4 Aquatic flora Art 7.8.5 Aquatic fauna Art 7.8.6 Benthic community	These Impacts are to reach distant part of the ECA of Sundarbans	The mentioned sub-sections of the Chapter-7 are related with the rationale of the selecting Important Environmental Components (IEC). The mentioned chapter does not state that these impacts shall be associated with the proposed power plant. The EIA concludes that due to adoption of efficient technologies, different pollution abatement measures, consideration of MoEF's standard (as mentioned in ECR 1997 and the amendments thereafter) in plant design, and plan of implementation and operation, impacts from the proposed power plant will be minor and will hardly reach to the Sundarbans. It is to be mentioned here that, the proposed plant is located 14 km away from the nearest point of Sundarbans and 70 km away from the World heritage site.	In Chapters 8 and 9, all the impact assessments and evaluations have been drawn considering these IECs. Accordingly, mitigation measures have been provided in Chapter 10.
3.2	Chapter 9: Impact Evaluation Art 9.1	These impacts are reversible under this report. But, no research and sources of information have not quoted.	The impact evaluations were done following EIA guideline of DoE and the ToR approved by DoE. Following a comprehensive evaluation matrix based on a qualitative scale defined by word scenarios each impact was evaluated through	The Final Report has been prepared incorporating further details of the methodology of Impact Evaluation in Chapter

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
			round table discussion and expert knowledge. The iterative approach was followed during finalizing the evaluation.	3, Section 3.16.
3.3	Coal transportation route and loading and unloading system at Akram point	a. Accidental firing in Sundarbans due to coal loading and unloading during dry season. b. Three wild life sanctuaries have been declared in the coal transportation route. So, this coal transportation will disturb the habitat of Dolphin and extinct the Dolphin community. c. Sulfur content of the imported coal should be 0.6% due to protect acid rain. If the rate is increased then it will create acid rain and damage the ecosystem of Sundarbans. d. Surely, the impact of power plant will extend in the ECA of Sundarbans area.	a. Proper management Plan to prevent the accidental fire from coal has been provided in the EMP. In general, coal-carrying vessels are equipped with coal combustion preventing equipments. b. Coal carrying vessels will be plying along the existing navigation route of Mongla Port Authority and BIWTA. For ensuring environmental safety for Sundarbans and Dolphin community, coal carrying vessels shall follow ECR 1997 and IMO conventions including MARPOL. DG shipping, Mongla Port Authority and BIWTA controls and regulate the aforementioned conventions and rules. c. All the emission including SO_2 and NO_2 shall satisfy MoEF standard. The possibility of acid rain is also very low due to undisturbed dispersion of SOx and low possibility of fumigation. Provisions have been kept in case of coal having high sulfur	Accidental risk and necessary mitigation measures have been addressed in Section 11.3.2, table 11.2 and table 11.4. Impacts of coal transportation have been mentioned in Section 8.4 and necessary mitigation measures have been discussed in Chapter 10. EMP For Coal Transportation has been discussed in Chapter 12 (sub-section 12.4.2, 12.4.11, etc) Sub-section 8.3.5 discusses details of SOx and NOx emission. The acid rain issue is discussed in sub-section 8.3.6. Impact on Sundarbans has been discussed 8.3.15,

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
			content; flue gas desulfurization will be operated to limit SO_2 emission with the standard. d. No major impacts will reach the Sundarbans due to: • The nearest point of Sundarbans is located 14km southwestward from the plant location. • Prevailing wind rarely flows towards Sundarbans • The power plant shall be implemented and operated following all the Environmental Rules and regulations of Bangladesh and satisfying MOEF's standard (ECA 1997) for ensuring protection of Sundarbans.	8.4.6 and 8.3.14.
3.4	Chapter 11: EMP	a. No reflection of EMP cost and name of responsible organization in the chapter? b. Emergency Environmental Management needs to be incorporated	a. EMP cost shall be borne by the responsible institutions mentioned in the Table 10.1 b. Chapter 11 describes about the hazard and risk assessment including Management Plan for emergency events, to prevent accidental event, etc	a. This issue is considered in Chapter 12 (section 12.8) and the detail cost estimation has been mentioned in the Feasibility Study Report. b. Discussed in Chapter 11
4.	**Comments from Department of Fisheries, Bangladesh**			
4.1	General comments on EIA	Members from Department of Fisheries conducted a short term study considering the	1. Thanks for your acknowledgement on this	No further action required

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
	report	findings of the EIA report. The conclusion of the short term study is: 1. The committee is primarily agreed with the observations and recommendations outlined in the CEGIS final EIA report. 2. There have been minimum participation of the field level officers (both Upazila and district level) of the Department of Fisheries was observed during the consultation period conducted by CEGIS. 3. Committee members also comprehended that to prepare a details report on short-term and long-term impacts of the proposed coal-based thermal power plant construction project a comprehensive study by involving different stakeholders is necessary.	EIA report. 2. EIA team made consultation meeting with the district fisheries officer of Bagerhat and Upazila fisheries officer of Rampal. 3. A wide range of stakeholder consultation meeting has been made with BPDB, BWDB, BIWTA, MPA, DFO, DoF, DoE, DAE, DC office, Local People, Shipping Agency, Cement Factory, Shipyards, etc.	
5.	**Comments from Director, Technical, DoE**			
5.1	General comments on EIA report	1. The EIA has to be in line with the approved ToR	1. The Final EIA Report has been prepared incorporating all issues and components mentioned in the approved ToR except the cost benefit analysis. The Cost Benefit Analysis is a part of the Feasibility Study.	1. The report has been prepared following the approved ToR.

Sl. No.	Section/Description as enumerated in the Final report	Comments	Responses	Action
		2. Attached feasibility study report	2. The Feasibility study has been submitted along the Final EIA Report	2. BPDB is to provide feasibility study report
		3. Attached coal sourcing report	3. The Chapter 5, section 5.15 describes coal sourcing and transportation	3. The Chapter 5, section 5.15 describes coal sourcing and transportation
		4. Ensure of coal quality	4. Coal Quality has been mentioned in Table 5.4 of section 5.15.	4. Coal Quality has been mentioned in Table 5.4 of section 5.13.
		5. Incorporate Ash utilization	5. Ash Utilization is mentioned in sub-section 12.6.	5. Ash Utilization is mentioned in sub-section 12.6.
		6. Incorporate economic evaluation of environmental cost and Cost Benefit Analysis	6. The EIA finds no significant environmental impacts that need to be evaluated by its economic cost. It is to be mentioned here that the economic evaluation of environmental impacts is beyond the scope of the EIA as per the ToR provided by BPDB.	6. Economic evaluation is not included. However, BPDB may carry out separate study for economic evaluation of environmental cost for detailing out the Environmental Action Plan by the EPC contractor after obtaining environmental clearance certificate.

Sl. No.	Section / Description as enumerated in the Final report	Comments	Responses	Action
		7. Use some automatic analyzer to monitor water quality and to identify the oil spillage	7. The section 5.24 mentions major monitoring equipments.	7. Monitoring equipments are mentioned in section 5.24 and monitoring plan is mentioned in Chapter 13. The collection of baseline data of the monitoring locations to be carried out during pre-construction phase.
		8. Provide baseline data of the location to be monitored during construction and operation period mentioned in the Monitoring Plan.	8. Baseline has been prepared following the ToR approved by the DoE. The baseline data of the locations to be monitored during construction and operation period may be recorded during pre-construction phase by the JV Company and EPC contractor to be appointed after obtaining Environmental Clearance Certificate	The same has been mentioned in section 13.1

Comments and suggestion of DoE provided in the meeting held on 20 May 2012 on EIA

Sl No	Comments from DoE	Response
1	**Baseline Delineation**	
a	Detail list of flora and fauna available in the study area are to be presented	The lists have been attached in Appendix XI of the Final Report
b	Baseline should include surface and ground water quality, river bed sediment, benthic community, air quality, etc	As per the comments we have updated the Final Report incorporating the followings: • Surface water quality of the Passur River in sub-section 6.5.10 and 6.9(a) • Groundwater quality of study area and project area in sub-section 6.7.4 and table (6.11) • River Bed sediment in sub-section 6.5.8 • Benthic community in section 6.18 • Air quality monitored at different locations at downwind direction of the project site in sub-section 6.4.4
c	Baseline should be prepared in a way that to be useful for following post project monitoring activities	Baseline has been prepared collecting all necessary primary and secondary data as per the ToR approved by DoE. But for the comparison of data to be monitored during project construction and operation phase, baseline shall be updated as per the monitoring plan during pre-construction phase by the project authority. All the data to be collected at pre-construction phase shall be submitted to DoE
d	Give detail location and GPS information of the data collection points	Map. 3.3, 3.4 and 3.5 of the chapter 3 give detail locations of the data collection points. Moreover, the relevant sections give detail description of the data collection points.
e	Prepare a map showing locations of baseline data collections	Map. 3.3, 3.4 and 3.5 of the chapter 3 give detail locations of the data collection points.
f	Describe existing tidal behavior and tidal inundation within the project area	As per the comments, the detail descriptions of tidal behavior, inundation, etc have been discussed in 6.5.5 and 6.5.6.
g	Describe present land use practice, agricultural practice in the project area	The details of agricultural land use, practice, production, crop calendar, etc have been discussed in section 6.13.
2	**Monitoring Plan**	
a	The Monitoring Plan suggested in the EIA Report is well enough and should be implemented by the project proponent.	Table 13.1 mentions BPDB/JV Company of the Power Plant as responsible authority along with other responsible institute (s) for monitoring.
b	Baseline data should also be in line with the format of monitoring plan so that monitoring data would be easily comparable with baseline conditions	Baseline has been prepared collecting all necessary primary and secondary data as per the ToR approved by DoE. But for the comparison of data to be monitored during project construction and operation phase, baseline shall be updated as per the monitoring plan during pre-construction phase by the project authority. And all the data to be collected at pre-construction phase shall be submitted to DoE
c	Mention DoE as a regulating/supervising/guiding authority of monitoring.	DoE has been mentioned as a regulating authority on behalf of GOB. This has been mentioned in the footnote of the table 13.1.

Sl No	Comments from DoE	Response
3	**Land use Map**	
	Provide a larger scale land use map. Land use map may also contain existing industries, port areas, and other infrastructures	Map 6.2b, 6.2c and 6.2d have been updated as per the comments
4	**Ash Management and Utilization**	
a	Consultation meeting might be carried out with Cement manufacturing agencies to know the use of ash in cement production.	Consultation has been carried out with Mongla Cement Factory and mentioned in table 15.3
b	Provide scientific explanation of ash utilization in Agricultural Field with practical example	Sub-section 12.6.2 has been updated provided with scientific explanation with appropriate citation and references of different relevant published scientific research papers.
5	**Water and Waste Water Treatment**	
a	Give all the potential sources of waste water, slurry and sludge	Sub-section 5.16.4 and 12.4.9 give detail description of potential sources of waste water, slurry and sludge
b	Describe process of water, waste water, effluent , sludge and slurry treatment	Sub-section 5.16.4 provides detail information on the waste water and effluent treatment processes, and disposal system for waste, sludge, etc.
c	Give process of disposal of waste, waste water, sludge and slurry	
6	**Stakeholder Consultation**	
	Summarize perception and opinion of the local people Highlight opinion of the project affected people and beneficiaries	Chapter 15 describes perception and opinion of stakeholder. Key opinions of the local have also been listed in different text box in the chapter.
7	**Public Disclosure of the EIA and Project**	
	BPDB should make a public disclosure meeting on proposed project and its EIA Give consent when to make the report publicly open through website of DoE. EIA report is a public document and as per the law the report should be made open for all	BPDB is taking necessary steps for organizing public disclosure
8	**Executive Summary**	
	• Give cross reference of the relevant sections in the executive summary so that reader can easily find the details if necessary • In executive summary, please give full meaning of the abbreviation when it first appears	The executive summary has been updated mentioning the references of the relevant sections as per the comment
9	**Environmental Management Plan**	
a	Standard and Good Practice: Give cross references of mentioned standards, good practices, etc, and annex Good Practice Documents	Good Practice Documents recommended by World Banks, IMO are separate documents published by World Bank and the relevant agencies which may not be possible to re-print without appropriate permission. However, in the relevant section references of the documents have been mentioned. Section 12.7 discusses about the Standard Operational Principles.
b	Environmental Management Plan: Include the following: 1. Fisheries Management Plan 2. Ecosystem Management Plan 3. Toxic and Hazardous Management Plan 4. Ash Management Plan 5. Socio-economic Management Plan 6. Health and Safety Management Plan	The EMP has been updated incorporating the mentioned Plan, 1. Fisheries Management Plan in sub-section 12.4.15 2. Ecosystem Management Plan in sub-section 12.4.12 3. Toxic and Hazardous Management Plan discussed in Section 11.4. 4. Ash Management Plan: The power plant inbuilt ash

Sl No	Comments from DoE	Response
		management system has been discussed in 15.14.15 and 15.14.14. In addition, EMP for ash management i.e. ash utilization has been discussed in section 12.6. Management of ash to be generated from coal handling and ash handling process has been discussed in 12.4.11, 12.4.12, and 12.6. 5. Different management plans related to socio-economy have been discussed in 12.3.10, 12.3.11, 12.3.12, 12.4.13, 12.4.14, etc 6. Health and safety management plan has been discussed in 12.3.10 and section 12.5 in details
10	**Annex**	
	• ToR of BPDB and Approved ToR of DoE should be in Annex • Good Practice Documents of World Bank, IMO or other agencies as mentioned in the report • Detail Layout of the project showing location of ETP, Water Treatment Plant, Ash Sump, Road Network, Township, Plant Location, Administrative Building, etc	• As per the comments the ToRs have been attached with the Final Report in Annex IX and X. • Good Practice Documents recommended by World Banks, IMO are separate documents published by World Bank and the relevant agencies which may not be possible to be re-printed without appropriate permission. However, in the relevant section references of the documents have been mentioned. Section 12.7 discusses about the Standard Operational Principles. • Detail Layout Plans have been attached in Annex IV
11	**Additional Documents:** Feasibility Study report should also be submitted to DoE as per the requirement of obtaining Environmental Clearance Certificate. The Feasibility Study Report shall not be made public from the DoE, this is only for reference and for reviewing the EIA	BPDB is taking necessary steps in this regard
12	Mention all back calculation applied in this EIA e.g. calculation of coal requirement, calculation of SOx emissions, etc	Calculation of coal requirement has been mentioned in 5.11 Calculation of SOx emission has been mentioned in 8.3.5.
13	Work Plan should be included in project description	The Work Plan of the project implementation has been discussed in section 4.10. A detail Work Plan (Project Implementation Schedule) has also been attached in Annex IV.
14	**Comments and Response Matrix**	
	Make Response to the comments of different department/agencies (i.e. IUCN, Forest Department, Department of Fisheries, BWDB, etc) made available to BPDB and CEGIS Mention section number where the comments have been taken care of	The comments response matrix attached with the final report in Annex VIII has been updated as per the comments

Appendix IX: Terms of Reference Provided by BPDB

A. Background

The Power System Master Plan (PSMP) of June 2006 (update) developed least cost generation addition plan up to year 2025. This plan includes an optimum mix of base load and peak load plants, corresponding to the electricity demand characteristics of Bangladesh. The PSMP recommended installing 4,000 MW new power plants capacity using coal as fuel by 2025 due to projections of limited gas reserves facing Bangladesh. As part of the plan, Government of Bangladesh (GOB)/ Bangladesh Power Development Board (BPDB) has decided to add two coal-fired steam power generating units of 2x(500-660) MW at proposed locations of Chittagong & Khulna based on imported coal including future plant capacity expansion provision for another 2 (two) units at each location. The Coal Fired Stream Power Plant shall be of most efficient technologies and minimum pollution level having Super – Criteria Stream Parameters. Environmental Impact Assessment (EIA) of the projects is to be conducted to comply with the environmental laws of Bangladesh including guideline of World Bank Group.

B. Objective

The objective is to conduct Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) for the proposed site Khulna. The eventual objective is to develop the projects through interested investors including private participants on Tariff Based Competitive Tendering. Towards this end in View, a Shell Company to be formed as subsidiary of BPDB (Bangladesh Power Development Board) and will be partner of the winning Sponsors/Developers through equity participation.

C. Scope of Services

The scope of works includes mainly execution of IEE and EIA and detail scope of works are as follows:

C1 Initial Environmental Examination

The scope of services under the IEE study is as follows:

i. Selection of 2 possible alternative sites and recommend one site which involves minimum agricultural land, minimum habitats to be displaced, minimum/avoiding hilly area, use maximum Government land (if available) and develop suitable layouts.

ii. Land acquisition plan from the office of the Deputy Commissioner's office.

iii. Land use/ Land cover including ecologically critical area, national parks, forest, orchard, cultural heritage site etc., if any, in the site selected for the power plant.

iv. Topographical survey of the selected project site.

v. Meteorological data collection of the site from Bangladesh Meteorological Department (BMD).

vi. Hydrological and morphological data collection from BWDB and BIWTA.

vii. Ago-ecological zones data collection from AEZ report.

viii. Agricultural data collection from BBS and DAE.

ix. Water resources and soil salinity data collection from BWDB and SRDI.

x. Collection of data on access to port/railway/road from Port Authority, Bangladesh Railway and Roads and Highway Department.

xi. Soil investigation of the selected site.

xii. Seismicity analysis.

xiii. Sources of fuel and water from BPDB.

xiv. Effluent disposal point(s).

xv. Data on water quality, air quality and noise level.

xvi. Transportation of raw material and fuel.

xvii. Preliminary planning, design and drawing of power plants.

xviii. Specific statutory requirements applicable in Bangladesh.

xix. Establishment of the environmental and social baseline condition in respect of water resources, air quality, noise level, land resources including land use/land cover, agriculture, fisheries, ecosystems and socio-economic condition.

xx. Public consultation and disclosure

xxi. Identification of Important Environmental and Social Components (IESC).

xxii. Assessment of impacts of the proposed power plant on the environmental and social components.

xxiii. Preliminary Environmental Management Plan (EMP).

xxiv. Risk and hazard analysis.

xxv. Terms of Reference (TOR) for the Environmental Impact Assessment (EIA) study for approval by DOE.

xxvi. Produce an IEE report, which shall form the basis of obtaining site clearance from the DOE.

C2 Environmental and Social Impact assessment

The scope of services under the EIA study is as follows:

i. Carry out environmental and social impact assessment identifying the maximum generation capacity capable of being installed (not less than 1300 MW) that will satisfy the applicable environmental requirements, including the laws and bylaws of Bangladesh and World Bank Group's health and safety guidelines.

ii. Carry out hydrological investigation; evaluate the necessary coal supplying system and power evacuation facilities required.

iii. Elaborate project description and design and the activities at pre-construction, construction and post-construction phases.

iv. Establish environmental and social baseline condition in respect of water resources, land resources, agriculture, fisheries, ecology and socio-economic condition.

v. Carry out meteorological, noise level and air quality investigations for the proposed power plants and the necessary additional transmission lines.

vi. Select environmental and social components likely to be impacts by the proposed coal-fired power plants.

vii. Identify suitable control measures to minimize CO_2, SO_2, NO_2 etc. emission from the power plants, if any, that should be required the developer under the request of proposals.

viii. Identify exhaust stack requirements applicable to each plant so that concentration of SO_2 and particulate matter in the surrounding area is uniform and minimum.

ix. Thermal plume modeling will be completed considering the proposed power plant including nearby industrial installations (if any).

x. Ability for the developers of the power generation projects to satisfy all national regulatory requirements and international obligations related to health and human safety and the environment in the construction, operation, and maintenance of imported coal projects of the anticipated size at the identified sites.

xi. Ability to dispose efficiently and in a manner that complies with all national regulatory requirements and international obligations related to the ash generation by the power generation facilities (and the development of a recommended plan for doing so).

xii. Social/infrastructure facilities to be required.

xiii. Assess and evaluate the ability of each of the project (and any expansion projects at the site) to comply with all health and safety and environmental laws of Bangladesh and the requirements of the World Bank group. Identify any restriction that should reasonably be imposed on the developers of the power generation projects to ensure that expansion projects can be designed, constructed and operated in compliance with all such laws, regulations and requirements and also international obligations.

xiv. Evaluate the impact on environment in line with Bangladesh and/or World Bank requirement for the coal power plant and transmission line to ensure that the power generation facilities and transmission facilities can be designed, constructed and operated in compliance with all applicable environmental requirements.

xv. Preparation of Environmental Management Plan (EMP), which shall include mitigation measures, enhancement and contingency measures and compensation.

xvi. As per TOR approved by the DOE, produce an EIA report which shall form the basis of obtaining environmental clearance from the DOE for implementation of the coal-fired steam power generation facilities of 2 x 500~600 MW.

D. Responsibilities of consultants

The consultant shall carry out the services as detailed in "Scope of Works" and "Job Description of Professionals" in the best interest of the BPDB with the reasonable care, skill and diligence with sound engineering administrative and financial practices and shall be responsible to the executive agency (BPDB) for discharge of responsibilities.

E. Resources Requirement / Qualification of Professionals

All Experts must have graduate with 10 years job experience in relevant field except Environmental Law Specialist, Junior Environmental Engineer and Field Researcher, whose job experience shall be 3 years.

F. Deliverables

The following reports are to be delivered by the consultants to BPDB:

- An Inception Report shall be submitted within 1(one) week from the commencement of the assignment
- A Draft Report on the Initial Environmental Examination (IEE) study at the end of 1.0 (one) months from the date of signing contract for obtaining location clearance from the DOE;
- A Final Report on the Initial Environmental Examination (IEE) study at the end of 1.5 (one and half) months from the date of signing contract for obtaining location clearance from the DOE;
- A Draft Report on the Environmental Impact Assessment (EIA) study at the end of 2.0 (two) months from the date of location clearance for obtaining environmental clearance from the DoE;
- A Final Report on the Environmental Impact Assessment (EIA) study at the end of 2.5 (two and half) months from the date of location clearance for obtaining environmental clearance from the DoE; and
- All report shall be submitted to BPBD in (five) hard copies and soft copy on CD.

G. Staffing

A multi-disciplinary team of professional, detailed below, should conduct the IEE and the EIA studies.

Sl. No.	Discipline	Number	Person-Months		
			IEE study	EIA study	Total
1	Environmental Engineer/Team Leader	1	2	3	4
2	Water Resources Engineer	1	1	2	3
3	Electrical Engineer	1	1	1	2
4	Morphologist	1	1	1	2
5	Mechanical engineer	1	1	1	2
6	Ecologist	1	1	1	2
7	Fisheries Specialist	1	1	1	2
8	Soil and Agriculture Specialist	1	1	1	2
9	Socio-Economist	1	1	1	2
10	Environmental Law Specialist	1	1	1	2
11	Junior Environmental Engineer	1	1	2	3
12	Field Researcher	2	2	2	4
	Total:	**13**	**14**	**16**	**30**

Appendix X: ToR Approved by DoE

Government of the People's Republic of Bangladesh
Department of Environment
www.doe-bd.org
Head Office, Paribesh Bhaban
E-16 Agargaon, Dhaka-1207

Memo No : DoE/Clearance/5062/2011/ Date: /04/2011

Subject: **Terms of Reference (ToR) for Environmental Impact Assessment (EIA) of the Proposed Khulna 1300 MW Coal Based Thermal Power Plant Project at Rampal Upazila under Bagerhat district.**

Ref: Your Application dated 28/03/2011 and 09/03/2011.

With reference to your letter dated 28/03/2011 and 09/03/2011 for the subject mentioned above, the Department of Environment hereby gives approval of TOR for Environmental Impact Assessment (EIA) for the proposed Khulna 1300 MW Coal Based Thermal Power Plant Project at Rampal Upazila under Bagerhat District subject to fulfilling the following terms and conditions :

1. The project authority shall submit a comprehensive Environmental Impact Assessment (EIA) report considering the overall activity of the said Project in accordance with the TOR and time schedule indicated in the Initial Environmental Examination (IEE) Report.

2. The TOR of the EIA shall incorporate the following components/items :

I. Executive Summary

II. Introduction
- II.1. Background
- II.2. Purpose of the Study
- II.3. Need of the Project
- II.4. Importance of the Project
- II.5. Scope of EIA Study
- II.6. EIA Team

III. Legal and Legislative Framework, Regulations and Policy Considerations (including inter alia Environment Policy, National Energy Policy, Industry Policy, National Forest Policy, National Water Policy, Coastal Zone Management Policy, National Land use Policy, National Agriculture Policy, Fisheries policy, National coal policy, etc.)

IV. Project Data Sheet
- IV.1. Project Proponent
- IV.2. Project location and area
- IV.3. Nature and Size of the Project
- IV.4. Project Concept
- IV.5. Project Components
- IV.6. Project Activities
- IV.7. Project schedule
- IV.8. Resources and utilities demand
- IV.9. Sources of Primary Fuels (Quality and Country of Origin)
- IV.10. Transportation of primary Fuel

V. Process Description

V.1. Project Site
V.2. Project Layout
V.3. Land Requirement
V.4. Fuel Requirement
V.5. Water Requirement
V.6. Technology Selection and Process Description
V.7. Description of Major Systems
V.8. Material Balance
V.9 Pollution Mitigation Measures (Units & Devices)

VI. Analysis of Suitability for Different Alternatives (this analysis shall be performed, among other approaches, in a GIS based Spatial Decision Support System (SDSS) presenting the suitability of different options for both the interventions)

VII. Detail description of the land cover/land use (with all the existing resource classes along with area coverage shall be shown in the respective maps derived from updated image of proper spatial and spectral resolution. Basic information (name of satellite, date and time of acquisition with atmospheric condition, spatial resolution, color composite etc.) of the image data to be used for making land use/land cover maps shall be mentioned)

VIII. Description of Environment

VIII.1 Study Area (10 Km. radius and 25 Km. towards Sundarbans), Period, Component and methodology (Seasonal Variation should be covered)
VIII.2 Coal availability, including distance to "mine mouth", the non-sterilization coal reserves and the feasibility of distance between station and coal
VIII.3 Water availability
VIII.4 Sorbent availability
VIII.5 Hydrogeology
VIII.6 Meteorology
VIII.7 Ambient Air Quality
VIII.8 Ambient Noise Quality
VIII.9 Surface & Ground Water Quality
VIII.10 Aquatic Monitoring
VIII.11 Soil Quality
VIII.12 Ecology
  VIII.12.1 Forests
  VIII.12.2 Flora
  VIII.12.3 Fauna
VIII.13 Demography Profile and Occupational Pattern
VIII.14 Land use and Cropping Pattern
VIII.15 Socio-economic Scenario
VIII.16 Distance to urban and rural communities (proximity to sensitive receptors)
VIII.17 Transmission capacity/options for linking to grid
VIII.18 Distance to existing infrastructure such as roads, etc.
VIII.19 Current and surrounding land use and associated communities

IX. Environmental Impacts

IX.1 Identification of Impact
IX.2 Sustainability of Quality of Coal and Continuity of Supply
IX.3 Construction Stage Impact
  IX.3.1 Impact on Landform
  IX.3.2 Impact on Natural Resources
  IX.3.3 Impact on Sundarbans Mangrove Eco-systems and other eco-systems
  IX.3.4 Impact on Ambient Air

IX.3.5 Impact on Ambient Noise
IX.3.6 Impact on Water Bodies
IX.3.7 Impact on Soil
IX.3.8 Impact on Workers Health, Sanitation and Safety
IX.3.9 Impact on Key Point Installations & others
IX.3.10 Solid Waste Disposal
IX.3.11 Social Impact due to industrial set up and harnessing of coal and other resources locally (if any)
IX.3.12 Impact due to transportation of raw materials

IX.4 Operation Stage Impact
IX.4.1 Impact on Natural Resource
IX.4.2 Impact on Sundarbans Mangrove Eco-systems and other eco-systems
IX.4.3 Impact due to collection of Resources from Local Sources within the Country (if any)
IX.4.4 Impact on Ambient Air
IX.4.5 Impact on Ambient Noise
IX.4.6 Impact on Water Bodies (both surface & ground)
IX.4.7 Solid Waste Disposal
IX.4.8 Soil and Agriculture
IX.4.9 Impact on Ground Water
IX.4.10 Impact due to Ash Disposal
IX.4.11 Ecology (Flora and Fauna)
IX.4.12 Impact on Occupational Health
IX.4.13 Impact on Public Health and Safety
IX.4.14 Impact on Traffic Movement
IX.4.15 Social Impact
IX.4.16 Impact on Tourism
IX.4.16 Impact due to transportation of primary fuels

X. Evaluation of Impacts

The impacts should be evaluated in terms of their local, regional and national importance. The impact should be assessed in terms of the magnitude, significance, frequency of the occurrence, duration and probability. The confidence level in the prediction must be stated. The judgment of significance of impacts can be based on one or more of the following, depending on the environmental factor being evaluated. These are :

i. comparison with laws, regulation or accepted national or international standards
ii. reference to pre-set criteria such as conservation or protected status of a site, feature or species
iii. consistency with pre-set policy objectives
iv. consultation and acceptability with the relevant decision makers, civil society, local community or the general public.

XI. Mitigation Of Impacts

Mitigation measures which may be of the following categories and coverages:

i. changing project layout, transport routes, disposal routes or locations, timing or engineering design
ii. introducing pollution controls, waste treatment, phased implementation and construction, engineering measures, monitoring, landscaping, social services or public education;
iii. rehabilitation, compensation to restore, relocate or provision of concession for damage

XII. Environmental Management Plan

XII.1 EMP during Construction Phase
XII.1.1 Site Preparation
XII.1.2 Infrastructure Services

XII.1.3 Construction Equipment
XII.1.4 Safety Measures
XII.2 EMP during Operation Phase
XII.2.1 Air Pollution Management
XII.2.1.1 transportation and handling of raw materials
XII.2.1.2 Operation Stage
XII.2.2 Waste Water Management
XII.2.3 Noise Management
XII.2.4 Solid Waste Management
XII.2.4.1 Fly Ash Utilization
XII.2.4.2 Ash Utilization
XII.2.5 House Keeping
XII.2.6 Safety and Occupational Health
XII.3 Greenbelt Development
XII.4 Rain Water Harvesting Plan
XII.5 Rehabilitation and Resettlement Plan
XII.6 Thermal pollution management
XII.7 Coal Washery
XII.8 Coal Yard Mgt
XII.9 CDM Intent
XII.10 Budget for EMP
XII.11 Contingency Plans

The project authority shall:

a) Provide a conceptual contingency plan that considers environmental effects associated with operational upset conditions such as serious malfunctions or accidents;

b) Describe the flexibility built into the plant design and layout to accommodate future modifications required by any change in emission standards, limits and guidelines.

XIII. Risk Assessment

XIII.1 Consequence Analysis
XIII.2 Emergency Response Plan
XIII.3 Risk Mitigation Measures

XIV. Environment Monitoring Plan

XIV.1 Monitoring Plan
XIV.1.1 Stack Emission Monitoring
XIV.1.2 Ambient Air Monitoring
XIV.1.3 Meteorological Monitoring
XIV.1.4 Equipment and Ambient Noise
XIV.1.5 Surface Water & Waste Water Monitoring
XIV.1.5 Ground Water Monitoring
XIV.1.6 Solid & Hazardous Waste Monitoring
XIV.1.7 Flora and Fauna Monitoring
XIV.1.8 Workers Health and Safety Monitoring
XIV.1.9 Community Health Monitoring
XIV.1.10 Monitoring of DMP
XIV.1.11 Monitoring and CSR Activities
XIV.2 Action During Abnormal Operating conditions
XIV.3 Budgets for Monitoring
XIV.4 Reporting

XV. Work Plan

XVI. Project Benefits with Benefit-Cost analysis that covers among others, Environmental and Social Cost

XVI. Public Consultation

Public Consultation both in Local and National Level should be carried out. The public participation process is critical in ensuring public review and input into the EIA process. Some of the authorities to be engaged include: Department of Environment, Forest Department, Water Development Board, BIWTA, Mongla Port Authority, RHD, PWD, DPHE, Bangladesh Parjatan Corporation, Department of Fisheries, LGED, other national/local departments where deemed necessary, Local Administrations (DC, UNO, UP Chairman & Members), Community Based Organizations, Non-Governmental Organizations, Business Unions, Farmers' Unions, etc.

The project authority must provide a detailed Public Participation Plan, which shall include, but not be limited to the following: A timetable for communication, detailing who will be consulted and why; as a minimum, one public meeting should be held during the Scoping phase and one public meeting during the impact assessment phase (although this number might be increased due to the width of the study area). The timing of these meetings would be decided upon in conjunction with relevant stakeholders; ensure that the public participation process complies with the relevant EIA regulations; compile minutes of the meetings and send to all participants and organize appropriate feedback mechanisms for public comment.

XVII. Conclusion & Recommendation

3. Without obtaining approval of EIA report by the Department of Environment, the project authority shall not be able to start the physical activity of the project and also not be able to open L/C in favor of importable machineries.
4. Rehabilitation of human settlement or compensation for any sort of activity which will incur damage or loss of public or private property shall be addressed as per Government of Bangladesh rules and regulations.
5. The project authority shall submit the EIA along with a filled-in application for Environmental Clearance in prescribed form, the revised feasibility report, the applicable fee in a treasury Chalan, the no objection certificates (NOCs) from the local authorities, NOC from forest department (if it is required in case of cutting any forested plant/trees-private or public), NOCs from other relevant agencies and other necessary documents to the Head Office of DOE with a copy to Khulna divisional office.
6. A soft copy of the image data as well as the maps to be generated from the image shall be submitted to DOE Head Office along with the EIA.

(**Syed Nazmul Ahsan**)
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&
Member Secretary
Environmental Clearance Committee
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Copy Forwarded to :

1) Private Secretary to the Hon'ble Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Khulna Division, Khulna.
3) Staff Officer to the Director General, Department of Environment, Head Office, Dhaka

Appendix XI: List of common flora and fauna occurred in the study area

Table A1: Terrestrial Flora

Scientific Name	Local name	Habit	Importance	Status
Abroma augusta	Ulatkambal	Shrub	Medicinal	Rare
Acacia moniliformis	Akashmoni	Tree	Note known	Common
Acacia nilotica	Babla	Tree	Ornamental	Common
Acalypha indica	Muktajhuri	Shrub	Medicinal	Common
Acanthus illicifolius	Hargoja	Saline Herb	Medicinal	Common
Achyranthes aspera	Apang	Herb	Medicinal	Common
Acrostichum aureum	Tiger Fern	Herb	Not Known	Common
Adenanthera	Rakton	Tree	Firewood	Rare
Adhatoda zeylanica	Bashak	Shrub	Medicinal	Rare
Aegle marmelos	Bel	Tree	Medicinal, Fruits	Common
Aeschynomene aspera	Shola	Shrub	Fuel	Rare
Albiazia odoratissima	Shrish	Tree	Timber	Common
Albizia richardiana	Gagon serish	Tree	Firewood, timber	Common
Albizia lebbeck	Sirish	Tree	Timber and fuel wood	Very Common
Albizia procera	Silkaroi	Tree	Timber and fuel wood	Common
Alostonia macrophylla	Chatim	Tree	Ornamental	Common
Alstonia scholaris	Shatim/Shatian	Tree	Timber	Rare
Amaarthus spinosa	Katanatea	Herb	Medicinal	Common
Anthocephalus chinensis	Kadam	Tree	Timber and fuel wood	Common
Aphanamixis polystachya	Pitraj	Tree	Timber	Rare
Areca catechu	Supari	Tree	Fruit and Timber	Very Common
Artocarpus heterophyllus	Kanthal	Tree	Timber, Fruits	Common
Artocarpus lakoocha	Deoa	Tree	Fruits	Rare
Averrhoa carambola	Kamranga	Tree	Fruits	Common
Avicennia officinalis	Bine	Tree	Timber	Common
Azadirachta indica	Nim	Tree	Timber and medicine	Common
Bambusa sp	Bash	Woody Herb	Furniture	Common
Barringtonia acutangula	Hijal	Shrub	Fuel wood	Common
Bauhinia sp.	Kanson	Tree	Ornamental	Rare
Bombax ceiba	Shimul	Tree	Cotton and Fuel wood	Common
Borassus flabellifera	Tal	Tree	Timber	Common
Calamus tenuis	Bet	Shrub	Thatching	Common
Calophyllum inophyllum	Sultan Chapa/Punnag	Tree	Ornamental	Rare
Calotropis gigantea	Akand	Shrub	Medicinal	Common
Calotropis procera	Akand	Shrub	Medicinal	Common
Carica papaya	Papay	Shrub	Fruit	Common
Carissa carandas	Karamcha	Shrub	Fruit	Common
Cassia fistula	Sonalu	Tree	Ornamental	Common
Cassia siamea	Minjira	Tree	Ornamental	Common
Cassia alata	Dardmardon	Shrub	Medicinal	Common
Cassia occidentalis	Barahalkasunda	Shrub	Fuel wood	Common
Cassia tora	Chakunda	Shrub	Fuel wood	Common
Casuarina eqisetifolia	Jahu	Tree	Ornamental	Common

Scientific Name	Local name	Habit	Importance	Status
Centella asitica	Thankuni	Herb	Medicinal and Vegetables	Common
Cerbera Odollam	Dabur/Amdoua	Tree	Fuel wood	Rare
Cestrum nocturnum	Hasnahena	Shrub	Ornamental	Rare
Citrus grandis	Jambura	Tree	Fruits	Common
Clerodendrum viscosum	Bhat	Shrub	Medicinal	Common
Cocos nucifera	Narikel	Tree	Fruit and Fuel wood	Very Common
Crataeva nurvala	Baroon	Tree	Fuel wood	Common
Crotolaria retusa	Ban-san	Herb	Medicinal	Rare
Croton bonplandianum	Banjhal	Herb	Medicinal	Common
Cuscuta australis	Swarnalata	Herb	Medicinal	Common
Cynodon dactylone	Durba Gash	Herb	Medicinal	Common
Dalbergia sissoo	Sisso	Tree	Timber	Common
Datura metel	Dhutura	Shrub	Medicinal	Rare
Datura suaveolens	Dutura	Herb	Medicinal	Rare
Delonix regia	Krichnochura	Tree	Ornamental	Common
Dillenia indica	Chalta	Tree	Fruit	Common
Diospyros discolor	Bilatigab	Tree	Fruit	Common
Diospyros perigrina	Deshigab	Tree	Fruit and Timber	Rare
E. ovalifolia	Tali Mander	Tree	Firewood	Common
Eclipta alba	Kalokashi	Herb	Medicinal	Common
Eichornia crassipes	Kachuripana	Herb	Fertilizer	Common
Enhydra fluctuins	Halencha	Herb	Vegetable	Common
Erythrina ovalifolia	Talimandar	Tree	Fuel wood	Common
Erythrina variegata	Mander	Tree	Firewood, Ornamental	Common
Euphorbia hirta	Dudhia	Herb	Fuel wood	Common
Excoecaria agallocha	Gheoa	Tree	Fuel wood	Common
Ficus hispida	Dumur	Tree	Fuel wood	Common
Ficus benghalensis	Bat	Tree	Fuel wood	Common
Ficus heterophylla	Bhui Dumur	Herb	Fuel wood	Common
Ficus hispida	Dumur	Shrub	Fruit and Fuel wood	Very Common
Ficus religiosa	Assawath	Tree	Fuel wood	Common
Gardenia jesminoides	Ghandhoraj	Shrub	Flower	Common
Glycosmis pentaphylla	Daton, Atdli pata	Shrub	Medicinal	Common
Gmelina arborea	Gamari	Tree	Timber	Rare
Heletropium indicum	Hatisuri	Herb	Medicinal	Common
Heriteria fomes	Sundari	Tree	Timber	Common
Hoya parasitica	Parghaca	Climber	Medicinal	Common
I. pescarpi	Chagol Khuri	Climber	Fuel	Rare
Ipomea fistulosa	Dhol Kalmi	Shrub	Fuel	Common
Justicia granderusa	Jagadmadon	Shrub	Medicinal	Rare
Leucas acpera	Satodrun	Herb	Medicinal	Common
Leucauna laucocephalata	Ipil ipil	Tree	Timber	Common
Litchi chinensis	Lichu	Tree	Fruit	Common
Musa sapientum	Kacha kala	Herb	Vegetable	Common
Mangifera indica	Aum	Tree	Fruit and Timber	Common
Marsilea quadrifolia	Susnishak	Herb	Medicinal	Common
Mikania scandens	Assamlata	Herb	Medicine	Common

Scientific Name	Local name	Habit	Importance	Status
Mimosa pudica	Lajjaboti	Shrub	Medicinal	Common
Moringa oleifera	Sajna	Tree	Vegetable	Common
Muntinga calabura	China chari	Tree	Ornamental	Very Rare
Musa paradisiaca var. sapientum	Kala	Shrub	Fruit	Common
Musa paradisiaca var. sapientum	Kala	Shrub	Fruit	Common
Nerium odorum	Karobi	Shrub	Medicinal	Common
Nicotiana plumbaginifolia	Bantamak	Herb	Wild	Common
Nipa fruticans	Golpata	Tree	Domestic use	Common
Nyctanthes arbortristris	Safali	Herb	Ornamental	Common
Nymphea nouchli	Sapla	Herb	Medicinal, Vegetable	Common
Nymphoides cristatum	Chandmala	Herb	Medicinal	Common
Ocimum americanum	Tulshi	Herb	Medicine	Common
Oryza sativa	Dhan	Herb	Food	Common
P. hydropiper	Panimarich	Herb	Medicinal	Common
P. plebajum	Ajban	Herb	Medicinal	Common
Pandanus sp.	Keya	Herb	Ornamental	Common
Phoenix paludosa	Hental	Tree	Wildlife	Common
Phoneix sylvestris	Khejur	Tree	Fruit and Fuel wood	Common
Physalis minima	Bantepari	Herb	-	Common
Pistia strateotes	Topapana	Herb	-	Common
Pithecolobium dulce	Dakshnia Babul	Tree	Ornamental, Avunue	Common
Polyalthia longifolia	Debdaru	Tree	Ornamental	Common
Polygonum orientale	Baro Panimarich	Herb	Medicinal	Common
Pongamia pinnata	Karonga	Tree	Fuel wood	Common
Psidium guajava	Peyara	Shrub	Fruit	Common
Raulwolfia serpentina	Sarpagandha	Shrub	Medicinal	Rare
Rhizophora mucronata	Khamu	Tree	Wild	Common
Rhynchospora rufescens	Shimbhatraji	Herb	-	Rare
Ricinus communis	Reri	Shrub	Oil	Common
Scoparia dulcis	Bandhana	Herb	Medicinal	Common
Sesbania grandiflora	Bakphul	Shrub	Medicinal	Rare
Sesbania rostrata	Dhaincha	Herb	Fuel / Fertilizer	Common
Spondias dulcis	Amra	Tree	Fruit	Common
Sterculia foetida	Jangli badam	Tree	Medicinal	Rare
Streblus asper	Sheora	Shrub	Fuel wood	Common
Swietenia mahagoni	Mahogoni	Tree	Timber, Medicinal	Very Common
Syzygium cumini	Kalogam	Tree	Medicinal, Timber	Common
Tamarindus indica	Tetul	Tree	Fruit	Common
Tectona grandis	Segun	Tree	Timber	Common
Terminalia arjuna	Arjun	Tree	Timber and Medicinal	Common
Terminalia bellirica	Bhorae	Tree	Medicinal	Rare
Terminalia catappa	Katbadam	Tree	Fruit	Common
Thevetia peruviana	Kalka	Tree	Ornamental	Common
Trewia nudiflora	Pitali/Latim	Tree	Timber and fuel wood	Common
Typha angustata	Hogla	Herb	Domestic use	Common
Vitex negundo	Nishinda	Shrub	Medicinal	Rare

Scientific Name	Local name	Habit	Importance	Status
Zizyphus mauritiana	Baroi	Tree	Fruit	Common

Source: IUCN, Department of Forest and Field Investigation

Table A2: Crop field Vegetation

Scientific Name	Local name	Habit	Importance	Status
Acalypha indica	Muktajhuri	Herb	Medicinal	C
Achyranthes aspera	Apang	Herb	Medicinal	C
Alternanthera sessilis	Sachishak	Herb	Vegetable	VC
Amaranthus spinosus	Kata note	Herb	Vegetable	VC
Calotropis gigantea	Akand	Shrub	Medicinal	C
Calotropis procera	Akand	Shrub	Medicinal	C
Carissa carandas	Karamcha	Shrub	Fruits	R
Chenopodium ambrosoides	Chapali ghash	Herb	Medicinal	VC
Cotula hemispherica	Kancha ghash	Herb	Domestic food	C
Crotolaria retusa	Ban-san	Herb	Medicinal	VC
Croton bonplandianum	Banjhal	Herb	Medicinal	C
Cuscuta australis	Swarnalata	Herb	Medicinal	C
Cynodon dactylon	Durba	Herb	Medicinal	VC
Dentella repens	Hachuti	Herb	Medicinal	C
Euphorbia hirta	Dudhia	Herb	Medicinal	VC
Marsilea quadrifolia	Susnishak	Herb	Vegetable	C
Nicotiana plumbaginifolia	Bantamak	Herb	Wild	C
Nyctanthes arbortristris	Sefali	Herb	Ornamental	C
Rhynchospora rufescens	Shimbhatraji	Herb	Medicinal	VC
Rorippa indica	Bansarisha	Herb	Medicinal	C
Sacciolepis interrupta	Nardulla	Herb	Medicinal	VC
Sesbania rostrata	Dhaincha	Herb	Fuel/Fertilizer	VC

C – Common, VC – Very Common, R - Rare

Source: IUCN, Department of Forest and Field Investigation

Table A3: Wetland Vegetation

Scientific Name	Local name	Habit	Importance	Status
Alternanthera philoxiroides	Helencha	Herb	Medicinal	VC
Aponogeton natans	Ghentu	Herb	Medicinal	C
Arundo donax	Baranal	Herb	Medicinal	VC
Azolla pinnata	Kutipana	Herb	Fish food	C
Ceratophyllum desmersum	Jhangi	Herb	-	C
Colocasia esculenta	Kachu	Herb	Medicinal	C
Cyperus sp.	Mutha	Herb	Domestic food	VC
Eclipta alba	Kalokeshi	Herb	Medicinal	C
Cheratopteris sp	Fern	Herb	-	C
Eichhornia crassipes	Kochuripana	Herb	Fertilizer	VC
Enhydra fluctuans	Helencha	Herb	Vegetable	VC
Fimbristylis milliaceae	Joina	Herb	Medicinal	C
Hygroryza aristata	Putki	Herb	Medicinal	C
Ipomoea aquatica	Kalmi sak	Herb	Vegetable	VC
Lemna perpusilla	Khudipana	Herb	-	C
Limnophila sessiliflora	Bijatighas	Herb	Domestic food	C
Ludwigia abscendens	Keshordam	Herb	Medicinal	C

Scientific Name	Local name	Habit	Importance	Status
Ludwigia hyssopifolia	Keshordam	Herb	Medicinal	VC
Mersilea quadrifoliata	Susnisak	Herb	Vegetable	VC
Monochoria hatata	Kechur	Herb	Medicinal	C
Nachamendra alternifolia	Kaisa	Herb	Domestic food	C
Najas. sp	Goisa	Herb	Domestic food	C
Nymphaea nouchali	Shapla	Herb	Vegetable	VC
Nymphaea stellata	Nilshapla	Herb	Vegetable	R
Phragmites karka	Nol Khagra	Herb	Fuel	VC
Pistia stratiotes	Topapana	Herb	-	VC
Polygonum barbatum	Bishkatali	Herb	Medicinal	C
Polygonum glabrum	Bishkatali	Herb	Medicinal	C
Polygonum lanatum	Bishkatali	Herb	Medicinal	C
Sagittaria sagittifolia	Chhotokul	Herb	Medicinal	C
Salvina cucullata	Kuripana	Herb	-	C
Scirpus juncoides	Chisra	Herb	Fuel	C
Spirodela polyrhiza	Khudipana	Herb	-	C
Trapa natans	Singra	Herb	Fruit	R
Utricualria exoleata	Chotojhangi	Herb	Medicinal	C
Vallisnaria spiralis	Bicha	Herb	Medicinal	C
Vetiveria zizanioides	Binna	Herb	Domestic use	C
Wolffia microscopica	Guripana	Herb	-	C

C – Common, VC – Very Common, R – Rare; Source: IUCN, Department of Forest and Field Investigation

Table A4: List of Bird

Scientific Name	**English Name**	**Local Name**	**LOCAL status**	**IUCN Global Status**
Glareola lactea	Small Pratincole	Soto Babubatan	UR	LC
Acridotheres fuscus	Jungle Myna	Jhuti Shalik	CR	LC
Acrocephalus stentoreus	Clamorous Reed Warbler	Bachal Nolfutki	CWV	LC
Actitis hypoleucos	Common Sandpiper	Pati Batan	CWV	LC
Aegithina tiphia	Common Iora	Pati Fatikjal	CR	LC
Alauda erythrorhynchos	Pale-billed Flowerpecker	Metethot Fuljhuri	CR	LC
Alauda gulgula	Oriental Skylark	Udoi Ovrobhorot	CR	LC
Alcedo atthis	Common Kingfisher	Pati Machranga	CR	LC
Amaurornis phoenicurus	White-breasted Water hen	Dholabook Dahuk	UR	LC
Anas acuta	Northern Pintail	Utturey Lenjahash	CWV	LC
Anas crecca	Eurasian Teal	Pati Tilihash	CWV	LC
Anas poecilorhyncha	Indian Spot-billed Duck	Metey Hash	UR	LC
Anas querquedula	Garganey	Giria Hash	CWV	LC
Anastomus oscitans	Asian Open bill	Ashio Shamkhol	CR	LC
Anser indicus	Bar-headed	Dagi Rajhash	UWV	LC

Scientific Name	**English Name**	**Local Name**	**LOCAL status**	**IUCN Global Status**
	Goose			
Anthus hodgsoni	Olive-backed Pipit	Jolpaipith Tulika	CWV	LC
Anthus richardi	Richard's Pipit	Richarder Tulika	CWV	LC
Anthus roseatus	Rosy Pipit	Golapi Tulika	CWV	LC
Anthus rufulus	Paddy field Pipit	Dhani Tulika	CR	LC
Arachnothera longirostra	Little Spider hunter	Choto Makormar	CR	LC
Ardea cinerea	Grey Heron	Dhupni Bok	CR	LC
Ardeola grayii	Indian Pond Heron	Deshi Kanibok	CR	LC
Artamus fuscus	Ashy Wood swallow	Metey Bonbabil	CR	LC
Athene brama	Spotted Owlet	Khuruley Kutipecha	CR	LC
Atthya ferina	Common Pochard	Pati Bhutihash	CWV	LC
Bubulcus ibis	Cattle Egret	Go Boga	CR	LC
Butorides striata	Striated Heron	Khude Bok	CR	LC
Caprimulgus macrurus	Large-tailed Nightjar	Lenja Ratchora	CR	LC
Casmerodius albus	Great Egret	Boro Boga	CR	LC
Celeus brachyurus	Rufous Woodpecker	Khoira Khathkurali	CR	LC
Centropus sinensis	Greater Coucal	Boro Kubo	CR	LC
Ceryle rudis	Pied Kingfisher	Pakra Machranga	CR	LC
Charadrius alexandrinus	Kentish Plover	Kentish Jiria	CR/RR	LC
Charadrius dubius	Little Ringed Plover	Choto Nothjiria	CR & CWV	LC
Charadrius leschenaultii	Greater Sand Plover	Boro Dhuljiria	CWV	LC
Charadrius mongolus	Lesser Sand Plover	Soto Dhuljiria	CWV	LC
Charadrius squatarola	Grey Plover	Metey Jiria	CWV	LC
Chlidonias hybrida	Whiskered Tern	Julphi Panchil	CR/WV	LC
Ciconia nigra	Black Strock	Kala Manikjor	WV	LC
Cisticola juncidis	Zitting Cisticola	Bhomra Soton	CR	LC
Columba livia	Common Pigeon	Gola Paira	CR	LC
Copsychus saularis	Oriental Magpie-Robin	Udoi Doel	CR	LC
Coracias benghalensis	Indian Roller	Bangla Nilkanto	CR	LC
Corvus macrorhynchos	Large-billed Crow	Dar Kak	CR	LC
Corvus splendens	House Crow	Pati Kak	CR	LC
Cuculus micropterus	Indian Cuckoo	Bokotakou Kokil	CR	LC
Cypsiurus balasiensis	Asian Palm Swift	Ashio Talbatashi	CR	LC
Dendrocitta vagabunda	Rufous Treepie	Khoira Harichacha	CR	LC
Dendrocopos canicapillus	Grey-cappedPygmy	Metetoopi Batkurali	UR	LC

Scientific Name	**English Name**	**Local Name**	**LOCAL status**	**IUCN Global Status**
	Woodpecker			
Dendrocopos macei	Fulvous-breasted Woodpecker	Batabi Kathkurali	CR	LC
Dendrocygna bicolor	Fulvous Whistling Duck	Raj Shorali	CWV	LC
Dendrocygna javanica	Lesser Whistling Duck	Pati Shorali	CR	LC
Dicrurus macrocercus	Black Drongo	Kala Fingey	CR	LC
Dinopium benghalense	Lesser Golden back	Bangla Kaththokra	CR	LC
Dinopium javanense	Common Golden back	Pati Kaththokra	CR	LC
Egretta garzetta	Little Egret	Choto Boga	CR	LC
Egretta intermedia	Yellow-billed Egret	Majhla Boga	CR	LC
Elanus caeruleus	Black-winged Kite	Katua Chil	UR	LC
Eudynamys scolopaceus	Asian Koel	Ashio Kalakokil	CR	LC
Falco tinnunculus	Common Kestrel	Pati Kestrel	CWV	LC
Gallicrex cinerea	Water cock	Deshi Kora	UR	LC
Gallinago gallinago	Common Snipe	Pati Chega	CWV	LC
Gallinago stenura	Pin-tailed Snipe	Lenja Chega	CWV	LC
Gallinula chloropus	Common Moorhen	Pati Panmurgi	CR	LC
Gelochelidon nilotica	Gull-billed Tern	Kalathot Panchil	CR	
Halcyon coromandra	Ruddy Kingfisher	Lal Machranga	RR	LC
Halcyon smyrnensis	White-throated Kingfisher	Dholagola Machranga	CR	LC
Haliaeetus leucogaster	White-bellied sea Eagle	Sindhu Eagle	RR	LC
Haliastur Indus	Brahminy Kite	Shonkho Chil	CR	LC
Heliopais personata	Masked Finfoot	Giolo Hansh	RR	LC
Hierococcyx varius	Common Hawk-Cuckoo	Pati Chokhgelo	CR	LC
Hypothymis azurea	Black-naped Monarch	Kalaghar Rajon	CR	LC
Ichthyophaga ichthyaetus	Grey-headed Fish Eagle	Metematha Kura-eegol	UR	Near Threatened
Ixobrychus cinnamomeus	Cinnamon Bittern	Khoira Bogla	UR	LC
Ketupa zeylonensis	Brown Fish Owl	Khoira Mechopecha	UR	
Lanius cristatus	Brown Shrike	Khoira Latora	CWV	LC
Lanius schach	Long-tailed Shrike	Lenja Latora	CR	LC
Larus brunnicephalus	Brown-headed Gull	Khoiramatha Gangchil	CWV	LC
Larus brunnicephalus	Great Black-headed Gull	Palasi Gangchil	CWV	LC

Scientific Name	**English Name**	**Local Name**	**LOCAL status**	**IUCN Global Status**
Larus ridibundus	Common Black-headed Gull	Kalamatha Gangchil	CWV	LC
LC Acridotheres tristis	Common Myna	Bhat Shalik	CR	LC
Leptocoma zeylonica	Purple-rumped Sunbird	Begunikomor Moutushi	CR	LC
Leptoptilos javanicus	Lesser Adjutant	Modontak	RR	Vulnerable
Lonchura malabarica	Indian Silver bill	Deshi Chandithot	UR	LC
Lonchura malacca	Black-headed Munia	Kalamatha Munia	UR	LC
Lonchura punctulata	Scaly-breasted Munia	Butibook Munia	CR	LC
Malacocincla abbotti	Abbott's Babbler	Aboter Satarey	CR	LC
Megalaima asiatica	Blue-throated Barbet	Neelgola Boshonto	CR	LC
Megalaima haemacephala	Coppersmith Barbet	Shekra Boshonto	CR	LC
Megalaima lineata	Lineated Barbet	Dagi Boshonto	CR	LC
Megalurus palustris	Striated Grassbird	Dagi Ghashpakhi	CR	LC
Merops orientalis	Green Bee-eater	Shobuj Shuichora	CR	LC
Metopidius indicus	Bronze-winged Jacana	Dol Pipi	UR	LC
Milvus migrans	Black Kite	Bhubon Chil	CR	LC
Mirafra assamica	Bengal Bush Lark	Bangla Jharbhorot	CR	LC
Motacilla alba	White Wagtail	Dhola Khonjon	CWV	LC
Motacilla cinerea	Grey Wagtail	Metey Khonjon	UWV	LC
Motacilla citreola	Citrine Wagtail	Sitrin Khonjon	CWV	LC
Motacilla flava	Western Yellow Wagtail	Holdey Khonjon	CWV	LC
Motacilla madaraspatensis	White-browed Wagtail	Dholavru Khonjon	UR	LC
Mycteria leucocephala	Painted Stork	Rangila bok	RR	Near Threatened
Nettapas coromandelianus	Cotton Pygmy Goose	Dhola Balihash	UR	LC
Numenius arquata	Eurasian Curlew	Eureshio Gulinda	V	LC
Numenius glareola	Wood Sandpiper	Bon Batan	CWV	LC
Tringa nebularia	Common Greenshank	Pati Shobujpa	CWV	LC
Tringa ochropus	Green Sandpiper	Shobuj Batan	UWV	LC
Nycticorax nycticorax	Black-crowned Night Heron	Kalamatha Nishibok	CR	LC
Oriolus xanthornus	Black-hooded Oriole	Kalamatha Benebou	CR	LC
Orthotomus sutorius	Common Tailorbird	Pati Tuntuni	CR	LC
Parus inornata	Plain Prinia	Nirol Prina	CR	LC
Parus major	Great Tit	Boro Tit	CR	LC

Scientific Name	**English Name**	**Local Name**	**LOCAL status**	**IUCN Global Status**
Passer domesticus	House Sparrow	Pati Chorui	CR	LC
Pelargopsis capensis	Stork-billed Kingfisher		UR	LC
Pericrocotus cinnamomeus	Small Minivet	Choto Saheli	CR	LC
Phaeniocophaeus tristis	Green-billed Malkoha	Shobujthot Malkoa	CR	LC
Phalacrocorax carbo	Great Cormorant	Boro Pankouri	CWV	LC
Phalacrocorax fuscicollis	Indian Cormorant	Deshi Pankouri	V	LC
Phalacrocorax niger	Little Cormorant	Choto Pankouri	CR	LC
Phylloscopus fuscatus	Dusky Warbler	Kalchey Futki	CWV	LC
Picus xanthopygaeus	Streak-throated Woodpecker	Dagigola Kathkurali	UR	LC
Platalea leucorodia	Eurasian Spoonbill	Kodali Bok	RR	LC
Ploceus manyar	Streak Weaver	Dagi Babui	RR (DD)	LC
Ploceus philippinus	Baya Weaver	Deshi babui	CR	LC
Pluvialis fulva	Pacific Golden Plover	Proshanto Shonajiria	CWV	LC
Prinia gracilis	Graceful Prinia	Shundori Prinia	RR (DD)	LC
Psittacula krameri	Rose-ringed Parakeet	Modna Tia	CR	LC
Pycnonotus cafer	Red-vented Bulbul	Bangla Bulbul	CR	LC
Rhipidura albicollis	White-throated Fantail	Dholagola Chatighurani	CR	LC
Rynchops albicolis	Indian Skimmer	Panikata	RR	Vulnerable
Sarkidiornis melanotos	Comb Duck	Nakta Hash	RWV	LC
Spilornis cheela	Crested Serpent Eagle	Tila Nag-eegol	CR	LC
Sterna acuticauda	Black-bellied Tern	Kalapet Panchil	UR	LC
Sterna aurantia	River Tern	Nodia Panchil	UWV	LC
Sterna hirundo	Common Tern	Pati Panchil	UWV	LC
Streptopelia chinensis	Spotted Dove	Tila Ghughu	CR	LC
Streptopelia decaocta	Eurasian Collared Dove	Eurashio Konthighughu	CR	LC
Streptopelia tranquebarica	Red Turtle Dove	Lal Konthighughu	CR	LC
Sturnus contra	Pied Myna	Ashio Pakrashalik	CR	LC
Sturnus ginginianus	Bank Myna	Gaang Shalik	UR	LC
Sturnus malabaricus	Chestnut-tailed Starling	Khoiralej Telshalik	CR	LC
Tadorna ferruginea	Ruddy Shelduck	Khoira Chokachoki	CWV	LC
Tadorna tadorna	Common Shelduck	Pati Chokachoki	CWV	LC
Terpsiphone paradisi	Asian Paradise-	Ashio Shabulbuli	UR	LC

Scientific Name	English Name	Local Name	LOCAL status	IUCN Global Status
	flycatcher			
Treron phoenicopterus	Yellow-footed Green Pigeon	Holdepa Horial	CR	LC
Tringa stagnatilis	Marsh Sandpiper	Bil Batan	UWV	LC
Tringa tetanus	Common Redshank	Pati Lalpa	CWV	LC
Turdoides striatus	Jungle Babbler	Bon Satarey	CR	LC
Turdoides earlei	Striated Babbler	Dagi Satarey	UR	LC
Tyto alba	Barn Owl	Lokkhi Pecha	UR	
Upupa epops	Eurasian Hoopoe	Pati Hoodhood	UR	LC
Vanellus duvaucelii	River Lapwing	Nodi Titi	UR	
Vanellus indicus	Red-wattled Lapwing	Hot Titi	UR	LC
Zoothera torquatus	Eurasian Stone Chat	Pati Shilafidda	CWV	LC
Zosterops palpebrosus	Oriental White-eye	Udoi Dholachokh	CR	LC

Source: IUCN, Department of Forest and Field Investigation

Note: Local Status: *CR-Common Resident, UR-Uncommon Resident, CWV- Common Winter Visitor, UWV- Uncommon Winter Visitor, RR-Rare Residant, DD-Data Deficient, WV-Winter Vagrant, RWV-Rare winter visitor*

Table A5: List of Mammals

English name	Local Name	Scientific Name	IUCN Global status	IUCN Local status
Asian House Shrew	Chika/Chucho	*Suncus murinus*	Least Concern (LC)	NO
Asian Palm Civet	Gandhogakul	*Paradoxurus hermaphroditus*	LC	VU
Asiatic Brush-tailed Porcopine	Sajaru	*Atherurus macrourus*	LC	EN
Asiatic Long tail Climbing Mouse	Gecho Indur	*Vandeleuria oleracea*	LC	DD
Barking Deer	Maya Harin	*Muntiacus muntjak*	LC	EN
Bengal Fox	Pati Shial/Shial	*Vulpes bengalensis*	LC	VU
Chital	Chitra Harin	*Axis axis*	LC	NO
Common Tree Shrew	Gecho Chucho	*Tupaia glis*	LC	DD
Estern House Mouse	Nenti indur	*Mus musculus*	LC	NO
Eurasian Otter	Ud Biral	*Lutta lutra*	Near Thretened	EN
Eurasian Wild Boar	Buno Shukar	*Sus scrofa*	LC	NO
Finless Porpoise	Shishu	*Neophocaenoides phocaenoides*	Vulnerable	EN
Fishing Cat	Mecho Biral/Baghailla	*Felis viverrina*	Endangered	EN
Ganges River Dolphin	Shishu / Shushuk	*Platanista gangetica*	Endangered	EN
Golden Jackal	Sial	*Canis aureus*	LC	VU
Greater Bandicot Rat	Dhari indur	*Bandicota indica*	LC	NO
Greater False Vampire Bat	Badur	*Megaderma lyra*	LC	NO

English name	Local Name	Scientific Name	IUCN Global status	IUCN Local status
Greater Short-nosed fruit Bat	Kola badur	*Cynopterus sphinx*	LC	DD
House Rart	Indur	*Rattus rattus*	LC	NO
Indian crested Porcupine	Shojaru	*Hystrix indica*	LC	EN
Indian Flying Fox	Baro Badur	*Pteropus giganteus*	LC	NO
Indian Hare	Khargosh	*Lepus nigricollis*	LC	EN
Indian Pipistrelle	Chamchika/ Cham Badur	*Pipistrellus coromandra*	LC	NO
Irrawaddy Dolphin	Mohonar Shushuk	*Orcaella brevirostris*	Vulnerable	CR
Jungle Cat	Ban Biral	*Felis chaus*	LC	EN
Large- Indian Civet	Baro Baghdash	*Viverra zibetha*	Near Threatened	EN
Leopard cat	Chita Biral	*Prionailurus bengalensis*	LC	DD
Lesser Bandicot -rat	Baro indur	*Bandicota bengalensis*	LC	NO
Little Indian Field Mouse	Metho indur	*Mus booduga*	LC	NO
Northern palm Squirrel	Khatbirali	*Funambulus pennantii*	LC	NO
Oriental Small- Clawed Otter	Bhodor/ Ud Biral	*Aonyx cinerea*	Vulnerable	EN
Rhesus Macaque	Kota Banor	*Macaca mulatta*	LC	VU
Small- Indian Civet	Choto Bagdash	*Viverricula indica*	LC	VU
Small- Indian Mongoose	Benji, Nakul	*Herpestes auropunctatus*	LC	NO
Bengal Tiger	Bagh	*Panthera tigris*	Endangered	CR

Local Status code: CR – Common Resident, C – Common, UR – Uncommon Resident, RR – Rare Resident, V – Vagrant, WV – Winter Visitor; UWV – Uncommon Winter Visitor
IUCN Status code: CR – Critically Endangered, EN - Endangered, VU – Vulnerable, NO – Not Threatened

Table A 6: List of Amphibians

English name	Local Name	Scientific Name	IUCN status	Local status
Asian Brown Tree Frog	Gecho Bang	*Polypedates leucomystax*	LC	NO
Green Frog	Sabuj Bang	*Euphlyctis hexadactylus*	LC	VU
Indian Bull Frog	Sona bang	*Hoplobactrachus tigerinus*	LC	NO
Indian Tree Frog	Gecho Bang	*Polypedates maculatus*	LC	NO
Asian Brown Painted Frog	Not known	*Kaloula pulchra*	LC	VU
Large Tree Frog	Baro Gecho Bang	*Rhacophorus maximus*	LC	VU
Leaping Frog	Pana bang	*Hylarana tytleri*	LC	NO
Ornate Microhylid	Cheena Bang	*Microhyla ornata*	LC	VU
Pointed-headed Frog	Pana Bang	*Rana alticola*	LC	VU
Skipper Frog	Mali Bang	*Euphlyctis cyanophlyctis*	LC	-
Southern Cricket Frog	Jhijhi Bang	*Fejervarya syhadrensis*	LC	NO
Two-striped Grass Frog	Kaad Bang	*Sylvirana taipehensis*	LC	EN

CR – Critically Endangered, EN - Endangered, VU – Vulnerable, NO – Not Threatened

Table A 7: List of Reptiles

English name	Local Name	Scientific Name	IUCN Global status	IUCN Local status
Bengal Monitor	Ghuy Shap	*Varanus bengalensis*	LC	VU
Brooks House Gecko	Tiktiki	*Hemidactylus brookii*	LC	NO

English name	Local Name	Scientific Name	IUCN Global status	IUCN Local status
Brown Roofed Turtle	Baro Kori Kasim	*Pangshura smithii*	Near threaten d	EN
Checkered Keelback	Dhora Shap	*Xenochropis piscator*	LC	NO
Common Garden Lizard	Roktochosha	*Calotes versicolor*	LC	NO
Common House Gecko	Tiktiki	*Hemidactylus frenatus*	LC	NO
Common River Terrpain	Boro Kasim	*Batagur baska*	Critically Endangered	CR
Common Smooth Water Snake	Painna Shap	*Enhydris enhydris*	LC	NO
Common Vine Snake	Laodoga Shap	*Ahaetulla nasuta*	-	VU
Common Wolf Snake	Gharginni Shap	*Lycodon aulicus*	-	VU
Crowned River Turtle	Kali Kasim	*Hardella thurjii*	Vulnerable	EN
Estuarine Crocodile	Lonapanir Kumir	*Crocodylus porosus*	Lower Risk/least concern	CR
Ganges softshell Turtle	Khalua Kasim	*Aspideretes gangeticus*	-	EN
Gharial	Ghorial/Baishal	*Gavialis gangeticus*	Critically Endangered	CR
Indian Rat Snake	Daraj Shap	*Ptyas mucosus*	LC	VU
Indian Roofed Turtle	Kori/Hali Kasim	*Pangshura tectum*	LC	-
Jerdon's Blind Snake	Dumukh Shap	*Typhlops jerdoni*	LC	-
Keeled Grass skink	Anjoni	*Mabuya carinata*	LC	-
Median Roofed Turtle		*Pangshura tentoria*	LC	EN
Monocled Cobra	Gokhra Shap	*Naja kaouthia*	LC	VU
Narrow-headed Softshell Turtle	Sim Kasim	*Chitra indica*	Endangered	CR
Olive Keelback	Maita Shap	*Atretium schistosum*	LC	-
Olive Ridley Turtle	Jalpaironga Samudrik Kasim	*Lepidochelys olivacea*	Vulnerable	EN
Spectacled Cobra	Khoiya Gokhra Shap	*Naja naja*	-	EN
Spotted Flapshell Turtle	Patapori	*Lissemys punctata*	LC	VU
Spotted Litter skink	Anzoni	*Sphenomorphus maculatus*	LC	
Tokay Gecko	Takkhak	*Gekko gecko*	LC	VU
Yellow Monitor	Sona Guy	*Varanus flavescens*	LC	EN
Yellow-bellied House Gecko	Tiktiki	*Hemidactylus flaviviridis*	LC	-
Ring Lizard	Ram Godi	*Varanus salvator*	LC	EN
Paintet Bronzedback tree Snake	Gecho	*Dendrelaphis pictus*	-	VU

Source: IUCN, Department of Forest and Field Investigation

Note: CR – Critically Endangered, EN - Endangered, VU – Vulnerable, NO – Not Threatened

Appendix XII: Equipment for Monitoring Environmental Parameter

Technical
Information
TI 200C/07/en
No. 51500283

Turbidity/Suspended Solids Measurement *Liquisys M CUM 223 / 253*

Turbidity and Suspended Solids Transmitter



Liquisys M CUM 253

Liquisys M CUM 223

Due to the modularity of its design, the Liquisys M CUM 223 / 253 transmitter can be adapted to a wide range of customer needs. The basic version, which provides simple measuring and alarm signalling functions, can be equipped with additional software and hardware modules to match specific applications. Retrofitting of expansion modules is also possible.

Areas of application

- Sewage treatment plants, suspended solids measurement
- Effluent treatment
- Water treatment and monitoring
- Drinking water
- Surface water: rivers, lakes, ocean
- Service water
- Indirect discharge
- Water recycling

Benefits at a glance

- Measuring transmitter in field or panel-mounted housing
- Universal application
  - One instrument for turbidity and suspended solids
  - Units: FNU (formazine standard), ppm, g/l, % or % SS
- Simple handling
  - Logically arranged menu structure with plain text in 6 languages facilitates instrument configuration
  - Large, two-line display indicates measured value and temperature at the same time
  - Ultrasimple calibration with user samples and alarm signalling for calibration errors
- Safe operation
  - Overvoltage (lightning) protection according to EN 61000-4-5
  - Direct access for manual contact control
  - User-defined alarm configuration for alarm contact and error current
  - Sensors are factory-calibrated with formazine standard and SiO_2
  - Automatic sensor self-recognition with calibration data transfer

The basic unit can be extended with:

- 2 or 4 contacts for use as:
  - Limit contacts (also for temperature)
  - P(ID) controller
  - Timer for simple rinse processes
  - Complete cleaning with Chemoclean
- Plus package:
  - Any current output configuration via table
  - Automatic initiation of cleaning in case of alarm or limit violation
  - Display in customer units (e.g. density) via table assignment
  - Live check of sensor
- HART® or PROFIBUS-PA
- 2nd current output for temperature

Quality made by
Endress+Hauser

ISO 9001

Endress+Hauser

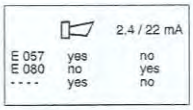
Nothing beats know-how

Details

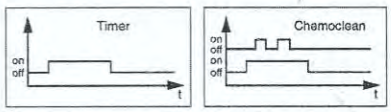
Liquisys M CUM 223 / 253 provides a solution for all drinking water processing, process water and sewage treatment applications.

Features of the **basic version (TU):**

Measurement of turbidity or suspended solids
This is selected via the menu. During measurement, the value measured can be displayed in the other measuring mode. The **temperature** is displayed at the same time if desired.

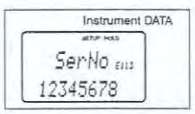


Different alarms are required depending on application and operator. Therefore the Liquisys M CUM 223 / 253 permits independent **configuration of the alarm contact and error current** for each individual error. Unnecessary or undesirable alarms can be suppressed in this manner.



Up to four contacts can be used as limit contacts (also for temperature), to implement a P(ID) controller or for cleaning functions.

Direct **manual operation of the contacts** (bypassing the menu) provides quick access to limit, control or cleaning contacts, permitting speedy correction of deviations.



The **serial numbers** of the instrument and modules and the order code can be called up on the display.

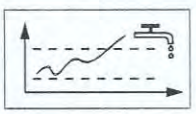
The **TS version** version provides **additional functions:**



In order to display wide measuring ranges while still achieving a high resolution in specific ranges, the **current output** can be configured as required via a table. This permits **bilinear** or **quasi-logarithmic** curves, etc.



The **live check** issues an alarm when the sensor signal does not change over a defined period of time. This may be caused by blocking, passivation, separation from the process, etc.



Soiling quickly results in excessive measured values. **Automatic cleaning** prevents alarms and inaccuracy caused by soiling.

In addition to concentration (ppm / % SS), **the display can also show other units** (e.g. density). A table is used for conversion (calibration in %).

Product Data Sheet
PDS 71-1056/rev.H
January 2009

DUAL-INPUT INTELLIGENT ANALYZER

- MULTI-PARAMETER INSTRUMENT – single or dual input. Choose from pH/ORP/ISE, Resistivity/Conductivity, % Concentration, Chlorine, Oxygen, Ozone, Temperature, Turbidity, Flow, and 4-20mA Current Input.
- LARGE DISPLAY – large easy-to-read process measurements.
- EASY TO INSTALL – modular boards, removable connectors, easy to wire power, sensors, and outputs.
- INTUITIVE MENU SCREENS with advanced diagnostics and help screens.
- SEVEN LANGUAGES included: English, French, German, Italian, Spanish, Portuguese, and Chinese.
- HART® AND PROFIBUS® DP Digital Communications options



FEATURES AND APPLICATIONS

The Model 1056 dual-input analyzer offers single or dual sensor input with an unrestricted choice of dual measurements. This multi-parameter instrument offers a wide range of measurement choices supporting most industrial, commercial, and municipal applications. The modular design allows signal input boards to be field replaced making configuration changes easy. Conveniently, live process values are always displayed during programming and calibration routines.

QUICK START PROGRAMMING: Exclusive Quick Start screens appear the first time the Model 1056 is powered. The instrument auto-recognizes each measurement board and prompts the user to configure each sensor loop in a few quick steps for immediate deployment.

DIGITAL COMMUNICATIONS: HART and Profibus DP digital communications are available. Model 1056 HART units communicate with the Model 375 HART® hand-held communicator and HART hosts, such as AMS Intelligent Device Manager. Model 1056 Profibus units are fully compatible with Profibus DP networks and Class 1 or Class 2 masters. HART and Profibus DP configured units will support any single or dual measurement configurations of Model 1056.

MENUS: Menu screens for calibrating and programming are simple and intuitive. Plain language prompts and help screens guide the user through these procedures.

DUAL SENSOR INPUT AND OUTPUT: The Model 1056 accepts single or dual sensor input. Standard 0/4-20 mA current outputs can be programmed to correspond to any measurement or temperature.

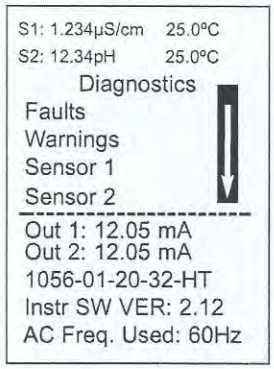
ENCLOSURE: The instrument fits standard ½ DIN panel cutouts. The versatile enclosure design supports panel-mount, pipe-mount, and surface/wall-mount installations.

ISOLATED INPUTS: Inputs are isolated from other signal sources and earth ground. This ensures clean signal inputs for single and dual input configurations. For dual input configurations, isolation allows any combination of measurements and signal inputs without cross-talk or signal interference.

TEMPERATURE: Most measurements require temperature compensation. The Model 1056 will automatically recognize Pt100, Pt1000 or 22k NTC RTDs built into the sensor.

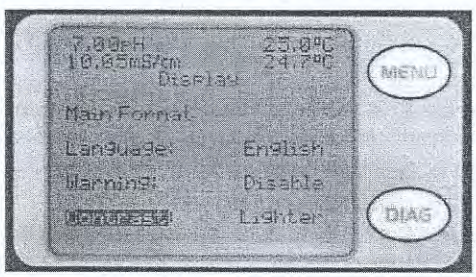
SECURITY ACCESS CODES: Two levels of security access are available. Program one access code for routine calibration and hold of current outputs; program another access code for all menus and functions.

DIAGNOSTICS: The analyzer continuously monitors itself and the sensor(s) for problematic conditions. The display flashes Fault and/or Warning when these conditions occur.

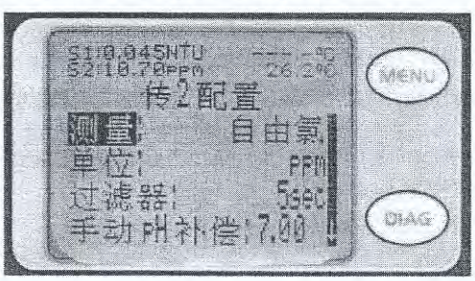


Information about each condition is quickly accessible by pressing DIAG on the keypad. User help screens are displayed for most fault and warning conditions to assist in troubleshooting.

DISPLAY: The high-contrast LCD provides live measurement readouts in large digits and shows up to four additional process variables or diagnostic parameters. The display is back-lit and the format can be customized to meet user requirements.



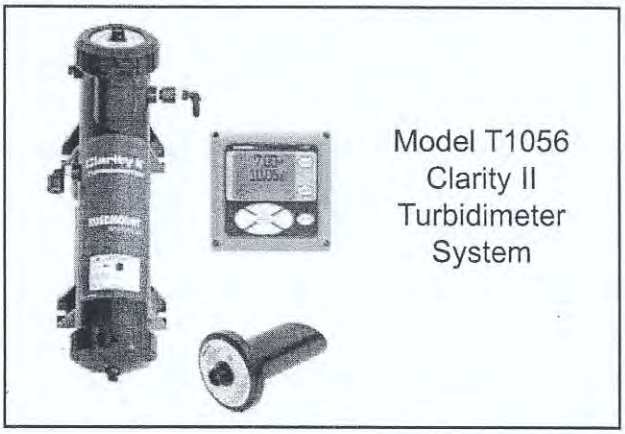
LOCAL LANGUAGES :
Rosemount Analytical extends its worldwide reach by offering seven local languages – English, French, German, Italian, Spanish, Portuguese, and Chinese. Every unit includes user programming menus; calibration routines; faults and warnings; and user help screens in all seven languages. The displayed language can be easily set and changed using the menus.



CURRENT OUTPUTS: Two 4-20 mA or 0-20 mA current outputs are electrically isolated. Outputs are fully scalable and can be programmed to linear or logarithmic modes. Output dampening can be enabled with time constants from 0 to 999 seconds. Output 1 includes digital signal 4-20 mA superimposed HART (option -HT only)

SPECIAL MEASUREMENTS: The Model 1056 offers measuring capabilities for many applications.

- **Single or Dual Turbidity:** Ideal in municipal applications for measurement of low-NTU filtered drinking water. Must be used with Clarity II sensor, sensor cable and debubbler.



- **4-Electrode Conductivity:**
The Model 1056 is compatible with Rosemount Analytical 4-electrode Model 410VP in the PURE-SENSE family of conductivity sensors. This sensor supports a wide array of applications and is capable of measuring a large range of conductivity with one geometric configuration. Wired to the Model 1056, this sensor can measure 2µS/cm to 300mS/cm with an accuracy of 4% of reading throughout the entire range.
- **4-20mA Current Input:** Accepts any analog current input from an external device for temperature compensation of measurements and atmospheric pressure input for partial pressure correction of oxygen.
- **Selective Ions:** The analyzer is able to measure ammonia and fluoride using commercially available ion-selective electrodes. All analyzers with installed pH boards can be programmed to measure selective ions.
- **pH Independent Free Chlorine:** With Rosemount Analytical's Model 498CI-01 sensor, the analyzer is able to measure free chlorine with automatic correction for process pH without the need for a pH sensor.
- **Inferential pH:** The analyzer is able to derive and display inferred pH (pHCalc) using two contacting conductivity signal boards and the appropriate contacting conductivity sensors. This method will calculate the pH of condensate and boiler water from conductivity and cation conductivity measurements.
- **Differential Conductivity:** Dual input conductivity configurations can measure differential conductivity. The analyzer can be programmed to display dual conductivity as ratio, % rejection, or % passage.

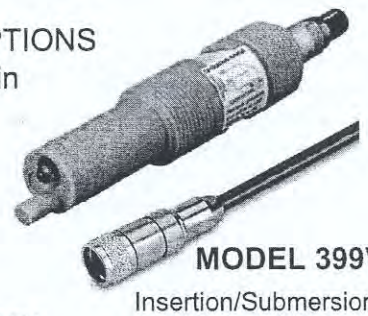
Product Data Sheet
PDS 71-399/rev.I
December 2006

pH/ORP Sensors

- NEW OPTIONS to meet a variety of application requirements, including:
  * Low ionic strength water
  * Processes with hydrofluoric acid, high pH, and reference poisoning elements
- QUICK CABLE-TO-SENSOR RELEASE, provided by the water-tight VP multiple-pin connector, eliminates cable twisting.
- EXTENDED SENSOR LIFE provided by double or triple junction reference cell in process solutions containing poisoning ions.
- OPTIMUM VERSITILITY FOR VARIOUS MOUNTING OPTIONS provided by one-piece construction with process threads in two places.
- MAXIMUM CHEMICAL RESISTANCE provided by rugged tefzel[1] body, completely sealed to eliminate sensor leakage.
- ENHANCED PERFORMANCE AND INCREASED LIFE with minimized glass cracking provided by field-proven ACCU-GLASS™[2] pH glass formulations.



MODEL 399
Insertion/Submersion Sensor with integral cable



MODEL 399VP
Insertion/Submersion Sensor with new VP connector (uses mating VP cable)

[1] Tefzel and Viton are registered trademarks of E.I. du Pont de Nemours and Co.

[2] ACCUGLASS is trademark of Rosemount Analytical.

FEATURES AND APPLICATIONS

The reference junction aids in the sensor's resistance to poisoning ions and helps prolong sensor life. Models 399 and 399VP are provided with a double junction reference, which protects the reference element from poisoning ions — such as ammonia, chlorine, cyanides, and sulfides — in the process. When large amounts of poisoning agents are present, an optional triple junction may be ordered to help prolong the sensor life. Both models, in either the double or triple reference configuration, are made with an outer ceramic junction constructed in an annular design around the pH/ORP-sensitive membrane.

The AccuGlass pH glass formulations exceed industry standards. The AccuGlass pH glass is a result of many years of glass research resulting in a formulation which has been found to increase the life of the sensor. Unlike other pH glasses presently on the market, this glass resists cracking especially at higher temperatures and reduces sodium ion error commonly found in high pH applications. Overall, the AccuGlass formulation enhances the sensor performance to measure pH more accurately and have a longer sensor life than ever before.

A choice of pH glass electrodes is available to best meet various application needs. Four types are available: hemi bulb, flat bulb, HF resistant, and Hi pH glass. The ACCUGLASS hemi bulb is the standard glass offered on both models and can be used for most applications. The hemi bulb is also found on the HF resistant and Hi pH glass options. The ACCUGLASS flat glass option can be used in abrasive or coating applications that etch or build up on glass, respectively.

Continued on following page...

FEATURES AND APPLICATIONS (cont.)

NEW - Model 399VP is offered with a watertight sensor-to-cable connector which eliminates re-wiring and cable twisting when replacing sensors. The Variopol VP multiple pin connector is an integral part of each sensor model and uses a mating VP cable; see page 7 for example. Once the cable is installed and wired to the analyzer, sensors are easily replaced without replacing the cable and without rewiring the analyzer. Also the cable can be disconnected from the sensor before removal from the process which eliminates cable twisting.

Models 399 and 399VP are housed in a molded Tefzel body with Viton o-rings, making each sensor virtually indestructible and chemically resistant. Complete encapsulation eliminates leakage or high humidity problems traditionally found in other pH/ORP designs. The simplified construction, designed with user convenience in mind does not require electrolyte (KCl) replenishment or any high maintenance troubleshooting procedures.

A preamplifier converts the high impedance pH signal into a stable, noise-free signal and must be used with all pH sensors. The Model 399 offers the choice of an integral sensor preamplifier. Both Models can use a remote preamplifier, integral to the analyzer/transmitter or in a remote junction box. All preamplifiers have a transmission capability of up to three miles.The Rosemount Analytical preamplifier method has become the industry standard for pH/ORP measurement reliability.

Installation is easily achieved through the wide variety of mounting configurations. Both Models feature 1 inch (MNPT) front and rear facing connections for insertion, submersion, or flow-through pH and ORP applications.

New options are available for special application needs, including high purity/low conductivity water, heavy reference poisoning, and continuous high or low temperature processes. Consult the factory or your local sales representative for more details on these new options.

Both models are combination sensors (pH, reference, and temperature within sensor body) and measure pH or ORP (Oxidation/Reduction Potential) of aqueous solutions in pipelines, open tanks, or ponds. Models 399 and 399VP are suitable for virtually all applications and are compatible with Rosemount Analytical and other manufacturers' instruments.

PHYSICAL SPECIFICATIONS

Materials of Construction: Tefzel, glass, ceramic, & Viton

Materials of ORP: Platinum

Process Connections: 1 in. MNPT, 2 places

Integral Cable:

10 or 32 ft cable with integral preamp

(remote preamp) 10 ft cable with remote preamp

Measured Range: pH: AccuGlass 0-14
ORP: -1500 to +1500 mV

Maximum Pressure:
790 kPa [abs] (100 psig) at 65°C (see Graph 1 below)

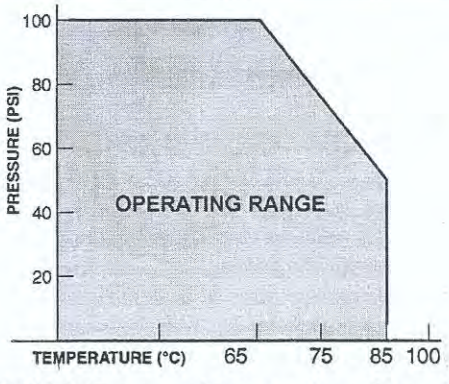
Weight/Shipping Weight: 0.45 kg/0.9 kg (1 lb/2 lb)

Temperature Compensation: Automatic 0° to 85°C (32° to 185°F), Temperature compensation is not required for 399 ORP when used with Models 1060, 1023 or 1181 ORP

Percent Linearity Over pH Range:

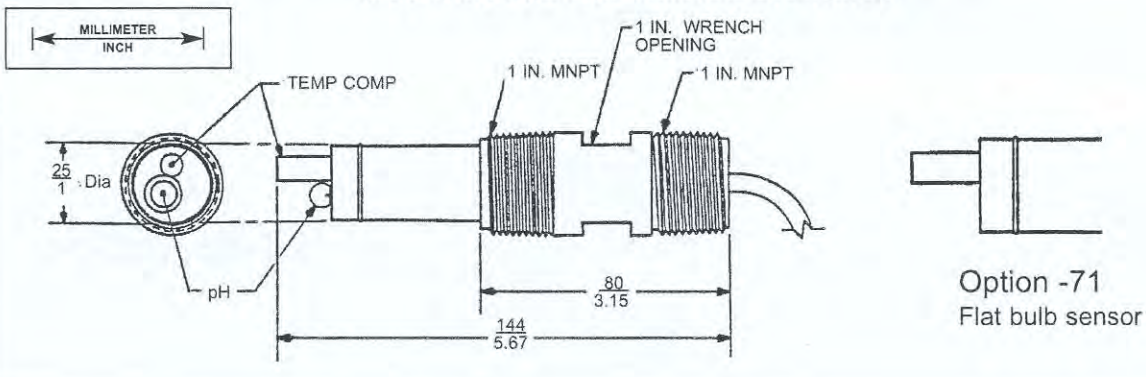
	GPLR Hemi Bulb	Flat Bulb
1-2 pH	94%	93%
2-12 pH	99%	98%
12-13 pH	97%	95%
13-14 pH	92%	–

- High pH glass provides greater accuracy over 12.5 pH
- HF glass provides improved resistance to hydrofluoric acid up to 300 ppm



GRAPH 1. Pressure/Temperature Operating Range for Models 399 and 399VP

MOUNTING AND DIMENSIONAL DRAWINGS

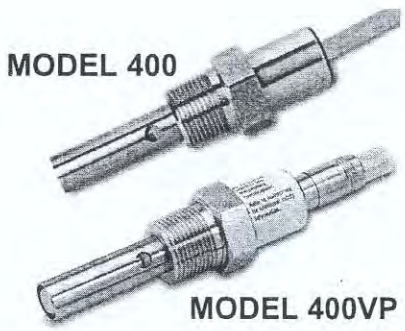


Option -71
Flat bulb sensor

Product Data Sheet
PDS 71-400/rev.I
December 2008

ENDURANCE® General Purpose Conductivity Sensors

- INITIAL CALIBRATION NOT REQUIRED. Pre-determined cell constant ensures out-of-the box accuracy.
- VERSATILE MOUNTING CONFIGURATIONS: screw-in, retractable, and flow-through.
- AVAILABLE WITH VARIOPOL (VP) quick disconnect fitting.



MODEL 400

MODEL 400VP

APPLICATIONS

The Model 400/400VP, 401, 402/402VP, and 404 sensors are intended for the determination of electrolytic conductivity in applications ranging from high purity water to cooling water. The sensors are ideal for use in clean, non-corrosive, samples having conductivity less than about 20,000 µS/cm. For dirty or corrosive samples or for samples having high conductivity, a toroidal sensor such as the Model 228 or 226 is recommended.



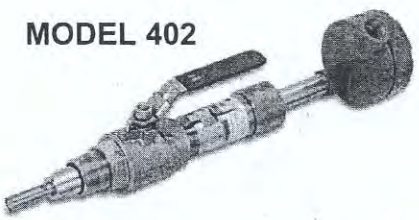
MODEL 401

FEATURES

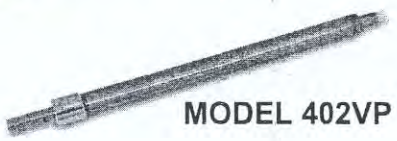
ENDURANCE sensors are contacting conductivity sensors. They are available in cell constants of 0.01, 0.1, 1.0, and 10/cm. The choice of cell constant depends on conductivity. High conductivity samples require larger cell constants. Consult the analyzer Product Data Sheet for recommended ranges and accuracy.

Sensors with 0.01, 0.1 and 1.0/cm cell constants have concentric titanium electrodes separated by a PEEK insulator. EPDM O-rings seal the internal parts of the sensor from the process liquid. A platinum RTD in the center electrode measures the solution temperature. Electrolytic conductivity is a strong function of temperature. The temperature measurement is used for correcting the conductivity readings to a reference temperature.

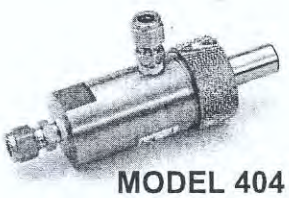
Sensors with 10/cm cell constants have graphite electrodes and an epoxy body. The RTD is enclosed in a titanium capsule protruding from the end of the sensor.



MODEL 402



MODEL 402VP



MODEL 404

ROSEMOUNT® Analytical

EMERSON. Process Management

Model 400 sensors are designed for direct screw-in insertion into process piping using a 3/4-inch MNPT fitting. The Model 400 sensor can also be used in sidestream samples. A 1-inch pipe tee with a 3/4-inch bushing is a suitable flow cell. A 3/4-inch pipe tee can be used with 0.1 and 1.0/cm cells. A transparent plastic flow cell is also available (PN 24091-02).

Model 401 sensor is intended for measuring clean, non-corrosive samples having conductivity between about 500 and 200,000 µS/cm. The sensor has a 10/cm cell constant.

Model 402 sensors are retractable; they can be removed from the process piping without shutting down and draining the line. Maximum retraction pressure is 64 psig (542 kPa abs). The sensor fits through a 1-1/4 inch full-port ball valve. Order the retraction assembly, which includes the ball valve, pipe nipple, packing adapter, and clamp to position the sensor, as an option.

Model 404 sensors combine the conductivity sensor with a flow cell. The design has a small holdup volume, so response to sudden changes in process conductivity and temperature are rapid. Model 404 sensors are available with a PVC or stainless steel body. The stainless steel version can be disassembled for cleaning. The PVC version cannot be taken apart.

Models 400 and 402 sensors are available with Variopol 6.0 quick disconnect watertight connectors. Wire the interconnecting cable to the analyzer and run the cable to the sensor. The sensor plugs into the cable receptacle. To replace the sensor, simply disconnect the Variopol fitting and plug in a new sensor. There is no need to rewire or rerun cable.

SPECIFICATIONS (Models 400 and 400VP)

Cell constants: 0.01, 0.1, and 1.0/cm

Wetted materials:
- Electrodes: titanium
- Body: 316 stainless steel
- Insulator: PEEK
- O-rings: EPDM

Process connection: 3/4 inch MNPT

Temperature: 32 – 221°F (0 – 105°C)

Temperature (option -60): 32 – 392°F (0 – 200°C)

Pressure: 250 psig (1825 kPa abs) maximum

Vacuum: 7.4 psia (51 kPa abs)

Cable length (Model 400 only): 10 ft (3.1 m) standard; 50 ft (15.2 m) optional

SPECIFICATIONS (Model 401)

Cell constant: 10/cm

Wetted materials:
- Electrodes: graphite
- Connector: PVDF (Kynar®)
- Insulator and body: epoxy
- O-rings: EPDM
- RTD capsule: titanium

Process connection: 3/4 inch MNPT

Temperature: (32 – 212°F) (0 – 100°C).

Pressure: 200 psig (1481 kPa abs) maximum

Cable length: 10 ft (3.1 m) standard; 50 ft (15.2 m) optional

SPECIFICATIONS (Models 402 and 402VP)

Cell constants: 0.01, 0.1, 1.0, and 10/cm

Wetted materials (0.01, 0.1, and 1.0/cm cells):
- Electrodes: titanium
- Sensor tube: 316 stainless steel
- Insulator: PEEK
- O-rings: EPDM
- Washer: Neoprene

Wetted materials (10/cm cell):
- Electrodes: graphite embedded in epoxy body
- Sensor tube: 316 stainless steel
- Insulator: Epoxy
- O-rings: EPDM
- Washer: Neoprene
- RTD capsule: titanium

Process connection: sensor is inserted through 1-1/4 inch NPT full port ball valve

Temperature: 32 – 212°F (0 – 100°C)

Pressure: 200 psig (1481 kPa abs) maximum

Retraction pressure: 64 psig (542 kPa abs) maximum

Cable length (Model 402 only): 10 ft (3.1 m). For longer cable length, choose option -60 (integral junction box) and order interconnecting cable separately.

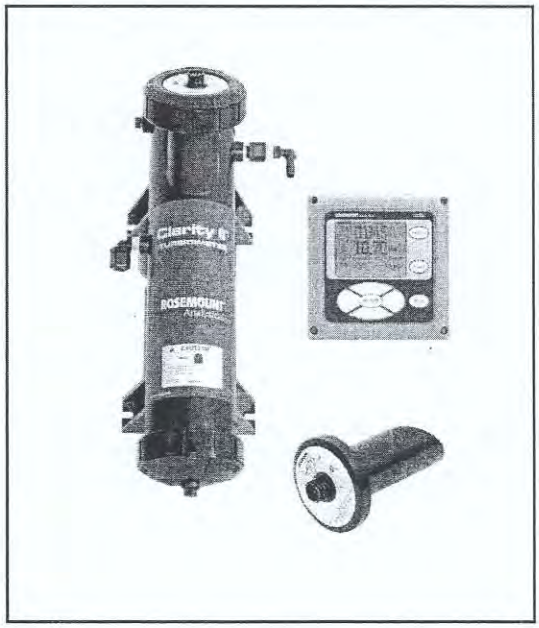
[1] *Kynar is a registered trademark of Elf Atochem North America, Inc.*

Product Data Sheet
PDS 71-T1056/rev.B
May 2008

Model T1056

CLARITY® II TURBIDIMETER

- COMPLETE SYSTEM includes single or dual input analyzer, sensor(s), and debubbler assembly
- CHOOSE U.S. EPA METHOD 180.1 or ISO METHOD 7027 compliant sensors
- RANGE 0-200 NTU
- RESOLUTION 0.001 NTU
- EASY TO USE MODEL 1056 ANALYZER with two analog outputs and four programmable alarm relays
- INTUITIVE, USER-FRIENDLY MENU in seven languages makes setup and calibration easy
- HART® DIGITAL COMMUNICATIONS - available



Clarity II is a registered trademark of Emerson Process Management.

FEATURES AND APPLICATIONS

The Clarity II turbidimeter is intended for the determination of turbidity in water. Low stray light, high stability, efficient bubble rejection, and a display resolution of 0.001 NTU make Clarity II ideal for monitoring the turbidity of filtered drinking water. Clarity II is also suitable for applications other than drinking water treatment including monitoring of filtered water discharges, condensate returns, and clarifiers.

Both USEPA 180.1 and ISO 7027 compliant sensors are available. USEPA 180.1 sensors use a visible light source. ISO 7027 sensors use a near infrared LED. For regulatory monitoring in the United States, USEPA 180.1 sensors must be used. Regulatory agencies in other countries may have different requirements.

The Clarity II turbidimeter consists of an analyzer, which accepts either one or two signal input boards, sensors, and a debubbler/measuring chamber and cable for each sensor. The cable plugs into the sensor and the analyzer, making setup fast and easy. Sensors can be located as far as 50 ft (15.2 m) away from the analyzer.

The Clarity II turbidimeter incorporates the easy-to-use Model 1056 intelligent analyzer. Menu screens and prompts are so intuitive on the large LCD display that a manual is practically not needed. 4-20mA analog outputs are fully scalable. Every unit includes four alarm relays with interval timer functions. Alarms are fully programmable for high/low logic and dead band. To simplify start-up and programming, the analyzer automatically recognizes installed turbidity signal boards and detects whether an EPA 180.1 or ISO 7027 sensor is being used.

Clarity II is available in an optional configuration in which the analyzer, sensor(s), and debubbling flow cell(s) are mounted on a single back plate. The sensor cables are pre-wired to the analyzer, so setup is exceptionally fast and easy. All the user does is mount the unit on a wall, bring in power and sample, and provide a drain. To order this option, consult the factory.

1.2 SPECIFICATIONS — ANALYZER

Enclosure: Polycarbonate. NEMA 4X/CSA 4 (IP65)

Dimensions: Overall 155 X 155 X 131 mm (6.10 X 6.10 X 5.15 in.) Cutout: 1/2 DIN 139mm (5.45 x 5.45 in.)

Conduit openings: Accepts 1/2" or PG 13.5 conduit fittings.

Display: Monochromatic graphic liquid crystal display. 128 x 96 pixel display resolution. Backlit. Active display area: 58 x 78mm (2.3 x 3.0 in.)

Security Code: 3-digit code prevents accidental or unauthorized changes in instrument settings and calibration.

Languages: English, German, Spanish, Italian, French, Portuguese, Chinese.

Units: Turbidity (NTU, FTU, or FNU); total suspended solids (mg/L, ppm, or no units)

Display resolution-turbidity: 4 digits; decimal point moves from x.xxx to xxx.x

Display resolution-TSS: 4 digits; decimal point moves from x.xxx to xxxx

Calibration methods: user-prepared standard, commercially prepared standard, or grab sample. For total suspended solids user must provide a linear calibration equation.

Ambient Temperature and Humidity: 0 to 50°C, (32 to 122°F); RH 5 to 95% (non-condensing)

Altitude: For use up to 2000 meters.

Storage Temperature Effect: -20 to 60°C, (-4 to 140°F)

Power: Ordering code -02:20-30VDC 15W min. input power

-03:85 to 265 VAC, 47.5 to 65.0 Hz. 15W min. input power.

⧈ Equipment protected by double insulation.

Input: One or two isolated sensor inputs

Outputs: Two 4-20 mA or 0-20 mA isolated current outputs. Fully scalable. Maximum load: 550 ohm. Output 1 has superimposed HART signal (options -32, -33 only)

Current Output Accuracy: ±0.05 mA @25°C

Terminal Connections Rating: Power connector (3-leads); 24-12 AWG wire size. signal board terminal blocks; 26-16 AWG wire size. Current output connectors (2-leads); 24-16 wire size. Alarm relay terminal blocks: 24-12 AWG wire size.

RFI/EMI: EN-61326 CE

LVD: EN-61010-1

Relays: Form C, single pole, double throw, epoxy sealed.

Maximum Relay Current		
	Resistive	**Inductive**
28 Vdc	5.0 A	3.0 A
115 Vac	5.0 A	3.0 A
230 Vac	5.0 A	1.5 A

⚠ CAUTION

RISK OF ELECTRICAL SHOCK

Field wiring terminals: removable terminal blocks for power, analog outputs, and sensors

SPECIFICATIONS — SENSOR

Method: EPA 180.1 or ISO 7027 (using 860 nm LED source). Must be specified when ordering.

Incandescent lamp life: two years

LED life: five years

Wetted materials: Delrin[1], glass, EPDM

Accuracy after calibration at 20.0 NTU:

0 - 1 NTU: ±2% of reading or ±0.015 NTU, whichever is greater.

0 - 20 NTU: ±2% of reading

Cable: 20 ft (6.1 m) or 50 ft (15.2 m). Maximum 50 ft (15.2 m). Connector is IP65.

Maximum Pressure: 30 psig (308 kPa abs)

Temperature: 40 - 95°F (5 - 35°C)

Sensor body rating: IP65 when cable is connected

SPECIFICATIONS — DEBUBBLER AND FLOW CHAMBER

Dimensions: 18.1 in. x 4.1 in. diam. (460 mm x 104 mm diam.) (approx.)

Wetted materials: ABS, EPDM, Delrin[1], polypropylene, nylon

Inlet: compression fitting accepts 1/4 in. OD tubing; fitting can be removed to provide 1/4 in. FNPT

Drain: barbed fitting accepts 3/8 in. ID tubing; fitting can be removed to provide 1/4 in. FNPT. Must drain to atmosphere.

Sample temperature: 40 - 95°F (5 - 35°C)

Minimum inlet pressure : 3.5 psig (125 kPa abs). 3.5 psig will provide about 250 mL/min sample flow.

Maximum inlet pressure: 30 psig (308 kPa abs). Do not block drain tube.

Recommended sample flow: 250 - 750 mL/min

Response Time: The table shows the time in minutes to percent of final value following a step change in turbidity.

[1]*Delrin is a registered trademark of DuPont Performance Elastomers.*

SPECIFICATIONS — MISCELLANEOUS

Weight/shipping weight:

Sensor: 1 lb/2 lb (0.5 kg/1.0 kg)

Analyzer: 2 lb/3 lb (1.0 kg/1.5 kg)

Debubbler: 3 lb/4 lb (1.5 kg/2.0 kg)

(rounded to the nearest lb or 0.5 kg)

Specifications subject to change without notice.

TELEDYNE INSTRUMENTS
Advanced Pollution Instrumentation
A Teledyne Technologies Company

MODEL **100E**

UV Fluorescence SO_2 Analyzer



EPA APPROVAL EQSA-0495-100
MCERTS certified Sira MC050067/00

- Ranges, 0-50 ppb to 0-20 ppm, user selectable
- Dual ranges and auto ranging
- Microprocessor controlled for versatility
- Multi-tasking software allows viewing test variables while operating
- Continuous self checking with alarms
- Dual bi-directional RS-232 ports for remote operation (optional RS-485 or Ethernet)
- Digital status outputs indicate instrument operating condition
- Adaptive signal filtering optimizes response time
- Temperature & Pressure compensation
- Internal Zero & Span check (optional)
- Internal data logging with 1 min to 365 day multiple averages
- Critical orifices provide flow stability

The Model 100E uses the proven UV fluorescence principle, coupled with state of the art microprocessor technology to provide accurate and dependable measurements of low level SO_2.

Exceptional stability is achieved with the use of an optical shutter to compensate for PMT drift and a reference detector to correct for changes in UV lamp intensity. A hydrocarbon "kicker" and advanced optical design combine to prevent inaccuracies due to interferents. The multi-tasking software gives real time indication of a large number of operational parameters and provides automatic alarms if diagnostic limits are exceeded.

All instruments of the TAPI E Series include an extensive built-in data acquisition capability using the analyzer's internal memory. This allows the logging of multiple parameters including averaged and instantaneous concentration values, calibration data and operating parameters such as flow, pressure and lamp intensity.

Stored data are easily retrieved through the serial port or optional Ethernet port via our APIcom software or from the front panel, allowing operators to perform predictive diagnostics and enhanced data analysis by tracking parameter trends.

The Model 100E combines lighter weight, rugged construction, ease of use, powerful diagnostics, modular design and outstanding performance to yield the ideal tool for today's air monitoring requirements.



MODEL **100E**

UV Fluorescence SO_2 Analyzer

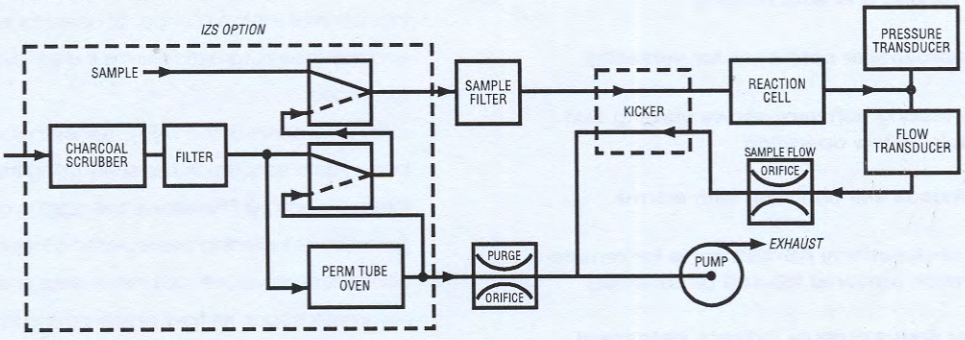
Specifications

Ranges:	0-50 ppb to 0-20,000 ppb full scale, user selectable. Dual ranges and auto ranging supported
Units:	ppb, ppm, µg/m³, mg/m³
Zero Noise:	< 0.2 ppb (RMS)
Span Noise:	< 0.5% of reading (RMS) above 50 ppb
Lower Detectable Limit (LDL):	0.4 ppb
Zero Drift:	< 0.5 ppb/24 hours, 1 ppb/7 days
Span Drift:	< 0.5% of FS/24 hours, ≤1% of FS/7 days
Lag Time:	20 seconds
Rise and Fall Time:	< 100 seconds to 95%
Linearity:	1% of full scale
Precision:	0.5% of reading above 50 ppb
Sample Flow Rate:	650 cm³/min ±10%
Operating Temperature Range:	5 - 40°C (with EPA Equivalency)

Dimensions (HxWxD):	7" (178 mm) x 17" (432 mm) x 23.5" (597 mm)
Weight:	35 lbs (16 kg)
Power:	100V - 120V, 220V - 240V, 50/60 Hz, 250W
Analog Outputs:	10V, 5V, 1V, 0.1V, selectable
Recorder Offset:	±10%
Serial Outputs:	Serial Port 1: RS-232 (DB-9M) Serial Port 2: standard RS-232 or optional RS-485 (DB-9F), Ethernet
Status (Digital)	8 outputs, 6 inputs (opto-isolated), 6 alarm outputs (optional)
Current Output:	Optional 4-20mA, select up to three channels
Approvals:	USEPA EQSA-0495-100 MCERTS certified Sira MC050067/00

NOTE: The values expressed above are in accordance with EPA definitions. All error specifications are based on constant conditions. Specifications exceed US EPA and Eignungsgeprüft requirements.

Schematic



How to Order

Model 100E Fluorescence SO_2 Analyzer includes:

- Selectable voltage (specify below)
- Internal pump
- Auto ranging and dual ranges
- 47mm diameter particulate filter
- 8 isolated digital status outputs
- Dual bi-directional RS-232
- APIcom remote control software

Specify input AC voltage & frequency:

☐ 100V - 115V ☐ 50Hz
☐ 220V - 240V ☐ 60Hz

Specify output DC voltage:

☐ 10V ☐ 5V ☐ 1V ☐ 0.1V

Calibration Options:

☐ TFE valves for selection of customer-supplied zero and span gas
☐ Internal zero and permeation tube oven for calibration check. Requires perm tube (separate option)

Additional Options:

☐ Rack mount brackets (19") with chassis slides
☐ Rack mount brackets only
☐ 4-20mA outputs (specify up to three channels)
☐ Multi-drop RS-232 connection
☐ Ethernet port includes 7 ft. CAT-5 cable (disables one serial port)
☐ NO_X optical filter (recommended for high NO_X applications

Accessories:

☐ RS-232 Cable
☐ Expendables Kit
☐ Spare Parts Kit

Specifications subject to change without notice. M100E/01.06

TELEDYNE INSTRUMENTS
Advanced Pollution Instrumentation
A Teledyne Technologies Company
9480 Carroll Park Drive ■ San Diego, CA 92121-5201
Ph. 858-657-9800 Fax 858-657-9816
Email api-sales@teledyne.com

For more information about the Teledyne API family of monitoring instrumentation products, call us or visit our website at

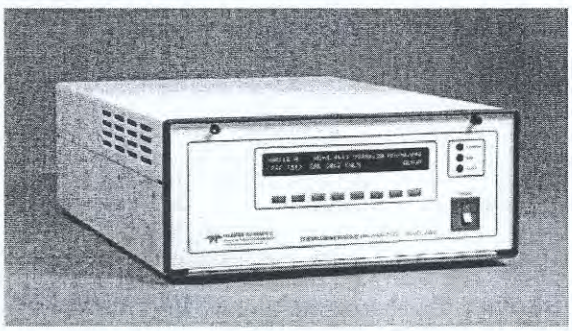
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CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2000
ANAB DNV

TELEDYNE INSTRUMENTS
Advanced Pollution Instrumentation
A Teledyne Technologies Company

MODEL **200E**

Chemiluminescence $NO/NO_2/NO_X$ Analyzer



EPA APPROVAL RFNA-1194-099
MCERTS certified Sira MC050068/00

- **Ranges, 0-50 ppb to 0-20 ppm, user selectable**
- **Independent ranges for NO, NO_2, NO_X**
- **Microprocessor controlled for versatility**
- **Multi-tasking software allows viewing test variables while operating**
- **Continuous self checking with alarms**
- **Permeation drier on ozone generator**
- **Dual bi-directional RS-232 ports for remote operation (optional RS-485 or Ethernet)**
- **Digital status outputs provide instrument operating condition**
- **Adaptive signal filtering optimizes response time**
- **Temperature & Pressure compensation**
- **Converter efficiency correction software**
- **Continuous automatic zero correction**
- **Catalytic ozone scrubber**
- **Internal Zero & Span check (optional)**
- **Internal data logging with 1 min to 365 day multiple averages**

The Model 200E uses the proven chemiluminescence detection principle, coupled with state-of-the-art microprocessor technology to provide the sensitivity, stability and ease of use needed for ambient or dilution CEM monitoring requirements.

The analyzer uses multi-tasking software which allows complete control of all functions while providing online indication of important operating parameters. Measurements are automatically compensated for temperature and pressure changes.

In addition, stability is enhanced by an Auto-Zero circuit that continuously provides a true zero reference. The result is sensitive, accurate, and dependable performance under the harshest operating conditions.

All instruments in the TAPI E Series include built-in data acquisition capability using the analyzer's internal memory. This allows the logging of multiple parameters including averaged or instantaneous concentration values, calibration data, and operating parameters such as pressures and temperatures.

Stored data are easily retrieved through the serial port or optional Ethernet port via APIcom or from the front panel, allowing the operator to perform predictive diagnostics and enhanced data analysis by tracking parameter trends.

The Model 200E combines lighter weight, rugged construction, ease of use, powerful diagnostics, modular design and outstanding performance to yield the ideal tool for today's air monitoring requirements.



MODEL **200E**
Chemiluminescence $NO/NO_2/NO_X$ Analyzer

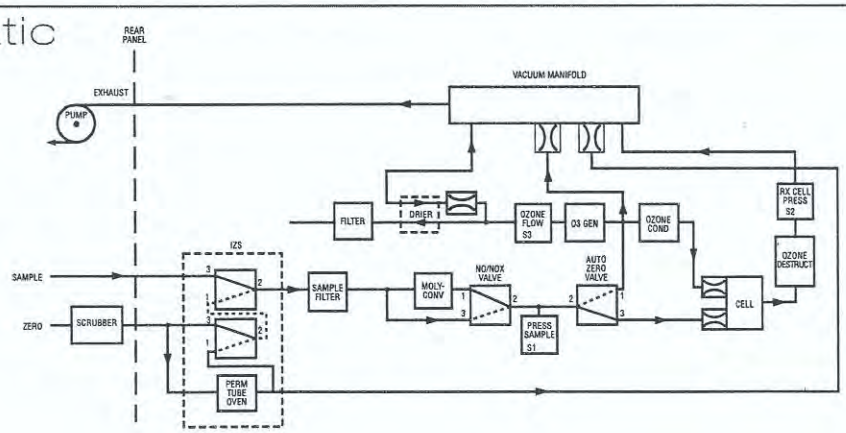
Specifications

Ranges:	0-50 ppb to 0-20,000 ppb full scale, user selectable. Independent NO, NO_2, NO_X ranges and autoranging supported
Units:	ppb, ppm, µg/m³, mg/m³
Zero Noise:	< 0.2 ppb (RMS)
Span Noise:	< 0.5% of reading (RMS) above 50 ppb
Lower Detectable Limit (LDL):	0.4 ppb
Zero Drift:	< 0.5 ppb/24 hours, <1 ppb/7 days
Span Drift:	< 0.5% of reading/24 hours, <1% of reading/ 7 days
Lag Time:	20 seconds
Rise and Fall Time:	< 60 seconds to 95%
Linearity:	1% of full scale
Precision:	0.5% of reading
Sample Flow Rate:	500 cm³/min ±10%
Operating Temperature Range:	5 - 40°C (with EPA Equivalency)

Dimensions (HxWxD):	7" (178 mm) x 17" (432 mm) x 23.5" (597 mm)
Weight:	Analyzer 40 lbs (18 kg) External Pump 15 lbs (7 kg)
Power:	100V - 120V, 220V - 240V, 50/60 Hz, 250W
Analog Outputs:	10V, 5V, 1V, 0.1V, selectable
Recorder Offset:	±10%
Serial Outputs:	Serial Port 1: RS-232 (DB-9M) Serial Port 2: standard RS-232 or optional RS-485 (DB-9F), Ethernet
Status (Digital)	8 outputs, 6 inputs (opto-isolated), 4 alarm outputs (optional)
Current Output:	Optional 4-20mA, select up to three channels
Approvals:	USEPA RFNA-1194-099, CE MCERTS certified Sira MC050068/00

NOTE: The values expressed above are in accordance with EPA definitions. All error specifications are based on constant conditions. Specifications exceed US EPA and Eignungsgeprüft requirements.

Schematic



How to Order

Model 200E Chemiluminescence NO, NO_2, NO_X Analyzer includes:

- External pump
- Permeation air dryer for ozone generator air supply
- Independent NO, NO_2, NO_X ranges
- Auto ranging
- 47mm diameter particulate filter
- 8 digital status outputs, 6 inputs
- Dual bi-directional RS-232
- APIcom remote control software

Specify input AC voltage & frequency:

☐ 100V - 115V ☐ 50Hz
☐ 220V - 240V ☐ 60Hz

Specify output DC voltage:

☐ 10V ☐ 5V ☐ 1V ☐ 0.1V

Calibration Options:

☐ Dual calibration valves for selection of customer-specified zero and span gas
☐ Internal zero and permeation tube oven for calibration check (requires permeation tube, available as option)
☐ Triple gas valve manifold

Optional Equipment:

☐ Rack mount brackets (19") with chassis slides
☐ Rack mount brackets only
☐ 4-20mA outputs (specify up to three channels)
☐ Multi-drop RS-232 connection
☐ Ethernet port includes 7 ft. CAT-5 cable (disables one serial port)
☐ Permeation dryer for sample gas
☐ Permeation dryer combination for ozone and sample air

Accessories:

☐ RS-232 Cable
☐ Expendables Kit
☐ Spare Parts Kit
☐ Chassis carrying handle
☐ Zero Air Scrubber

Specifications subject to change without notice. M200E/01.06

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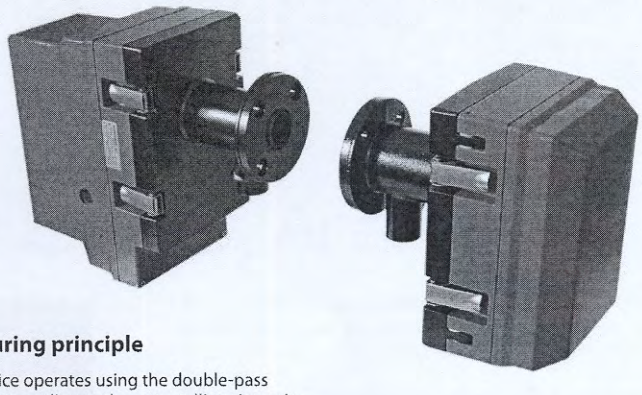
For more information about the Teledyne API family of monitoring instrumentation products, call us or visit our website at

www.teledyne-api.com

CERTIFIED QUALITY MANAGEMENT SYSTEM ISO 9001:2000

Optical opacity /dust monitor

Standard system for plants with concentrations >50 mg/m³.



Features

- In-situ measuring procedure, continuous measurement
- Semi-conductor source with long service life
- Super-wide band diode (SWBD), which provides more stable measuring results in comparison to devices with conventional LEDs
- Powerful microprocessor technology
- Measured value display on LC display in opacity, extinction or in mg/m³
- Automatic function tests with correction of measured values in relation to soiling
- Optics and electronics in a hermetically sealed unit - no smoke gas can enter device
- Easy adjustment without additional equipment
- Low-maintenance thanks to optimal purge air conduction.

Applications

Plants in which the dust concentration quantity needs to be measured, e.g.:

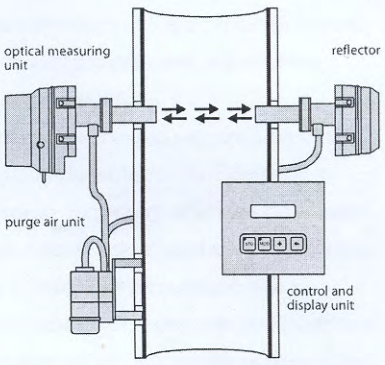
- Furnace plants with semi-anthracite coal, brown coal, fuel oil and combined heating
- Converter plants, asphalt mixing plants
- Plants for cement manufacture.

Approvals

- Suitability-tested by the TÜV Cologne, test report 936/801017
- Itemized in the list of suitable measuring devices for continuous emission measuring.
- MCERTS

Measuring principle

The device operates using the double-pass method according to the auto-collimation principle. The light beam traverses the measuring distance twice. The attenuation of the light beam by the dust content in the measuring section is measured and evaluated.



System components

- Mounting flanges
- Measuring head
- Reflector
- Control and display unit
- Purge air unit.

Options

- Bus interface, e.g. Modbus or similar
- Automatic quick-closing shutters to protect the measuring head and the reflector in the event of failure of the purge air
- Weather protection covers, for outdoor installation
- Explosion proof design for EEx p, Zone 1 or Zone 2
- With an additional display unit at the measuring location, the control and display unit can be installed in up to 1000 m distance away
- Temperature compensation through additional analog input
- Special model for measuring distances up to 18 m with 2 purge air units
- Filter set for sensitivity and linearity control.

measurements	opacity, extinction	detection limit	<2% of measuring range
switchable measuring ranges	opacity: 0–20% ... 0–100% extinction: 0–0.1 ... 0–1.6 dust: 0–100 mg/m³ ... 0–4000 mg/m³ [1]	reference point drift	<0.4% of measuring range/month
measuring principle	transmission	zero point drift	<0.4% of measuring range/month
flue gas temperature	above dew point up to 250°C, optional up to 1000°C, depending on application	supply voltage	95–264 VAC, 47–63 Hz, 30 VA
flue gas pressure	-50 up to +20 hPa, optional higher	dimensions (h x w x d)	measuring head 363 x 185 x 398 mm
duct diameter	1 up to 12 m, optional up to 18 m	weight	7 kg
ambient temperature	-20 up to +50°C, optional higher	remarks	[1] with reference to one meter of path length after gravimetric calibration
protection	IP65, Ex optional	purge air supply	
measuring outputs	2 x 0 / 4–20 mA / 500 Ohm, manual or automatic measuring range switching, optional Modbus RTU (RS 485)	purge air quantity	approx. 80 m³/h
digital outputs	6 programmable relay outputs, permissable load 250 V / 100 VA	supply voltage	115/230 VAC, 50/60 Hz, 0.37 / 0.43 kW
digital inputs	6 programmable potential free inputs	dimensions (h x w x d) weight	350 x 550 x 500 mm 12 kg
accuracy	<1% of measuring range	protection	IP54

DURAG GROUP smart solutions for combustion and environment

DURAG GmbH
Kollaustrasse 105 · 22453 Hamburg · Germany
Tel. +49 40 554 218-0 · Fax +49 40 584 154
E-Mail: info@durag.de

www.durag.de

Appendix XIII: Sub-Soil Investigation Report at Passur River

RANA SOIL ENGINEERING

Sub-Soil Investigation

278, Sher-E-Bangla Road, Rayer Bazar, Dhanmondi, Dhaka-1209

BORE LOG

RIG NO :

CLIENT : BANGLADESH POWER DEVELOPMENT BOARD
PROJECT : IEE & EIA OF 2X (500-600) MW COALBASED THERMAL POWER PLANT TO BE CONSTRUCTED AT
LOCATION : THE LOCATION OF KHULNA
ADDRESS : UP: RAJNAGAR
P.S. : RAMPAL DIST. : BAGERHAT BORING DATE : 04-01-11

BORE HOLE NO : BH. 7
GROUND LEVEL :
GROUND WATER LEVEL : 1.0 M
BORE HOLE DIA : 10 CM.
DATE : 05-01-11 TIME :

NO. OF SAMPLE	TYPE OF SAM	DEPTH IN METTER	THICKNESS	LITHOLOGICAL DESCRIPTION	LITHOLOGICAL LOG	DIA OF BORING	BLOWS ON SPOON PER 15 CM PENETRATION 15CM	15CM	15CM	STANDARED PENETRATION RESISTANCE BLOWS PER 30 CM OF PENETRATION	INDEX DISTURBED UNDISTURBED REMARKS
D-1		1.5	15.45 m	Gray soft to stiff Clay		100mm	1	1	1	2	
D-2		3.0					1	1	1	2	
D-3		4.5					1	1	1	2	
D-4		6.0					1	1	2	3	
D-5		7.5					1	1	2	3	
D-6		9.0					1	1	1	2	
D-7		10.5					2	2	4	6	
D-8		12.0					2	3	5	8	
D-9		13.5					2	3	6	9	
D-10		15.0					3	4	6	10	
D-11		16.5	1.5 m	Gray medium dense Silty very fine Sand			7	10	15	25	
D-12		18.0	15 m	Gray dense and very dense very fine Sand little Silt			9	15	18	33	
D-13		19.5					9	13	15	28	
D-14		21.0					9	14	16	30	
D-15		22.5					15	20	26	46	
D-16		24.0					20	28	30	58	
D-17		25.5					8	15	16	31	
D-18		27.0					8	15	18	33	
D-19		28.5					15	27	30	57	
D-20		30.0					16	30	32	62	

0 10 20 30 40 50 60

CLAY
SILT & CLAY
SILT
SAND
MICA
ORGANIC

RANA SOIL ENGINEERING

Sub-Soil Investigation

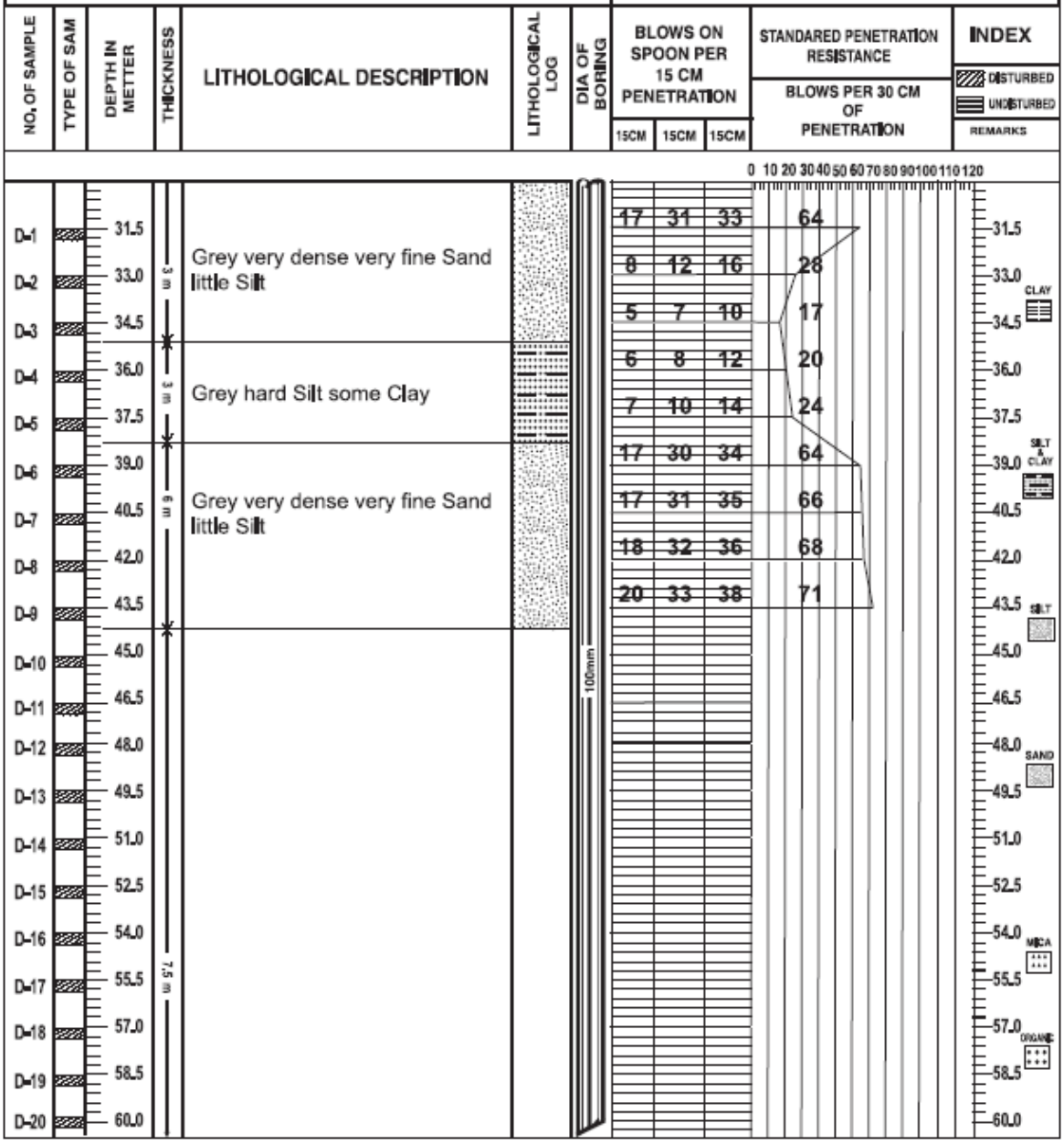
278, Sher-E-Bangla Road, Rayer Bazar, Dhanmondi, Dhaka-1209

BORE LOG

RIG NO :

CLIENT : BANGLADESH POWER DEVELOPMENT BOARD
PROJECT : IEE & EIA OF 2X (500-600) MW COALBASED THERMAL POWER PLANT TO BE CONSTRUCTED AT
LOCATION : THE LOCATION OF KHULNA
ADDRESS : UP: RAJNAGAR
P.S. : RAMPAL DIST. : BAGERHAT BORING DATE : 04-01-11

BORE HOLE NO : TOWER NO- 7
GROUND LEVEL :
GROUND WATER LEVEL : 1.0 M
BORE HOLE DIA : 10 CM.
DATE : 05-01-11 TIME :



RANA SOIL ENGINEERING

Sub-Soil Investigation

278, Sher-E-Bangla Road, Rayer Bazar, Dhanmondi, Dhaka-1209

BORE LOG

RIG NO :

CLIENT : BANGLADESH POWER DEVELOPMENT BOARD
PROJECT : IEE & EIA OF 2X (500-600) MW COALBASED THERMAL POWER PLANT TO BE CONSTRUCTED AT
LOCATION : THE LOCATION OF KHULNA
ADDRESS : UP: RAJNAGAR
P.S. : RAMPAL DIST. : BAGERHAT BORING DATE : 31-12-10

BORE HOLE NO : BH. 8
GROUND LEVEL :
GROUND WATER LEVEL : 1.50 M
BORE HOLE DIA : 10 CM.
DATE : 01-01-11 TIME :

NO. OF SAMPLE	TYPE OF SAM	DEPTH IN METTER	THICKNESS	LITHOLOGICAL DESCRIPTION	LITHOLOGICAL LOG	DIA OF BORING	BLOWS ON SPOON PER 15 CM PENETRATION 15CM	15CM	15CM	STANDARED PENETRATION RESISTANCE: BLOWS PER 30 CM OF PENETRATION	INDEX: DISTURBED / UNDISTURBED	REMARKS
D-1		1.5	4.5m	Gray soft Clay		100mm	1	1	1	2		
D-2		3.0					1	1	1	2		
D-3		4.5					1	1	2	3		
D-4		6.0	1.5m	Gray soft Silt			1	1	2	3		
D-5		7.5	3 m	Gray medium stiff Clay			2	2	3	5		
D-6		9.0					2	2	2	4		
D-7		10.5	4 m	Gray medium to stiff Silt			2	3	4	6		
D-8		12.0					3	4	6	10		
D-9		13.5					4	56	7	12		
D-10		15.0	14.5 m	Gray medium to dense very fine Sand some Silt			5	6	9	15		
D-11		16.5					5	6	8	14		
D-12		18.0					6	8	12	20		
D-13		19.5					6	9	13	22		
D-14		21.0					7	10	15	25		
D-15		22.5					7	12	16	28		
D-16		24.0					8	14	18	32		
D-17		25.5					8	14	19	33		
D-18		27.0					8	15	20	35		
D-19		28.5					9	16	20	36		
D-20		30.0					9	17	21	38		

0 10 20 30 40 50 60

CLAY
SILT & CLAY
SILT
SAND
MICA
ORGANIC

RANA SOIL ENGINEERING

Sub-Soil Investigation

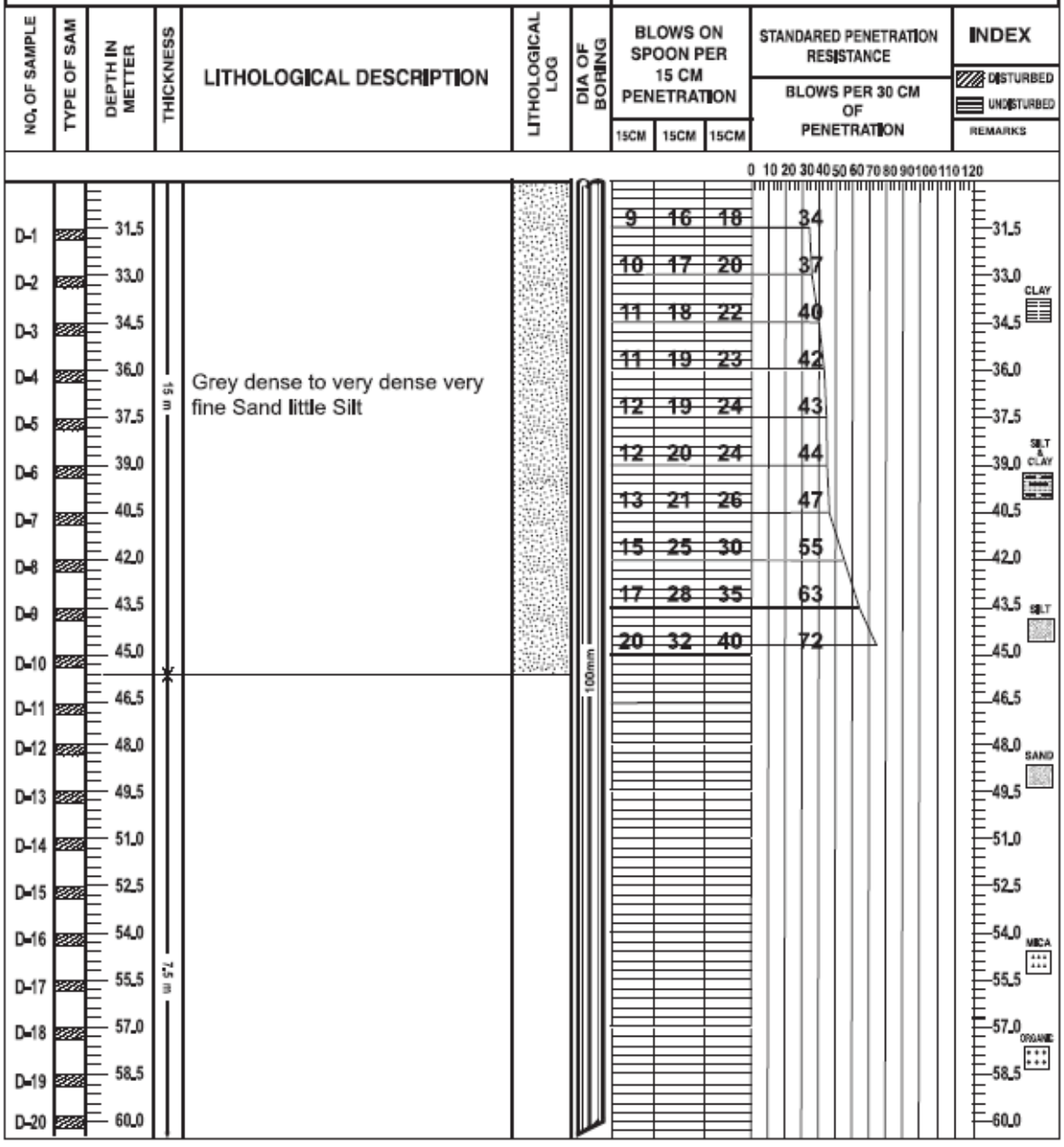
278, Sher-E-Bangla Road, Rayer Bazar, Dhanmondi, Dhaka-1209

BORE LOG

RIG NO :

CLIENT : BANGLADESH POWER DEVELOPMENT BOARD
PROJECT : IEE & EIA OF 2X (500-600) MW COALBASED THERMAL POWER PLANT TO BE CONSTRUCTED AT
LOCATION : THE LOCATION OF KHULNA
ADDRESS : UP: RAJNAGAR
P.S. : RAMPAL DIST. : BAGERHAT BORING DATE : 31-12-10

BORE HOLE NO : TOWER NO- 8
GROUND LEVEL :
GROUND WATER LEVEL : 1.50 M
BORE HOLE DIA : 10 CM.
DATE : 01-01-11 TIME :



RANA SOIL ENGINEERING

Sub-Soil Investigation

278, Sher-E-Bangla Road, Rayer Bazar, Dhanmondi, Dhaka-1209

BORE LOG

RIG NO :

CLIENT : BANGLADESH POWER DEVELOPMENT BOARD
PROJECT : IEE & EIA OF 2X (500-600) MW COALBASED THERMAL POWER PLANT TO BE CONSTRUCTED AT
LOCATION : THE LOCATION OF KHULNA
ADDRESS : UP: RAJNAGAR
P.S. : RAMPAL DIST. : BAGERHAT BORING DATE : 29-12-10

BORE HOLE NO : BH. 9
GROUND LEVEL :
GROUND WATER LEVEL : 1.30 M
BORE HOLE DIA : 10 CM.
DATE : 30-12-10 TIME :

NO. OF SAMPLE	TYPE OF SAM	DEPTH IN METTER	THICKNESS	LITHOLOGICAL DESCRIPTION	LITHOLOGICAL LOG	DIA OF BORING	BLOWS ON SPOON PER 15 CM PENETRATION			STANDARED PENETRATION RESISTANCE: BLOWS PER 30 CM OF PENETRATION	INDEX: REMARKS
							15CM	15CM	15CM	0 10 20 30 40 50 60	DISTURBED / UNDISTURBED
D-1		1.5	10.95 m	Gray very soft to soft Clay		100mm	1	0	1	1	
D-2		3.0					1	1	1	2	
D-3		4.5					1	1	1	2	
D-4		6.0					1	1	1	2	
D-5		7.5					1	1	1	2	
D-6		9.0					1	1	1	2	
D-7		10.5					1	1	2	3	
D-8		12.0	3.5 m	Gray medium dense Silt little very fine Sand			3	4	6	10	
D-9		13.5					3	4	7	11	
D-10		15.0					3	3	5	8	
D-11		16.5					4	5	8	13	
D-12		18.0	5 m	Gray medium dense very fine Sand little Silt			4	6	10	16	
D-13		19.5					5	8	11	19	
D-14		21.0					4	6	8	14	
D-15		22.5	3 m	Gray stiff Clay			2	3	5	8	
D-16		24.0					3	4	7	11	
D-17		25.5	1.5 m	Gray medium dense Silty very fine Sand			3	5	8	13	
D-18		27.0	4.5 m	Gray medium dense very fine Sand some Silt			7	12	16	28	
D-19		28.5					9	12	17	29	
D-20		30.0					11	12	18	30	

CLAY
SILT & CLAY
SILT
SAND
MICA
ORGANIC

RANA SOIL ENGINEERING

Sub-Soil Investigation

278, Sher-E-Bangla Road, Rayer Bazar, Dhanmondi, Dhaka-1209

BORE LOG

RIG NO :

CLIENT : BANGLADESH POWER DEVELOPMENT BOARD
PROJECT : IEE & EIA OF 2X (500-600) MW COALBASED THERMAL POWER PLANT TO BE CONSTRUCTED AT
LOCATION : THE LOCATION OF KHULNA
ADDRESS : UP: RAJNAGAR
P.S. : RAMPAL DIST. : BAGERHAT BORING DATE : 29-12-10

BORE HOLE NO : TOWER NO- 9
GROUND LEVEL :
GROUND WATER LEVEL : 1.30 M
BORE HOLE DIA : 10 CM.
DATE : 01-01-11 TIME :

NO. OF SAMPLE	TYPE OF SAM	DEPTH IN METTER	THICKNESS	LITHOLOGICAL DESCRIPTION	LITHOLOGICAL LOG	DIA OF BORING	BLOWS ON SPOON PER 15 CM PENETRATION 15CM	15CM	15CM	STANDARED PENETRATION RESISTANCE BLOWS PER 30 CM OF PENETRATION	INDEX DISTURBED / UNDISTURBED / REMARKS
D-1		31.5	15 m	Grey dense to very dense very fine Sand little Silt		100mm	11	15	20	35	CLAY
D-2		33.0					11	17	23	40	
D-3		34.5					11	18	23	41	
D-4		36.0					12	19	24	43	
D-5		37.5					12	20	25	45	
D-6		39.0					12	22	27	49	SILT & CLAY
D-7		40.5					13	23	27	50	
D-8		42.0					14	24	29	53	
D-9		43.5					14	25	30	55	SILT
D-10		45.0					15	27	32	58	
D-11		46.5	7.5 m								
D-12		48.0									SAND
D-13		49.5									
D-14		51.0									
D-15		52.5									
D-16		54.0									MICA
D-17		55.5									
D-18		57.0									ORGANIC
D-19		58.5									
D-20		60.0									

0 10 20 30 40 50 60 70 80 90 100 110 120

Appendix XIV: Questionnaires for Socio-economic study

SOCIO-ECONOMIC BASELINE DATA COLLECTION
Checklist for Rapid Rural Appraisal (RRA)

1. Facilitation Information

Name of Facilitator	
Date of Facilitation	

2. Project Information

Name of Project	
Gross Area (ha.)	
Net Area (ha.)	

3. Study Area

Mauza	
Union/Ward	
Municipality (if any)	
Upazila/Thana	
District	

4. Educational Institution

Sl. No.	Type of facility	Nos. of Institution	Type of facility	Nos. of Institution
1	Primary School		Ebtedayee Madrasha	
2	High School		Dakhil Madrasha	
3	College		Alim/Fazil Madrasha	

Note: The category "Primary School" includes only Government Primary School (GPS) and Registered Non-government Primary School (RNGPS)

5. Disease Prevalence

Ranking by Incidence	Name of Disease	Ranking by Incidence	Name of Disease
1		**6**	
2		**7**	
3		**8**	
4		**9**	
5		**10**	

Note: If the facilitator can collect disease profile from the Upazila Health Complex then this question could be skipped

6. Health Facilities

Sl. No.	Type of Facility	Number of Facilities
1	District/Sadar Hospital	
2	Upazila Health Complex	
3	Union Sub-Center	
4	Union Family Welfare Center	
5	Community Clinic	
6	Private Health Clinics/hospitals	
7	Other (if any)	

7. Peripheral Health Facilities (if any)

Number	
Name	
Description/status	

8. Sources of Treatment Facilities

Sl. No.	Source of treatment facilities	Percentage of Households Received
1	Trained physician	
2	Paramedic/diploma physician	
3	Quack doctor & informal treatments	
4	No treatment facilities at all	

9. Electricity Coverage

Sl. No.	Type of facility	Percentage of Households
1	Grid	
2	Solar	
3	Biogas	
4	Other (if any)	

10. Income and Expenditure

Range (Tk./month)	Percentage of Households	
	Expenditure	Income
Less than 1,000		
1,000 - 2,000		
2,000 – 5,000		
5,000 - 9,000		
9,000 - 20,000		
More than 20,000		

11. Labor and Wage

Type of Activity	Male Labor		Female Labor	
	Availability (put √)	Daily Wage (Tk.)	Availability (put √)	Daily Wage (Tk.)
Farming	H M L		H M L	
Non-Farming	H M L		H M L	

Note: H=High; M=Medium; L=Low. Farming activities include agricultural activity and Non-farming activities include earthwork, brickfield work, construction work etc)

12. Self Assessed Subsistence Poverty

Sl. No.	Poverty Status	Percentage of Households
1	Deficit	
2	Balance/Breakeven	
3	Surplus	

13. GO/NGO Safety Net Programs

Name of GO/ NGO Department	Activity	% of HHs Coverage

14. Land Price

Sl. No.	Lands Type	Sale Value (Tk./per acre)
1	Homesteads land	
2	Agricultural land	
3	Commercial Land	
4	Others (if any)	

15. Land Ownership

Land Holding Categories	Distribution of Household (%)
Absolute Landless (0 decimal)	
Functional Landless (up to 49 decimal)	
Marginal (50-100 decimal)	
Small (101-249 decimal)	
Medium (250-749 decimal)	
Large (more than 750 decimal)	

16. Disaster and Damage (in last five years)

Most Prevalent Disasters	
Ranking by Incidence	**1) 2) 3) 4) 5)**
Tangible loss due to Disasters	
Intangible loss due to Disasters	
Impacts on Households	
Impacts on Livelihood	
Proposed Mitigation	

Note: These data will be cross-checked with the multidisciplinary information

17. Migration Trend

Type of Migration	Out Migration		In Migration	
	Place of destination	Number/ Percentage*	Place of origin	Number/ Percentage*
Seasonal Labor migration				
Permanent Household migration				

*Percentage of migration will be applicable in case of seasonal labor migration; whereas number will be applicable in case of permanent migration of households

18. Professional/occupational Conflict

Type of Conflict	
Reasons of Conflict	
Area	
Groups engaged in conflict	
Proposed solutions	

19. Miscellaneous

Particulars	Number	Name	Brief Description
Ethnic Community			
Vulnerable Community			
Cultural Heritage Site			
Common Property Resources			

20. Profile of RRA Participants

Name	Age	Occupation	Address/ Mobile no.
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

ENVIRONMENTAL IMPACT ASSESSMENT OF 2X (500-660) MW COAL BASED THERMAL POWER PLANT TO BE CONSTRUCTED AT THE LOCATION OF KHULNA

CHECKLIST FOR PUBLIC CONSULTATION MEETING

1. Comprehension about the Project
   - 1.1. People's understanding about the project (e.g. whether the participants are informed about the project or not)
     - 1.1.1. Location of project
     - 1.1.2. Scope of project (e.g. distribution of electricity, sharing of electricity)
   - 1.2. Sources and types of information

2. Occupation trends in the study area
   - 2.1. Prevailing occupations
   - 2.2. Impact of the Project (e.g. whether the Project will adversely affect the occupations or not)
   - 2.3. Suggestions to mitigate the adverse effects
   - 2.4. Suggestions on compensation strategy

3. Perceptions on positive/negative impacts of the Project
   - 3.1. Miscellaneous benefits those the Project will incur
     - 3.1.1. Poverty alleviation
     - 3.1.2. Employment generation
     - 3.1.3. Women empowerment
     - 3.1.4. Transportation & communication
     - 3.1.5. ...
   - 3.2. Problems those the project will hasten
     - 3.2.1. Eviction from homestead
     - 3.2.2. Employment loss
     - 3.2.3. Migration
     - 3.2.4. ...

4. Perceptions about the impacts on the Sundarbans
   - 4.1. Adverse effects on the Sundarbans
   - 4.2. Suggestions to mitigate these impacts

5. Suggestions for planners/implementing agencies
   - 5.1. Suggestions on location
   - 5.2. Suggestions on implementation
   - 5.3. Suggestions on mitigation
   - 5.4. Suggestions on compensation
   - 5.5. ...

Appendix XV: Document of CSR and list of the PAPs

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বিদ্যুৎ, জ্বালানী ও খনিজ সম্পদ মন্ত্রণালয়
বিদ্যুৎ বিভাগ।
www.powerdivision.gov.

নং-বিজ্বাখস/বিঃ উঃ-১/বেসরকারিকরণ-১৯০/২০১২/৩০২৩ তারিখ-০৫/১১/২০১২ খ্রিঃ।

বিষয় ঃ ভবিষ্যতে স্থাপিতব্য কয়লা ভিত্তিক তাপ বিদ্যুৎ কেন্দ্র প্রকল্প এলাকার উন্নয়ন কার্যক্রমে অংশগ্রহণের নিমিত্ত সামাজিক উন্নয়ন তহবিল গঠন প্রসংগে।

সূত্র ঃ বিউবো'র স্মারক নং-২১৯৯-বিউবো(সচি)/উন্নয়ন-১৯৯/২০১০ তারিখ-০৯/১০/২০১২।

উপর্যুক্ত বিষয়ে সূত্রস্থ পত্রের প্রেক্ষিতে জানানো যাচ্ছে যে, ভবিষ্যতে স্থাপিতব্য সকল কয়লা ভিত্তিক তাপ বিদ্যুৎ কেন্দ্র নির্মাণ প্রকল্প এলাকায় স্থানীয় উন্নয়নমূলক কার্যক্রমে অংশগ্রহণের জন্য একটি "সামাজিক উন্নয়ন তহবিল গঠন" করার নিমিত্ত এ সকল বিদ্যুৎ কেন্দ্র হতে উৎপাদিতব্য প্রতি ইউনিট বিদ্যুতের মূল্যের সাথে ০.০৩ টাকা (তিন পয়সা) যোগ করে ট্যারিফ নির্ধারণ করার বিষয়ে সরকারের সম্মতি জ্ঞাপন করা হলো। বর্ণিত তহবিল হতে নিম্নোক্ত ক্ষেত্রসমূহে অর্থ ব্যয় করা যেতে পারে ঃ

ক) রাস্তা নির্মাণ;
খ) পানীয় জলের ব্যবস্থা;
গ) বিদ্যুৎ সরবরাহ;
ঘ) শিক্ষা প্রতিষ্ঠান স্থাপন ও উন্নয়ন;
ঙ) শিক্ষা বৃত্তি প্রদান;
চ) চিকিৎসা সুবিধা উন্নয়ন;
ছ) খেলাধুলা ও সাংস্কৃতিক উন্নয়ন;
জ) পেশাগত উন্নয়ন ও প্রশিক্ষণ এবং
ঝ) জীবনমান উন্নয়নের অন্যান্য পদক্ষেপ ইত্যাদি।

উক্ত তহবিলে অর্থ জমা করা এবং অর্থ ব্যয়ের পদ্ধতি ইত্যাদি বিষয়ে পরবর্তীতে সিদ্ধান্ত প্রদান করা হবে।

২। এ বিষয়ে পরবর্তী প্রয়োজনীয় কার্যক্রম গ্রহণের জন্য নির্দেশক্রমে অনুরোধ করা হলো।

(মোহাম্মদ হুমায়ুন কবীর)
সিনিয়র সহকারী সচিব
ফোনঃ ৯৫৫৯৯২৮।

কার্যার্থে বিতরণ ঃ-

১। চেয়ারম্যান, বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড, ওয়াপদা ভবন, মতিঝিল বা/এ, ঢাকা।
২। ব্যবস্থাপনা পরিচালক, ইজিসিবি, কাওরান বাজার, ঢাকা।
৩। ব্যবস্থাপনা পরিচালক, এপিএসসিএল, বি-বাড়ীয়া।
৪। ব্যবস্থাপনা পরিচালক, নওপাজেকো, বিদ্যুৎ ভবন, ১নং আব্দুল গণি রোড, ঢাকা।

অনুলিপি সদয় অবগতির জন্য ঃ

১। প্রতিমন্ত্রী মহোদয়ের একান্ত সচিব, বিদ্যুৎ বিভাগ।
২। সচিব মহোদয়ের একান্ত সচিব, বিদ্যুৎ বিভাগ।

প্রকল্প পরিচালকের দপ্তর নং ৪৬ তাং ০৮/১১/১২

NTPC Letter

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
জেলা প্রশাসকের কার্যালয়, বাগেরহাট
(এল, এ শাখা)
www.dcbagerhat.gov.bd

স্মারক নং -জেপ্রবা/এল, এ/০১/২০১০-১১/ ২২ (২৪৩) তারিখঃ- ১৪ জানুয়ারি, ২০১৩ খ্রিঃ।

বিষয় ঃ বাগেরহাট জেলার রামপালে ১৩২০ মেঃওঃ কয়লা ভিত্তিক তাপ বিদ্যুত কেন্দ্র নির্মাণের জন্য অধিগ্রহণকৃত ও হস্তান্তরকৃত ১৮৩৪.০০ একর জমি বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ডের অনুকূলে রেজিষ্ট্রেশন ও ষ্টেক হোল্ডারদের নামের তালিকা প্রেরণ প্রসংগে।

সূত্র ঃ তাঁর স্মারক নং ২২/প্রঃ পঃ/চখুকভিতাবিকেঃপ্রঃ/বিউবো/২০১৩ তারিখ ১০-০১-২০১৩ খ্রিঃ

উপর্যুক্ত বিষয় ও সূত্রোস্থিত স্মারকের পরিপ্রেক্ষিতে, কয়লা ভিত্তিক তাপ বিদ্যুৎ কেন্দ্র নির্মাণ প্রকল্পের জন্য ০১/২০১০-১১ নং এল,এ কেসের মাধ্যমে অধিগ্রহণকৃত জমির ষ্টেক হোল্ডারদের নামের তালিকা সদয় অবগতি ও প্রয়োজনীয় কার্যার্থে এসাথে প্রেরণ করা হলো।

সংযুক্তিঃ ৪৮ ফর্দ।

১৪/১/১৩
(মোঃ ওবায়দুর রহমান)
অতিরিক্ত জেলা প্রশাসক (রাজস্ব)
বাগেরহাট
১৪/১/১৩

প্রকল্প পরিচালক
(অতিঃ প্রধান প্রকৌশলী)
চট্টগ্রাম ও খুলনা ১৩০০মেঃওঃ x২কয়লাভিত্তিক
তাপ বিদ্যুৎ কেন্দ্র নির্মান প্রকল্প, বিউবো, ঢাকা।

এল, এ ০১/২০১০-১১ নং কেসের ষ্টেক হোল্ডারদের নামের তালিকা

ক্রমিক নং	এল, এ কেস নং	নাম ও পিতার নাম	ঠিকানা	মন্তব্য
০১	০১/২০১০-১১	শেখ কামরুজ্জামান টুকু পিতা-মৃত-এস, এম বদিউজ্জামান	সাং-৩নং টিবি ক্রস রোড, খুলনা	
০২	০১/২০১০-১১	শেখ আনোয়ারুজ্জামান পিতা-মৃত-শেখ আবু সাইদ	সাং-৬৫ নং হাজী মহসিন রোড,খুলনা	
০৩	০১/২০১০-১১	শেখ মেজবাউজ্জামান টিপু পিতা-মৃত এস, এম বদিউজ্জামান	সাং-সুনগর, উপজেলা-বাগেরহাট সদর জেলা-বাগেরহাট।	
০৪	০১/২০১০-১১	এস, এম ইমামুল হক জুয়েল পিতা-মৃত-এস, এম জাফর	সাং-টুটপাড়া, খুলনা	
০৫	০১/২০১০-১১	নাজমুল আহম্মদ পিতা-মৃত-আহসন আহম্মদ	সাং-২৮৯/১ নং খানজাহান আলী রোড খুলনা	
০৬	০১/২০১০-১১	আঃ সোবহান ফকির পিতা-মোঃ শাহাদাৎ ফকির	সাং-৭৭ বাইতুল আমান মহল্লা, মনসুর খা সড়ক, টুটপাড়া, খুলনা	
০৭	০১/২০১০-১১	মোঃ মাহফুজউল্লাহ পিতা-আলহাজ সোহরাব উদ্দিন	সাং-১৪/১ মিয়া পাড়া, খুলনা	
০৮	০১/২০১০-১১	মোঃ মাহবুব উল্লাহ পিতা-আলহাজ সোহরাব উদ্দিন	সাং-১৪/১ মিয়া পাড়া, খুলনা	
০৯	০১/২০১০-১১	নাছিমা খাতুন পিতা-আলহাজ সোহরাব উদ্দিন	ঐ	
১০	০১/২০১০-১১	নাদিরা বেগম পিতা-আলহাজ সোহরাব উদ্দিন	ঐ	
১১	০১/২০১০-১১	সুবাষ রায় চৌধুরী পিতা-শরৎ রায় চৌধুরী	সাং-তেকাটিয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
১২	০১/২০১০-১১	মোঃ আবুল কালাম আজাদ পিতা-শেখ নজরুল ইসলাম	সাং-শ্রীফলতলা, উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৩	০১/২০১০-১১	আশীম কুমার দাশ পিতা-কার্তিক চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
১৪	০১/২০১০-১১	মোঃ সাইদুর রহমান পিতা-মৃত-মোঃ বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৫	০১/২০১০-১১	মোঃ জামির আলী শেখ পিতা-মৃত-মোঃ বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৬	০১/২০১০-১১	মোঃ ছাদেক আলী শেখ পিতা-মৃত-মোঃ বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৭	০১/২০১০-১১	ইব্রাহীম শেখ পিতা-মোঃ ফরিদ উদ্দিন শেখ	সাং-তুলশিরাবাদ উপজেলা-রামপাল,জেলা-বাগেরহাট।	
১৮	০১/২০১০-১১	মোঃ ফরিদ উদ্দিন শেখ পিতা-মৃত-আপ্তাব শেখ	ঐ	
১৯	০১/২০১০-১১	সরফরাজ শেখ পিতা- মোঃ ফরিদ উদ্দিন শেখ	ঐ	
২০	০১/২০১০-১১	মোস্তাফা শেখ পিতা-মোঃ ফরিদ উদ্দিন শেখ	ঐ	
২১	০১/২০১০-১১	শেখ মিনহাজ পিতা-সরফরাজ শেখ	ঐ	
২২	০১/২০১০-১১	আঃ আজিজ শেখ পিতা-মৃত-জোহর শেখ	ঐ	
২৩	০১/২০১০-১১	মোঃ সেলিম সরদার পিতা-মৃত-সরদার আব্দুর রাজ্জাক	সাং-বর্ণি, উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৪		নুর নাহার বেগম জং-মৃত সরদার আঃ রাজ্জাক	ঐ	
২৫	০১/২০১০-১১	নেহার রঞ্জন দাশ পিতা-মৃত-শরৎ চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট,জেলা-বাগেরহাট।	
২৬	০১/২০১০-১১	বিরেন কুমার দাশ পিতা-মৃত-শরৎ চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট,জেলা-বাগেরহাট।	
২৭	০১/২০১০-১১	মোঃ নুর আলী শেখ পিতা-মৃত-আঃ ছামাদ শেখ	সাং-শ্রীরম্ভা, উপজেলা-ফকিরহাট জেলা-বাগেরহাট।	
২৮	০১/২০১০-১১	পিযুষ কুমার দাশ পিতা-মৃত-কার্তিক চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
২৯	০১/২০১০-১১	আশিষ কুমার দাশ পিতা-মৃত-কার্তিক চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৩০	০১/২০১০-১১	সুশীল কুমার দাশ	সাং-বেতাগা	

নিত্য গোপাল
অতিঃ ভূমি অধিগ্রহণ কর্মকর্তা
বাগেরহাট

১৪৭৮	০১/২০১০-১১	যুগল কুমার দাস পিং মৃঃ হরিপদ দাস	ঐ	
১৪৭৯	০১/২০১০-১১	রামপ্রসাদ দাস পিং মৃঃ হরিপদ দাস	ঐ	
১৪৮০	০১/২০১০-১১	প্রদিপ কুমার দাস পিং মৃঃ হরিপদ দাস	ঐ	
১৪৮১	০১/২০১০-১১	মোঃ নজর ল ইসলাম ফকির পিং মৃঃ ইয়াতিম আলী ফকির	সাং-ভট্টবালিয়াঘাটা উপজেলা-বাগেরহাট জেলা- বাগেরহাট	
১৪৮২	০১/২০১০-১১	কেরামত আলী ফকির পিতা মৃঃ সামছুদ্দিন	ঐ	
১৪৮৩	০১/২০১০-১১	নেয়ামত আলী পকির পিতা মৃঃ সামছুদ্দিন	ঐ	
১৪৮৪	০১/২০১০-১১	শিরিনা বেগম পিতা মৃঃ সামছুদ্দিন	ঐ	
১৪৮৫	০১/২০১০-১১	শাহিনা সোবাহান পিতা মৃঃ সামছুদ্দিন	ঐ	
১৪৮৬	০১/২০১০-১১	হাফিজা আলম পিতা মৃঃ সামছুদ্দিন	ঐ	
১৪৮৭	০১/২০১০-১১	এস,এম কামরুজ্জামান পিং মৃঃ লুতফর রহমান	সাং-ছায়রাবাদ, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৪৮৮	০১/২০১০-১১	নাহিদুজ্জামান পিতা মৃঃ লুতফর রহমান		
১৪৮৯	০১/২০১০-১১	মোঃ আজমির হোসেন পিতা মৃঃ মোঃ আছাদুজ্জামান		
১৪৯০	০১/২০১০-১১	মোসাঃ সুমা খাতুন পিতা মৃঃ মোঃ আছাদুজ্জামান		
১৪৯১	০১/২০১০-১১	মোসাঃ আখিয়ারা পিতা মৃঃ মোঃ আছাদুজ্জামান		
১৪৯২	০১/২০১০-১১	মোসাঃ আজমিনআরা বেগম জং মৃৎ আছাদুজ্জামান শেখ		
১৪৯৩	০১/২০১০-১১	মোঃ লাল উদ্দিন গাজী পিং মৃঃ এরমান গাজী	সাং-গোড়কাঠি, উপজেলা-দাকোপ জেলা- খুলনা	
১৪৯৫	০১/২০১০-১১	জালাল শেখ পিং মৃঃ ওসমান শেখ	সাং-সাপমারীকাটাখালী উপজেলা-রামপাল, জেলা- বাগেরহাট	
১৪৯৬	০১/২০১০-১১	মোঃ আঃ অহেদ মুন্সি পিং মৃঃ মোঃ রিয়াজ উদ্দিন মুন্সি	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৪৯৭	০১/২০১০-১১	মোঃ খোরশেদ আলী শেখ পিং মৃঃ মোঃ আব্দুর রহমান শেখ	সাং-মুর লিয়া, উপজেলা-ফকিরহাট জেলা- বাগেরহাট	
১৪৯৮	০১/২০১০-১১	আব্দুল ওহাব মোল া পিং মৃঃ আক্কাস মোল া	সাং-কাপাশডাংগা, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৪৯৯	০১/২০১০-১১	মোসাঃ সুফিয়া বেগম জং মোঃ রফিক শেখ	সাং-গোয়ালঘাটা উপজেলা-বটিয়াঘাটা, জেলা- খুলনা	
১৫০০	০১/২০১০-১১	মোঃ কাওছার ইজারাদার পিতা মৃঃ ছোকাতুল া ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা- বাগেরহাট	
১৫০১	০১/২০১০-১১	মোঃ ইউসুফ আলী শেখ পিতা মোঃ জোহর আলী শেখ	সাং-ধনপোতা উপজেলা-ফকিরহাট, জেলা- বাগেরহাট	
১৫০২	০১/২০১০-১১	মোঃ জোহর আলী শেখ পিতা মৃঃ ছলেমান শেখ	ঐ	
১৫০৩	০১/২০১০-১১	মোছাঃ রেহেনা বেগম পিতা মোঃ জোহর আলী শেখ	ঐ	
১৫০৪	০১/২০১০-১১	মনোয়ারা বেগম পিতা মোঃ জোহর আলী শেখ	ঐ	
১৫০৫	০১/২০১০-১১	জাহানারা খাতুন পিতা মোঃ জোহর আলী শেখ	ঐ	
১৫০৬	০১/২০১০-১১	মমতাজ বেগম জং মৃঃ আঃ লতিফ সরদার	সাং-উঃ গৌরম্ভা, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫০৭	০১/২০১০-১১	মোঃ আশরাফ উদ্দিন শেখ পিতা-মৃঃ-সেরাজ উদ্দিন শেখ	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫০৮	০১/২০১০-১১	মোঃ খানজাহান আলী গাজী পিতা-খাদেম আলী গাজী	সাং-কাপাশডাংগা, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫০৯	০১/২০১০-১১	মোঃ আকবর আলী শেখ পিতা-মৃঃ-আফছার উদ্দিন শেখ	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫১০	০১/২০১০-১১	মোঃ মীর আলী শেখ পিতা-মৃঃ-আফছার উদ্দিন শেখ	ঐ	

১৪৫১	০১/২০১০-১১	মোঃ জাকির হোসেন পিতা মৃঃ আব্দুল মালেক শেখ	ঐ	
১৪৫২	০১/২০১০-১১	ফেরদাউস শেখ পিতা মৃঃ আব্দুল মালেক শেখ	ঐ	
১৪৫৩	০১/২০১০-১১	জাহাংগীর কবির পিতা মৃঃ আব্দুল মালেক শেখ	ঐ	
১৪৫৪	০১/২০১০-১১	সরিফা বেগম পিতা মৃঃ আব্দুল মালেক শেখ	ঐ	
১৪৫৫	০১/২০১০-১১	মার্ফা বেগম পিতা মৃঃ আব্দুল মালেক শেখ	ঐ	
১৪৫৬	০১/২০১০-১১	আফরোজা বেগম পিতা মৃঃ আব্দুল মালেক শেখ	ঐ	
১৪৫৭	০১/২০১০-১১	শেখ কায়কোবাদ পিতা আঃ রাজ্জাক	সাং-সুগন্ধি উপজেলা- বাগেরহাট জেলা- বাগেরহাট	
১৪৫৮	০১/২০১০-১১	মোঃ নজমল হোসেন পিতা মৃঃ আব্দুল মতলেব শেখ	সাং-বর্নি উপজেলা- রামপাল জেলা- বাগেরহাট	
১৪৫৯	০১/২০১০-১১	স,ম আঃ মোহিত পিতা-মোঃ নজমল হোসেন	ঐ	
১৪৬০	০১/২০১০-১১	এস,এম বাহাউদ্দিন সাওয়াল ডলার পিতা মৃঃ এস,এম বদরুজ্জামান	৩৯ সামছুর রহমান রোড খুলনা	
১৪৬১		রোকেয়া খাতুন জং মৃঃ কায়েম আলী	ঐ	
১৪৬২	০১/২০১০-১১	এস,এম মঞ্জুর কাদির পিতা মৃঃ মোঃ রুহুল আমীন মোল□া	৮ নং নূর মসজিদ সড়ক ওয়ার্ড নং ২৮ খুলনা	
১৪৬৩	০১/২০১০-১১	মোঃ রুস্তম আলী শেখ পিতা মৃঃ আছির উদ্দিন	সাং-সোনাতুনিয়া উপজেলা-রামপাল জেলা- বাগেরহাট	
১৪৬৪	০১/২০১০-১১	নিমাই কৃষ্ণ দাস পিতা মৃঃ দীনবন্ধু দাস	সাং-ষাটতলা বেতাগা উপজেলা-রামপাল জেলা- বাগেরহাট	
১৪৬৫	০১/২০১০-১১	মোঃ নজরুল ইসলাম শেখ পিতা মৃঃ শেখ আব্দুল আজিজ	সাং-আদাঘাট উপজেলা-রামপাল জেলা- বাগেরহাট	
১৪৬৬	০১/২০১০-১১	আঃ ছালাম শেখ পিতা মৃঃ শেখ আব্দুল আজিজ	ঐ	
১৪৬৭	০১/২০১০-১১	রোকেয়া বেগম পিতা মৃঃ শেখ আব্দুল আজিজ	ঐ	
১৪৬৮	০১/২০১০-১১	আলেয়া বেগম পিতা মৃঃ শেখ আব্দুল আজিজ	ঐ	
১৪৬৯	০১/২০১০-১১	আংগুরা বেগম পিতা মৃঃ শেখ আব্দুল আজিজ	ঐ	
১৪৭০	০১/২০১০-১১	নাছরিন বেগম পিতা মৃঃ শেখ আব্দুল আজিজ	ঐ	
১৪৭১	০১/২০১০-১১	মোসাঃ সামছুন্নাহার বেগম পিতা মৃঃ শেখ আব্দুল আজিজ	ঐ	
১৪৭২	০১/২০১০-১১	মোঃ আলাল উদ্দিন শেখ পিতা মৃঃ শেখ আব্দুল আজিজ	সাং-আদাঘাট উপজেলা-রামপাল জেলা- বাগেরহাট	
১৪৭৩	০১/২০১০-১১	নূর মহম্মদ আকুঞ্জি পিতা মৃঃ ছায়েম মলংগী	সাং-শুভদিয়া উপজেলা-ফকিরহাট জেলা- বাগেরহাট	
১৪৭৪	০১/২০১০-১১	কৃষ্ণ পদ দাস পিতা মৃঃ হরিপদ দাস	সাং-পিলজংগ উপজেলা-ফকিরহাট জেলা- বাগেরহাট	
১৪৭৫	০১/২০১০-১১	কালিপদ দাস পিং মৃঃ হরিপদ দাস	ঐ	
১৪৭৬	০১/২০১০-১১	নারায়ন চন্দ্র দাস পিং মৃঃ হরিপদ দাস	ঐ	
১৪৭৭	০১/২০১০-১১	সুবোল কুমার দাস পিং মৃঃ হরিপদ দাস	ঐ	

১৪২৫	০১/২০১০-১১	মলি□ক সাকাওয়াত হোসেন পিতা মৃঃ মোঃ শাহাদাত হোসেন	সাং-বির্নি উপজেলা- রামপাল জেলা- বাগেরহাট	
১৪২৬	০১/২০১০-১১	শেখ খবির উদ্দিন পিতা মৃঃ শেখ রিয়াজ উদ্দিন	সাং-ঝনঝনিয়া উপজেলা- রামপাল জেলা- বাগেরহাট	
১৪২৭	০১/২০১০-১১	মেফতাহ উদ্দিন শেখ পিতা মৃঃ আলহাজ্ব রিয়াজ উদ্দিন	সাং-ঝনঝনিয়া উপজেলা- রামপাল জেলা- বাগেরহাট	
১৪২৮	০১/২০১০-১১	শেখ আছাদুজ্জামান বাদশা পিতা শেখ ফরিদ আহম্মেদ	বড়ী নং-৯, রাস্তা নং বেনী বাবু রোড, খুলনা সিটি কর্পোরেশন খুলনা	
১৪২৯	০১/২০১০-১১	শেখ মনির□জ্জামান পিতা শেখ ফরিদ আহম্মেদ	ঐ	
১৪৩০	০১/২০১০-১১	শেখ ফরিদ আহম্মেদ পিতা হাজী রিয়াজ উদ্দিন শেখ	ঐ	
১৪৩১	০১/২০১০-১১	আছিয়া বেগম জং-মৃত মোঃ রাহাজদ্দিন শেখ	সাং-ধনপোতা উপজেলা–ফকিরহাট জেলা- বাগেরহাট	
১৪৩২	০১/২০১০-১১	এস,এম বদর□জ্জামান পিতা-মৃত আঃ মতলেব শেখ	৯নং হাজী ইসমাইল লিংক রোড,পৈপাড়া, খুলনা	
১৪৩৩	০১/২০১০-১১	মেহের□ন্নেছা জং-মৃত আঃ মতলেব শেখ	ঐ	
১৪৩৪	০১/২০১০-১১	সাইয়েদুন্নেছা পিতা-মৃত আঃ মতলেব শেখ	ঐ	
১৪৩৫	০১/২০১০-১১	আছমা বেগম পিতা-মৃত আঃ মতলেব শেখ	ঐ	
১৪৩৬	০১/২০১০-১১	মিসেস মাকছুদা হাছান পিতা-মৃত আঃ মতলেব শেখ	ঐ	
১৪৩৭	০১/২০১০-১১	মোসাঃ কামর□ন্নাহার পিতা-মৃত আঃ মতলেব শেখ	ঐ	
১৪৩৮	০১/২০১০-১১	ফতেমা বেগম জং-মৃত আঃ মতলেব শেখ	ঐ	
১৪৩৯	০১/২০১০-১১	কালিপদ মন্ডল জং-মৃত রাজমোহন মন্ডল	সাং-রাজনগর উপজেলা–রামপাল জেলা- বাগেরহাট	
১৪৪০	০১/২০১০-১১	গোপাল মন্ডল জং-মৃত ভক্ত মন্ডল	সাং-রাজনগর উপজেলা–রামপাল জেলা- বাগেরহাট	
১৪৪১	০১/২০১০-১১	এম,একরামূল হক জং-মৃত হাজী মৃঃ নেছার উদ্দিন আহম্মেদ	৬৬ নং হাজী মহসীন রোড খুলনা	
১৪৪২	০১/২০১০-১১	আনোয়ার□ল হক পিতা মৃঃ মোঃ নেছা উদ্দিন ইজারদার	ঐ	
১৪৪৩	০১/২০১০-১১	এম মঞ্জুর□র হক পিতা মৃঃ মোঃ নেছা উদ্দিন ইজারদার	ঐ	
১৪৪৪	০১/২০১০-১১	মনির□ল হক পিতা মৃঃ মোঃ নেছা উদ্দিন ইজারদার	ঐ	
১৪৪৫	০১/২০১০-১১	মাহাফুজুল হক পিতা মৃঃ মোঃ নেছা উদ্দিন ইজারদার	ঐ	
১৪৪৬	০১/২০১০-১১	হাসনা জাহান পিতা মৃঃ মোঃ নেছা উদ্দিন ইজারদার	ঐ	
১৪৪৭	০১/২০১০-১১	লুৎফুন্নেছা পিতা মৃঃ মোঃ নেছা উদ্দিন ইজারদার	ঐ	
১৪৪৮	০১/২০১০-১১	লায়লা আরজুমান বানু পিতা মৃঃ মোঃ নেছা উদ্দিন ইজারদার	ঐ	
১৪৪৯	০১/২০১০-১১	সুফিয়া হক পিতা মৃঃ মোঃ নেছা উদ্দিন ইজারদার	ঐ	
১৪৫০	০১/২০১০-১১	৩শেখ মোঃ শামিম পিতা মৃঃ আব্দুল মালেক শেখ	সাং-বর্নি উপজেলা- রামপাল জেলা- বাগেরহাট	

		পিতা মৃঃ মোঃ রজ্জব আলী শেখ		
১৩৯১	০১/২০১০-১১	শাহার ন বেগম পিতা মৃঃ মোঃ রজ্জব আলী শেখ	ঐ	
১৩৯২	০১/২০১০-১১	মোসাঃ হোসনেয়ারা পিতা মৃঃ মোঃ রজ্জব আলী শেখ	ঐ	
১৩৯৩	০১/২০১০-১১	ছেহের ন বেগম পিতা মৃঃ মোঃ রজ্জব আলী শেখ	ঐ	
১৩৯৪	০১/২০১০-১১	আমের ননেছা পিতা মৃঃ মোঃ রজ্জব আলী শেখ	ঐ	
১৩৯৫	০১/২০১০-১১	৮মোঃ হাবিবুর রহমান শেখ পিতা মৃঃ আঃ রশিদ শেখ	সাং-সোনাতুনিয়া, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৯৬	০১/২০১০-১১	মোঃ মতিয়ার রহমান পিতা মৃঃ আঃ রশিদ শেখ	সাং-সোনাতুনিয়া, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৯৭	০১/২০১০-১১	শেখ মঞ্জুর রহমান পিতা মৃঃ আঃ রশিদ শেখ	সাং-সোনাতুনিয়া, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৯৮	০১/২০১০-১১	মোসাঃ রাহিলা বেগম জং মৃঃ আঃ রশিদ শেখ	সাং-সোনাতুনিয়া, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৯৯	০১/২০১০-১১	এস,এম বদরুদ্দোজা পিতা এস,এম বদরুজ্জামান	৯নং হাজী ইসমাইল লিংক রোড,পৈপাড়া,খুলনা	
১৪০০	০১/২০১০-১১	অলিনুর নাহার জং- এস,এম বদরুজ্জামান	ঐ	
১৪০১	০১/২০১০-১১	নিয়াজ ফতেমা পিতা এস,এম বদরুজ্জামান	ঐ	
১৪০২	০১/২০১০-১১	মোঃ নাজমূল হাছান পিতা শেখ খলিলুর রহমান	সাং-কাপাশডাংগা, উপজেলা- রামপাল জেলা- বাগেরহাট	
১৪০৩	০১/২০১০-১১	মোঃ আঃ জলিল শেখ পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪০৫	০১/২০১০-১১	শেখ খলিলুর রহমান পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪০৬	০১/২০১০-১১	মোঃ আঃ মান্নান শেখ পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪০৭	০১/২০১০-১১	মোঃ হান্নান শেখ পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪০৮	০১/২০১০-১১	মোঃ এস,এম ইসলাম পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪০৯	০১/২০১০-১১	মোঃ জাহাংগীর শেখ পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪১০	০১/২০১০-১১	জাহানারা বেগম পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪১১	০১/২০১০-১১	রেহানারা বেগম পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪১২	০১/২০১০-১১	আফরোজা বেগম পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪১৩	০১/২০১০-১১	মোঃ আছলাম শেখ পিং মৃঃ হাজ্বী কেয়াম উদ্দিন	ঐ	
১৪১৫	০১/২০১০-১১	মোঃ মোস্তাফিজ শেখ পিতা মৃঃ বদর জ্জামান শেখ	সাং-বর্নি, উপজেলা- রামপাল জেলা- বাগেরহাট	
১৪১৬	০১/২০১০-১১	মাহাবুর রহমান পিং-মৃঃ বদর জ্জামান শেখ	ঐ	
১৪১৭	০১/২০১০-১১	মোসাঃ ছাপারা বেগম পিং-মৃঃ বদর জ্জামান শেখ	ঐ	
১৪১৮	০১/২০১০-১১	মোসাঃ তানুরা বেগম পিং-মৃঃ বদর জ্জামান শেখ	ঐ	
১৪১৯	০১/২০১০-১১	মোসাঃ মরিয়ম বেগম জং-মৃঃ বদর জ্জামান শেখ	ঐ	
১৪২০	০১/২০১০-১১	মোঃ বিল□াল শেখ পিতা মৃঃ আঃ মালেক শেখ	ঐ	
১৪২১	০১/২০১০-১১	মোঃ রিজাউল করিম পিতা মৃঃ আঃ মালেক শেখ	ঐ	
১৪২২	০১/২০১০-১১	মোসাঃ মাঝু বিবি জং মৃঃ আঃ মালেক শেখ	ঐ	
১৪২৩	০১/২০১০-১১	আলহাজ্ব র হুল আমীন সিদ্দিকি পিতা মৃঃ মৌঃ মোবারক আলী	২০ নং মিনারা মসজিদ রোড,ছোলায়মান নগর, সোনাডাংগা,খুলনা	
১৪২৪	০১/২০১০-১১	বিজয় কৃষ্ণ দাস পিতা মৃঃ নিবারন চরন দাস	সাং-ষাটতলা উপজেলা- ফকিরহাট, জেলা- বাগেরহাট	

১৩৬২	০১/২০১০-১১	মোসাঃ মাহফুজা বেগম পিং মৃঃ মাওলানা আব্দুল খালেক	ঐ	
১৩৬৩	০১/২০১০-১১	মোসাঃ সাকেরা বেগম পিং মৃঃ মাওলানা আব্দুল খালেক	ঐ	
১৩৬৪	০১/২০১০-১১	স ম রেজাউল করিম পিতা মৃঃ কায়েম আলী শেখ	সাং-বর্নি ছায়রাবাদ, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৬৫	০১/২০১০-১১	আব্দুল লতিফ মুন্সি পিতা মৃঃ মমিন উদ্দিন মুন্সি	সাং বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৬৬	০১/২০১০-১১	নাছির উদ্দিন মুন্সি পিতা মৃঃ মমিন উদ্দিন মুন্সি	ঐ	
১৩৬৭	০১/২০১০-১১	জিল[illegible]র রহমান মুন্সি পিতা মৃঃ মমিন উদ্দিন মুন্সি	ঐ	
১৩৬৮	০১/২০১০-১১	রিজিয়া খাতুন পিতা মৃঃ মমিন উদ্দিন মুন্সি	ঐ	
১৩৬৯	০১/২০১০-১১	মেহের[illegible]ন্নেছা পিতা মৃঃ মমিন উদ্দিন মুন্সি	ঐ	
১৩৭০	০১/২০১০-১১	রহিমা বেগম জং নাছির উদ্দিন মুন্সি	ঐ	
১৩৭১	০১/২০১০-১১	ছালমা খাতুন পিতা মৃঃ মমিন উদ্দিন মুন্সি	ঐ	
১৩৭২	০১/২০১০-১১	সাহার[illegible]ন্নেছা পিতা মৃঃ মমিন উদ্দিন মুন্সি	ঐ	
১৩৭৩	০১/২০১০-১১	মোঃ আমজাদ শেখ পিতা মৃঃ মমিন শেখ	সাং ধনপোতা উপজেলা-ফকিরহাট জেলা- বাগেরহাট	
১৩৭৪	০১/২০১০-১১	হাজরা ফার[illegible]ক আহম্মেদ পিতা মোঃ জালাল হাহম্মদ হাজরা	সাং-বাশেরহুলা উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৭৫	০১/২০১০-১১	শেখ উকিল উদ্দিন পিতা মৃঃ রহিম উদ্দিন	সাং-আদাঘাট উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৭৬	০১/২০১০-১১	শেখ আকরাম হোসেন পিতা-শেখ উকিল উদ্দিন	ঐ	
১৩৭৭	০১/২০১০-১১	শেখ মইন উদ্দিন পিতা-শেখ উকিল উদ্দিন	ঐ	
১৩৭৮	০১/২০১০-১১	মোঃ মালেক মুন্সি পিতা মৃঃ মমিন উদ্দিন মুন্সি	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৭৯	০১/২০১০-১১	এম,এ ওহাব খান পিতা মৃঃ দীন আলী খান	সাং-বুজবুনিয়া, উপজেলা-বটিয়াঘাটা জেলা- খুলনা	
১৩৮০	০১/২০১০-১১	শাহনেওয়াজ বেগম জং -এম,এ ওহাব খান	ঐ	
১৩৮১	০১/২০১০-১১	স,ম ওবায়দুর রহমান পিতা মৃঃ আলহাজ্ব কায়েম আলী	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৮২	০১/২০১০-১১	ইজারাদার মহিউদ্দিন আহম্মেদ পিতা মৃঃ ইজারাদার শফিউদ্দিন	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৮৩	০১/২০১০-১১	ললিত মোহন পাল পিতা মৃঃ রাজেন্দ্র নাথ পাল	সাং-কিসমতভট্ট, উপজেলা-বাগেরহাট সদর জেলা- বাগেরহাট	
১৩৮৪	০১/২০১০-১১	মোঃ আলমগীর পিতা মৃঃ মোঃ রজ্জব আলী শেখ	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৩৮৫	০১/২০১০-১১	মোঃ ইছা শেখ পিতা মৃঃ মোঃ রজ্জব আলী শেখ	ঐ	
১৩৮৬	০১/২০১০-১১	নুরনবি শেখ পিতা মৃঃ মোঃ রজ্জব আলী শেখ	ঐ	
১৩৮৭	০১/২০১০-১১	ফার[illegible]ক হোসেন পিতা মৃঃ মোঃ রজ্জব আলী শেখ	ঐ	
১৩৮৮	০১/২০১০-১১	মোঃ জাহিদ শেখ পিতা মৃঃ মোঃ রজ্জব আলী শেখ	ঐ	
১৩৮৯	০১/২০১০-১১	মোঃ জাহাংগীর পিতা মৃঃ মোঃ রজ্জব আলী শেখ	ঐ	
১৩৯০	০১/২০১০-১১	মেহের[illegible]ন বেগম	ঐ	

		পিতা-মৃত-মাওঃ আব্দুল খালেক		
১৩৩০	০১/২০১০-১১	মোঃ আশরাফুল ইসলাম পিতা-মৃত-মাওঃ আব্দুল খালেক	ঐ	
১৩৩১	০১/২০১০-১১	মোসাঃ শাহানা বেগম পিতা-মৃত-মাওঃ আব্দুল খালেক	ঐ	
১৩৩২	০১/২০১০-১১	মোসাঃ রোজিনা বেগম পিতা-মৃত-মাওঃ আব্দুল খালেক	ঐ	
১৩৩৩	০১/২০১০-১১	মোসাঃ মাহামুদা বেগম পিতা-মৃত-মাওঃ আব্দুল খালেক	ঐ	
১৩৩৪	০১/২০১০-১১	মোসাঃ শাকেরা বেগম পিতা-মৃত-মাওঃ আব্দুল খালেক	ঐ	
১৩৩৫	০১/২০১০-১১	মোঃ আবজাল শেখ পিতা-মৃত-মোলাম উদ্দিন	সাং-জাড়িয়া মাইট, ফকিরহাট, বাগেরহাট	
১৩৩৬	০১/২০১০-১১	মোঃ মোস্তাজ উদ্দিন শেখ পিতা-মৃত-ছহির উদ্দিন শেখ	ঐ	
১৩৩৭	০১/২০১০-১১	লিয়াকত শেখ পিতা-মোঃ মোস্তাজ উদ্দিন শেখ	ঐ	
১৩৩৮	০১/২০১০-১১	মারুফা বেগম পিতা-মোঃ মোস্তাজ উদ্দিন শেখ	ঐ	
১৩৩৯	০১/২০১০-১১	শিরিনা বেগম পিতা-মোঃ মোস্তাজ উদ্দিন শেখ	ঐ	
১৩৪০	০১/২০১০-১১	মেরিনা বেগম পিতা-মোঃ মোস্তাজ উদ্দিন শেখ	ঐ	
১৩৪১	০১/২০১০-১১	হারিফা বেগম পিতা-মোঃ মোস্তাজ উদ্দিন শেখ	ঐ	
১৩৪২	০১/২০১০-১১	সুফিয়া বেগম পিতা-মোঃ মোস্তাজ উদ্দিন শেখ	ঐ	
১৩৪৩	০১/২০১০-১১	হেলেনা বেগম পিতা-মোঃ মোস্তাজ উদ্দিন শেখ	ঐ	
১৩৪৪	০১/২০১০-১১	ওহাব শেখ পিতা-মৃত-বারিক শেখ	ঐ	
১৩৪৫	০১/২০১০-১১	মোঃ শাহজাহান শেখ পিতা-ওহাব শেখ	ঐ	
১৩৪৬	০১/২০১০-১১	মোঃ লিয়াকত শেখ পিতা-ওহাব শেখ	ঐ	
১৩৪৭	০১/২০১০-১১	মোঃ সাকাওয়াত শেখ পিতা-ওহাব শেখ	ঐ	
১৩৪৮	০১/২০১০-১১	মোসাঃ আকলিমা বেগম পিতা-ওহাব শেখ	ঐ	
১৩৪৯	০১/২০১০-১১	মোসাঃ মমতাজ বেগম পিতা-ওহাব শেখ	ঐ	
১৩৫০	০১/২০১০-১১	রাবিয়া বেগম জং-মৃত-সেকেন্দার শেখ	ঐ	
১৩৫১	০১/২০১০-১১	সৈয়দ আহম্মদ রাহান পিতা-মৃত-আব্দুল মান্নান	সাং-১০ নং শিরিশ নগর গেইট, সোনাডাঙ্গা, খুলনা	
১৩৫২		তাছলিমা বেগম পিতা-মৃত-কায়েম আলী	ঐ	
১৩৫৩	০১/২০১০-১১	মহসিন মোল্লা পিতা-মৃত-মোঃ আঃ রহমান মোল্লা	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১৩৫৪		মোসাঃ জাহেদা বেগম জাং-মৃত-মোঃ আঃ রহমান মোল্লা	ঐ	
১৩৫৫	০১/২০১০-১১	মোঃ খায়রুল ইসলাম পিতা মৃঃ মাওলানা আব্দুল খালেক	সাং রাজনগর, রামপাল, বাগেরহাট	
১৩৫৬	০১/২০১০-১১	রফিকুল ইসলাম পিং মৃঃ মাওলানা আব্দুল খালেক	ঐ	
১৩৫৭	০১/২০১০-১১	হেমায়েতুল ইসলাম পিং মৃঃ মাওলানা আব্দুল খালেক	ঐ	
১৩৫৮	০১/২০১০-১১	মোজাহেদুল ইসলাম পিং মৃঃ মাওলানা আব্দুল খালেক	ঐ	
১৩৫৯	০১/২০১০-১১	আশরাফুল ইসলাম পিং মৃঃ মাওলানা আব্দুল খালেক	ঐ	
১৩৬০	০১/২০১০-১১	মোসাঃ সাহানা বেগম পিং মৃঃ মাওলানা আব্দুল খালেক	ঐ	
১৩৬১	০১/২০১০-১১	মোসাঃ রজিনা বেগম পিং মৃঃ মাওলানা আব্দুল খালেক	ঐ	

১২৯৭	০১/২০১০-১১	সানজিদা শেখ মহুয়া পিতা-মৃত-আব্দুল কাদের	ঐ	
১২৯৮	০১/২০১০-১১	খুরশিদা আক্তার মুক্তা জং-মৃত-আবু আফজাল	ঐ	
১২৯৯	০১/২০১০-১১	রিমান মাহামুদ পিতা-মৃত আবু আফজাল	ঐ	
১৩০০	০১/২০১০-১১	সিসলি বিনতে আফজাল পিতা-মৃত-আবু আফজাল	ঐ	
১৩০১	০১/২০১০-১১	মোঃ শাহিদুজ্জামান ইজারাদার পিতা-মোঃ দেলোয়ার হোসেন	সাং-কালেখারবেড়, রামপাল, বাগেরহাট।	
১৩০২	০১/২০১০-১১	রাবেয়া বেগম জং-শেখ আলী আকবর সম্রাট	সাং-গোবিন্দপুর, রামপাল, বাগেরহাট।	
১৩০৩	০১/২০১০-১১	পার্থ প্রতীম মূখার্জী পিতা-মৃত-নরেশ চন্দ্র মূখার্জী	সাং-পিপুলবুনিয়া, রামপাল, বাগেরহাট।	
১৩০৪	০১/২০১০-১১	অপূর্ব মূখার্জী পিতা-ঐ	ঐ	
১৩০৫	০১/২০১০-১১	মোঃ বাসির উদ্দিন খলিফা পিতা-মৃত-মোঃ মহিউদ্দিন খলিফা	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১৩০৬	০১/২০১০-১১	মোঃ নাছির উদ্দিন খলিফা পিতা-মৃত-মোঃ মহিউদ্দিন	ঐ	
১৩০৭	০১/২০১০-১১	মোসাঃ সাকিনা বেগম পিতা-মৃত-মোঃ মহিউদ্দিন খলিফা	ঐ	
১৩০৮	০১/২০১০-১১	মোসাঃ শরিফা বেগম জং-আক্তার আকুঞ্জী	ঐ	
১৩০৯	০১/২০১০-১১	মোঃ রফি উদ্দিন খলিফা পিতা-মৃত-ফজর উদ্দিন খলিফা	ঐ	
১৩১০	০১/২০১০-১১	মোসাঃ নাজিফা বেগম জং-ছিদ্দিক শেখ	সাং-নোয়াইলতলা, বটিয়াঘাটা, খুলনা	
১৩১১	০১/২০১০-১১	হাজেরা বেগম পিতা-মৃত-আঃ গণি মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১৩১২	০১/২০১০-১১	মোসাঃ রওশনারা বেগম পিতা-মৃত-আঃ গণি মুন্সী	ঐ	
১৩১৩	০১/২০১০-১১	মোসাঃ তানিয়া বেগম পিতা-মৃত-আঃ গণি মুন্সী	ঐ	
১৩১৪	০১/২০১০-১১	মোসাঃ লিপা খাতুন পিতা-মৃত-আঃ গণি মুন্সী	ঐ	
১৩১৫	০১/২০১০-১১	মোসাঃ রুপা খাতুন পিতা-মৃত-আঃ গণি মুন্সী	ঐ	
১৩১৬	০১/২০১০-১১	আমেনা খাতুন পিতা-মৃত-আঃ গণি মুন্সী	ঐ	
১৩১৭	০১/২০১০-১১	মোঃ কাদের মুন্সী পিতা-মৃত-আঃ গণি মুন্সী	ঐ	
১৩১৮	০১/২০১০-১১	নাছের মুন্সী পিতা-মৃত-আঃ গণি মুন্সী	ঐ	
১৩১৯	০১/২০১০-১১	মোঃ রাসেল মুন্সী পিতা-মৃত-আঃ গণি মুন্সী	ঐ	
১৩২০	০১/২০১০-১১	মোসাঃ আকলিমা বেগম জং -মৃত-আঃ গণি মুন্সী	ঐ	
১৩২১	০১/২০১০-১১	অরুন কুমার পাল পিতা-মৃত-হরশিত পাল	সাং-কিসমতভট্ট, বাগেরহাট সদর	
১৩২২	০১/২০১০-১১	দিপক কুমার পাল পিতা-মৃত-হরশিত পাল	ঐ	
১৩২৩	০১/২০১০-১১	হালিমা বেগম জং-নোয়াব আলী শেখ	সাং-সাপমারিকাটাখালী রামপাল, বাগেরহাট	
১৩২৪	০১/২০১০-১১	তৈয়েবুর রহমান শেখ পিতা-মৃত-সোলায়মান আলী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১৩২৫	০১/২০১০-১১	মোঃ খায়রুল ইসলাম পিতা-মৃত-মাওঃ আব্দুল খালেক	সাং-রাজনগর,রামপাল, বাগেরহাট	
১৩২৬	০১/২০১০-১১	মোঃ সাইফুল ইসলাম পিতা-মৃত-মাওঃ আব্দুল খালেক	ঐ	
১৩২৭	০১/২০১০-১১	মোঃ রফিকুল ইসলাম পিতা-মৃত-মাওঃ আব্দুল খালেক	ঐ	
১৩২৮	০১/২০১০-১১	মোঃ হেমায়েতুল ইসলাম পিতা-মৃত-মাওঃ আব্দুল খালেক	ঐ	
১৩২৯	০১/২০১০-১১	মোঃ মোজাহেদুল ইসলাম	ঐ	

		জং-শেখ আঃ মজিদ		
১২৬৫	০১/২০১০-১১	মোঃ মাবুবর রহমান পিতা-মৃত-আঃ রহমান মোল্লা	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৬৬	০১/২০১০-১১	মোঃ আছাদ মল্লিক পিতা-মৃত-নুর মহম্মদ মল্লিক	সাং-টেংরামারী, রামপাল, বাগেরহাট	
১২৬৭	০১/২০১০-১১	মোঃ দাউদ শেখ পিতা-মৃত-মোমিন উদ্দিন শেখ	সাং-ধনপোতা, রামপাল, বাগেরহাট	
১২৬৮	০১/২০১০-১১	মুশফিকুর রহমান পিতা-মৃত-আব্দুস ছালাম	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৬৯	০১/২০১০-১১	জিল্লুর রহমান পিতা-মৃত-আব্দুস ছালাম	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৭০	০১/২০১০-১১	মোঃ শহিনুর রহমান পিতা-মৃত-আব্দুস ছালাম	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৭১	০১/২০১০-১১	মোসাঃ শীমা পারভীন পিতা-মৃত-আব্দুস ছালাম	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৭২	০১/২০১০-১১	মোসাঃ রেশমা পারভীন পিতা-মৃত-আব্দুস ছালাম	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৭৩	০১/২০১০-১১	মোসাঃ রীমা পারভীন(লাকি) পিতা-মৃত-আব্দুস ছালাম	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৭৪	০১/২০১০-১১	রাশিদা খাতুন জং-মৃত-আব্দুস ছালাম	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৭৫	০১/২০১০-১১	শেখ মোঃ রফিকুজ্জামান পিতা-মৃত-শেখ মোঃ কাওছার আলী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৭৬	০১/২০১০-১১	আঙ্গুরা বেগম পিতা-মৃত-নুর মোহাম্মদ শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৭৭	০১/২০১০-১১	মোঃ মনিরুজ্জামান শেখ পিতা-মৃত-নুর মোহাম্মদ শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৭৮	০১/২০১০-১১	ছাবিয়া বেগম পিতা-মৃত-নুর মোহাম্মদ শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৭৯	০১/২০১০-১১	আসাদুজ্জাম শেখ পিতা- জুলফিকার আলী শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৮০	০১/২০১০-১১	মোঃ শওকাত হোসেন পিতা-মৃত-আকাম উদ্দিন শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৮১	০১/২০১০-১১	মোঃ সাব্বির হোসেন পিতা-মোঃ শওকাত হোসেন	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৮২	০১/২০১০-১১	তহুরা বেগম জং-মৃত কামাল শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৮৩	০১/২০১০-১১	মোঃ তানভির শেখ পিতা-মৃত কামাল শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৮৪	০১/২০১০-১১	মোঃ সাব্বির শেখ পিতা-মৃত কামাল শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৮৫	০১/২০১০-১১	মোঃ জাবির শেখ পিতা-মৃত কামাল শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৮৬	০১/২০১০-১১	সামসুন্নাহার পিতা-মৃত-মতলেব শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৮৭	০১/২০১০-১১	মোসাঃ রবিয়া বেগম জং-মৃত শ,ম হাবিবুর রহমান	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৮৮	০১/২০১০-১১	মোসাঃ আনোয়ারা খাতুন জং-মৃত আনছার উদ্দিন শেখ	সাং-১৯ এমটি রোড, খুলনা সদর	
১২৮৯	০১/২০১০-১১	বনানী বেগম জং-মোঃ বজলুর রহমান	সাং-সাপমারিকাটাখালী, রামপাল, বাগেরহাট	
১২৯০	০১/২০১০-১১	মোঃ সালাউদ্দিন শেখ পিতা-মৃত-আলাল উদ্দিন শেখ	সাং-আদঘাট, রামপাল, বাগেরহাট	
১২৯১	০১/২০১০-১১	আলাল উদ্দিন শেখ পিতা-মৃত-রহিম উদ্দিন শেখ	ঐ	
১২৯২	০১/২০১০-১১	মোঃ মঈন উদ্দিন হাজরা পিতা-হাজরা জালাল আম্মেদ	সাং-বাশেরহুলা,রামপাল, বাগেরহাট	
১২৯৩	০১/২০১০-১১	মোঃ নাজমুল হুদা পিতা-মোঃ জালাল আহম্মেদ হাজরা	ঐ	
১২৯৪	০১/২০১০-১১	রোকেয়া বেগম জং-মৃত-আব্দুল কাদের	সাং-এস, এম কলেজ রোড, বানরগাতী, খুলনা	
১২৯৫	০১/২০১০-১১	কামরুন্নেছা পিতা-মৃত-আব্দুল কাদের	ঐ	
১২৯৬	০১/২০১০-১১	মেহেরুন্নেছা পিতা-মৃত-আব্দুল কাদের	ঐ	

১২৩২	০১/২০১০-১১	ছবুরুন্নেছা বিবি পিতা-ইয়াদ আলী মীর	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৩৩	০১/২০১০-১১	মোঃ হাসমত আলী মীর পিতা-মৃত আহাদ আলী মীর	সাং-বর্ণি, রামপাল, বাগেরহাট	
১৩৩৪	০১/২০১০-১১	মোঃ শুকুর আলী মীর পিতা-মৃত-নেছার আলী মীর	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৩৫	০১/২০১০-১১	মোঃ সাহেব আলী মীর পিতা-মৃত-নেছার আলী মীর	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৩৬	০১/২০১০-১১	মোসাঃ কোমেলা বেগম পিতা-মৃত-নেছার আলী মীর	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৩৭	০১/২০১০-১১	মোসাঃ আয়শা বেগম পিতা-মৃত-নেছার আলী মীর	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৩৮	০১/২০১০-১১	মোসাঃ আছিয়া বেগম জং -মৃত-নেছার আলী মীর	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৩৯	০১/২০১০-১১	মোঃ আকরাম হেসেন পিতা-আঃ হামিদ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৪০	০১/২০১০-১১	আকুঞ্জী কামরুজ্জামান পিতা-মৃত-আকুঞ্জী ইলিয়াছ হোসেন	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১২৪১	০১/২০১০-১১	মোঃ মনিরুজ্জামান আকুঞ্জী পিতা-মৃত-আকুঞ্জী ইলিয়াছ হোসেন	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১২৪২	০১/২০১০-১১	মোসাঃ সামছুন্নাহার পিতা-মৃত-আকুঞ্জী ইলিয়াছ হোসেন	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১২৪৩	০১/২০১০-১১	মোসাঃ নাজমা বেগম পিতা-মৃত-আকুঞ্জী ইলিয়াছ হোসেন	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১২৪৪	০১/২০১০-১১	মোসাঃ ছালমা ইসলাম পিতা-মৃত-আকুঞ্জী ইলিয়াছ হোসেন	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১২৪৫	০১/২০১০-১১	মনোয়ারা বেগম জং-মৃত-আকুঞ্জী ইলিয়াছ হোসেন	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১২৪৬	০১/২০১০-১১	মোঃ হালিম আকঞ্জী পিতা-মৃত আপ্তাব আকুঞ্জী	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১২৪৭	০১/২০১০-১১	সুফিয়া বেগম পিতা-মৃত আপ্তাব আকুঞ্জী	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১২৪৮	০১/২০১০-১১	মেরিনা বেগম পিতা-মৃত আপ্তাব আকুঞ্জী	সাং-গৌরম্ভা, রামপাল, বাগেরহাট	
১২৪৯	০১/২০১০-১১	এমডি আঃ মজিদ শেখ পিতা-মৃত-মোঃ কদমআলী শেখ	সাং-ভট্টবালিয়াঘাটা, বাগেহাট সদর	
১২৫০	০১/২০১০-১১	নজিমুদ্দিন শেখ পিতা-মৃত-আঃ আজিজ শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১২৫১	০১/২০১০-১১	মোঃ মনিরুজ্জামান পিতা- নজিমুদ্দিন শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১২৫২	০১/২০১০-১১	মোঃ আক্তার আলী শেখ পিতা- নজিমুদ্দিন শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১২৫৩	০১/২০১০-১১	এমডি আঃ মজিদ শেখ পিতা-মৃত-মোঃ কদমআলী শেখ	সাং-ভট্টবালিয়াঘাটা, বাগেহাট সদর	
১২৫৪	০১/২০১০-১১	মোসাঃ রাবিয়া বেগম জং-আঃ হালিম হাজরা	সাং-ভট্টবালিয়াঘাটা, বাগেহাট সদর	
১২৫৫	০১/২০১০-১১	আঃ হালিম হাজরা পিতা-মৃত-আব্দুল কাদের হাজরা	সাং-সৈয়দপুর, বাগেরহাট সদর	
১২৫৬	০১/২০১০-১১	মোঃ আল আমিন পিতা-মৃত-একলাচ মোল্লা	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৫৭	০১/২০১০-১১	খাদিজা নাজনিন পিতা-মৃত-একলাচ মোল্লা	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৫৮	০১/২০১০-১১	শামিমা খাতুন পিতা-মৃত-একলাচ মোল্লা	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৫৯	০১/২০১০-১১	তাছলিমা বেগম পিতা-মৃত-একলাচ মোল্লা	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৬০	০১/২০১০-১১	মোসাঃ স্বপ্না বেগম জং-মৃত-একলাচ মোল্লা	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৬১	০১/২০১০-১১	ফাতেমা বেগম জং-মৃত-একলাচ মোল্লা	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
১২৬২	০১/২০১০-১১	সিরাজ খান পিতা-মৃত-তোরাপ আলী খান	সাং-চিত্রা মধ্যপাড়া, রামপাল, বাগেরহাট	
১২৬৩	০১/২০১০-১১	মোঃ নিজাম মোল্লা পিতা-মৃত এজার উদ্দিন মোল্লা	সাং-ঝনঝনিয়া, রামপাল, বাগেরহাট	
১২৬৪	০১/২০১০-১১	মোসাঃ রাশিদা বেগম	সাং-শ্রীকলস, রামপাল, বাগেরহাট	

		জং-মৃত-নেছার উদ্দিন		
১২০০	০১/২০১০-১১	মোঃ আবু জাফর শেখ পিতা-মৃত-আবুল হাসান শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
১২০১	০১/২০১০-১১	মোসাঃ রোমেছা বেগম জং-মৃত-আবুল হাসান শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
১২০২	০১/২০১০-১১	ফরিদা ইয়াছমিন জং-মৃত-হাসান আলী শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
১২০৩	০১/২০১০-১১	কামরুল হাসান পিতা-মৃত-আবুল হাসান শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
১২০৪	০১/২০১০-১১	তামান্না হাসান পিতা-মৃত-আবুল হাসান শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
১২০৫	০১/২০১০-১১	মোঃ ওয়াহিদুজ্জামান লাভলু পিতা-আঃ লতিফ শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২০৬	০১/২০১০-১১	মোস্তাফিজুর রহমান পিতা-আঃ লতিফ শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২০৭	০১/২০১০-১১	মোঃ হুয়াল শেখ পিতা-আঃ লতিফ শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২০৮	০১/২০১০-১১	মোসাঃ নাজমুন্নাহার বেগম পিতা-আঃ লতিফ শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২০৯	০১/২০১০-১১	মোসাঃ আঞ্জুমনারা বেগম পিতা-আঃ লতিফ শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২১০	০১/২০১০-১১	মোসাঃ ফরিদা ইয়াছমিন পিতা-আঃ লতিফ শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২১১	০১/২০১০-১১	মোসাঃ আফরোজা বেগম পিতা-আঃ লতিফ শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২১২	০১/২০১০-১১	মোসাঃ পান্না খাতুন পিতা-আঃ লতিফ শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২১৩	০১/২০১০-১১	মোসাঃ হিম্মা খাতুন পিতা-আঃ লতিফ শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২১৪	০১/২০১০-১১	আঃ লতিফ শেখ পিতা-মৃত-আজিমুদ্দিন শেখ	সাং-সায়েরাবাদ, রামপাল বাগেরহাট	
১২১৫	০১/২০১০-১১	মোঃ আনিছুর রহমান গাজী পিতা-মৃত-মোঃ আলী আকবর গাজী	সাং-কাপাশডাঙ্গা, রমাপাল, বাগেরহাট	
১২১৬	০১/২০১০-১১	মোসঃ আলেজা বেগম পিতা-মৃত-মোঃ আলী আকবর গাজী	সাং-কাপাশডাঙ্গা, রমাপাল, বাগেরহাট	
১২১৭	০১/২০১০-১১	মোসাঃ বেবী বেগম পিতা-মৃত-মোঃ আলী আকবর গাজী	সাং-কাপাশডাঙ্গা, রমাপাল, বাগেরহাট	
১২১৮	০১/২০১০-১১	মোসাঃ মেরী বেগম পিতা-মৃত-মোঃ আলী আকবর গাজী	সাং-কাপাশডাঙ্গা, রমাপাল, বাগেরহাট	
১২১৯	০১/২০১০-১১	মোসাঃ হালিমা বেগম পিতা-মৃত-মোঃ আলী আকবর গাজী	সাং-কাপাশডাঙ্গা, রমাপাল, বাগেরহাট	
১২২০	০১/২০১০-১১	মোসাঃ শিরিনা বেগম পিতা-মৃত-মোঃ আলী আকবর গাজী	সাং-কাপাশডাঙ্গা, রমাপাল, বাগেরহাট	
১২২১	০১/২০১০-১১	মোসাঃ অলেদা বেগম পিতা-মৃত-মোঃ আলী আকবর গাজী	সাং-কাপাশডাঙ্গা, রমাপাল, বাগেরহাট	
১২২২	০১/২০১০-১১	মোসাঃ আঙ্গুরা বেগম পিতা-মৃত-মোঃ আলী আকবর গাজী	সাং-কাপাশডাঙ্গা, রমাপাল, বাগেরহাট	
১২২৩	০১/২০১০-১১	মোসাঃ ফুরজাহান বেগম জং -মৃত-মোঃ আলী আকবর গাজী	সাং-কাপাশডাঙ্গা, রমাপাল, বাগেরহাট	
১২২৪	০১/২০১০-১১	মোঃ শামছু মল্লিক পিতা-মৃত-আফছার মল্লিক	সাং-বর্ণি , রামপাল, বাগেরহাট	
১২২৫	০১/২০১০-১১	মোসাঃ শাহনাজ বেগম জং-এস, এম হাসান আলী	সাং-উজলকুড়,রামপাল, বাগেরহাট	
১২২৬	০১/২০১০-১১	মাজু বিবি জং-মৃত-কেয়ম উদ্দিন শেখ	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১২২৭	০১/২০১০-১১	মোঃ নওশের আলী শেখ পিতা-মৃত-ওসমান শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২২৮	০১/২০১০-১১	মোঃ মনিরুজ্জামান শেখ পিতা-মোঃ জুলফিকার আলী শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২২৯	০১/২০১০-১১	মোঃ নুরুজজামান শেখ পিতা- জুলফিকার আলী শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৩০	০১/২০১০-১১	মোঃ নওশের আলী মীর পিতা-মৃত-ইয়াদ আলী মীর	সাং-বর্ণি, রামপাল, বাগেরহাট	
১২৩১	০১/২০১০-১১	ছাকাত আলী মীর পিতা-মৃত-ইয়াদ আলী মীর	সাং-বর্ণি, রামপাল, বাগেরহাট	

		পিতা-মৃত-জহুর আলী ফরাজী		
১১৬৮	০১/২০১০-১১	মোসাঃ সুফিয়া বেগম পিতা-মৃত-জহুর আলী ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১১৬৯	০১/২০১০-১১	মোসাৎ কহিনুর বেগম পিতা-মৃত-জহুর আলী ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১১৭০	০১/২০১০-১১	শেখ মোঃ শহিদুজ্জামান পিতা-মৃত-আঃ ছামাদ শেখ	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৭১	০১/২০১০-১১	শেখ মোঃ শাহজাহান আলী পিতা-মৃত-আঃ ছামাদ শেখ	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৭২	০১/২০১০-১১	শেখ মোঃ সাইফুজ্জামান পিতা-মৃত-আঃ ছামাদ শেখ	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৭৩	০১/২০১০-১১	শেখ সাইদুজ্জামান পিতা-মৃত-আঃ ছামাদ শেখ	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৭৪	০১/২০১০-১১	নুরজাহান বেগম জং-মৃত-আঃ ছামাদ শেখ	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৭৫	০১/২০১০-১১	রাহিলা খাতুন জং-আঃ রাজ্জাক ফকির	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৭৬	০১/২০১০-১১	শেখ মোঃ হায়াত মাহমুদ পিতা-মৃত-খানজাহান আলী শেখ	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৭৭	০১/২০১০-১১	শেখ মোঃ হায়াত মাসুদ পিতা-মৃত-খানজাহান আলী শেখ	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৭৮	০১/২০১০-১১	বুয়েজা বেগম পিতা-মৃত-খানজাহান আলী শেখ	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৭৯	০১/২০১০-১১	হামিদা বেগম জং-মৃত-খানজাহান আলী শেখ	সাং-শুভদিয়া, ফকিরহাট,বাগেরহাট	
১১৮০	০১/২০১০-১১	কাজি আসাফুজ্জামান পিতা-মৃত-কাজী আছর উদ্দিন	সাং-চাদপুর, রামপাল, বাগেরহাট	
১১৮১	০১/২০১০-১১	কাজি আসাফুজ্জামান পিতা-মৃত-কাজী আছর উদ্দিন	সাং-চাদপুর, রামপাল, বাগেরহাট	
১১৮২	০১/২০১০-১১	কাজী আছাদুজ্জামান পিতা-মৃত-কাজী আছর উদ্দিন	সাং-চাদপুর, রামপাল, বাগেরহাট	
১১৮৩	০১/২০১০-১১	কাজী মহিতুজ্জামান পিতা-মৃত-কাজী আছর উদ্দিন	সাং-চাদপুর, রামপাল, বাগেরহাট	
১১৮৪	০১/২০১০-১১	কাজী আরিফুজ্জামান পিতা-মৃত-কাজী আছর উদ্দিন	সাং-চাদপুর, রামপাল, বাগেরহাট	
১১৮৫	০১/২০১০-১১	কাজী আহসানুজ্জামান পিতা-মৃত-কাজী আছর উদ্দিন	সাং-চাদপুর, রামপাল, বাগেরহাট	
১১৮৬	০১/২০১০-১১	কাশমিরী আক্তার জং-মোস্তফা কামাল পাটয়ারী	সাং-চাদপুর, রামপাল, বাগেরহাট	
১১৮৭	০১/২০১০-১১	খাদিজা বেগম জং-মৃত-কাজী আছর উদ্দিন	সাং-চাদপুর, রামপাল, বাগেরহাট	
১১৮৮	০১/২০১০-১১	মোঃ বজলুর রহমান পিতা-মৃত-মোঃ আবু বক্কর সরদার	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৮৯	০১/২০১০-১১	হাসিনা বেগম জং-মৃত আবু বক্কর সরদার	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯০	০১/২০১০-১১	মমতাজ খাতুন পিতা-মৃত-মোঃ আবু বক্কর সরদার	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯১	০১/২০১০-১১	শাহনাজ খাতুন পিতা-মৃত-মোঃ আবু বক্কর সরদার	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯২	০১/২০১০-১১	মৌমিতা পাপিয়া পিতা-শেখ হায়দার আলী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯৩	০১/২০১০-১১	নাফিজ আল আমিন পিতা-শেখ হয়দার আলী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯৪	০১/২০১০-১১	শেখ হায়দার আলী পিতা-সুলতান আলী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯৫	০১/২০১০-১১	বড়ু বিবি জং-মৃত-রাজ্জাক আলী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯৬	০১/২০১০-১১	মেশকাতুর রহমান পিতা-মৃত-নেছার উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯৭	০১/২০১০-১১	সুফিয়া বেগম পিতা-মৃত-নেছার উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯৮	০১/২০১০-১১	মোসাঃ নাফিজা বেগম পিতা-মৃত-নেছার উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৯৯	০১/২০১০-১১	মোসাঃ হাজেরা বেগম	সাং-বর্ণি, রামপাল, বাগেরহাট	

১১৩৬	০১/২০১০-১১	নিয়াজ ফাতেমা পিতা-এস, এম বদরুজ্জামান	সাং-৯ পৈপাড়া, হাজী ইসমাইল লিংক রোড, সোনাডাঙ্গা, খুলনা	
১১৩৭	০১/২০১০-১১	আলিনুর নাহার জং-এস, এম বদরুজ্জামান	সাং-৯ পৈপাড়া, হাজী ইসমাইল লিংক রোড, সোনাডাঙ্গা, খুলনা	
১১৩৮	০১/২০১০-১১	সুকুমার দাশ পিতা-মৃত বিজয় চন্দ্র দাশ	সাং-বেতাগা, ফকিরহাট বাগেরহাট	
১১৩৯	০১/২০১০-১১	সৃতিষ কুমার ওরফে সুজিত দাশ পিতা-মৃত বিজয় চন্দ্র দাশ	সাং-বেতাগা, ফকিরহাট বাগেরহাট	
১১৪০	০১/২০১০-১১	বিপ্লব কুমার দাশ পিতা-মৃত বিজয় চন্দ্র দাশ	সাং-বেতাগা, ফকিরহাট বাগেরহাট	
১১৪১	০১/২০১০-১১	মোঃ সাইদুর রহমান পিতা-মৃত-বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১১৪২	০১/২০১০-১১	মোঃ জামির আলী শেখ পিতা-মৃত-বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১১৪৩	০১/২০১০-১১	মোঃ ছাদেক আলী শেখ পিতা-মৃত-বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১১৪৪	০১/২০১০-১১	মোঃ নওয়াব আলী গাজী পিতা-মৃত-রুস্তম আলী গাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১১৪৫	০১/২০১০-১১	আব্দুল মজিদ মুন্সী পিতা-মৃত-রেয়াজ উদ্দিন মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৪৬	০১/২০১০-১১	মোসা জাকিয়া বেগম জং-মোঃ কুদ্দুস মল্লিক	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৪৭	০১/২০১০-১১	মোঃ মনির হোসেন শেখ পিতা-মোঃ আব্দুল শেখ	সাং-মুরুলিয়া, রামপাল, বাগেরহাট।	
১১৪৮	০১/২০১০-১১	মোঃ সাইফুল ইসলাম পিতা-মোঃ আব্দুল শেখ	সাং-মুরুলিয়া, রামপাল, বাগেরহাট।	
১১৪৯	০১/২০১০-১১	মোঃ আব্দুল শেখ পিতা-মোঃ আয়েন উদ্দিন শেখ	সাং-মুরুলিয়া, রামপাল, বাগেরহাট।	
১১৫০	০১/২০১০-১১	মোঃ এবারত আলী পিতা-মৃত-সামসুদ্দিন শেখ	সাং-ধনপোতা, ফকিরহাট, বাগেরহাট।	
১১৫১	০১/২০১০-১১	মোঃ তৈয়েবুর রহমান পিতা-মৃত-সামছুদ্দিন শেখ	সাং-ধনপোতা, ফকিরহাট, বাগেরহাট	
১১৫২	০১/২০১০-১১	মোঃ জুলফিকার আলী শেখ পিতামৃত-ওসমান আলী শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৫৩	০১/২০১০-১১	চম্পা ইয়াছমিন জং-মোঃ মোতাহার	সাং-রাজনগর, রামপাল, বাগেরহাট	
১১৫৪	০১/২০১০-১১	মোসাঃ রওশনারা জং-মোঃ শাহজাহান মোল্লা	সাং-রাজনগর, রামপাল, বাগেরহাট	
১১৫৫	০১/২০১০-১১	মোসাঃ আনোয়ারা বেগম জং-মৃত-মোঃ আলী আকুঞ্জী	সাং-রাজনগর, রামপাল, বাগেরহাট	
১১৫৬	০১/২০১০-১১	অলোক কুমার দাশ পিতা-মৃত-বিজয় লল দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
১১৫৭	০১/২০১০-১১	মোঃ লোকমান মুন্সী পিতা-মৃত-আঃ আজিজ মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৫৮	০১/২০১০-১১	আয়ুব আলী মুন্সী পিতা-মৃত-আঃ আজিজ মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৫৯	০১/২০১০-১১	মোঃ আলতাফ হোসেন পিতা-মৃত-আঃ আজিজ মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৬০	০১/২০১০-১১	মোঃ সাইফুল ইসলাম পিতা-মৃত-আঃ আজিজ মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৬১	০১/২০১০-১১	জয়নাব বেগম পিতা-মৃত-আঃ আজিজ মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৬২	০১/২০১০-১১	আকলিমা বেগম পিতা-মৃত-আঃ আজিজ মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৬৩	০১/২০১০-১১	হোসনেয়ারা বেগম পিতা-মৃত-আঃ আজিজ মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৬৪	০১/২০১০-১১	হাফিজুর রহমান মুন্সী পিতা-মৃত-আঃ আজিজ মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৬৫	০১/২০১০-১১	মোসাঃ রহিমা বেগম পিতা-মৃত-আঃ আজিজ মুন্সী	সাং-বর্ণি, রামপাল, বাগেরহাট	
১১৬৬	০১/২০১০-১১	মোঃ হুজ্জত আলী ফরাজী পিতা-মৃত-জহুর আলী ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১১৬৭	০১/২০১০-১১	মোঃ ইয়াহিয়া ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	

১০৭১	০১/২০১০-১১	মোসাঃ সাহেরা বুল বুল পিতা-মৃত-জয়নাল আবেদীন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৭২	০১/২০১০-১১	মোসাঃ শিরিণ জাহান পিতা-মৃত-জয়নাল আবেদীন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৭৩	০১/২০১০-১১	মোঃ রুহুল আবেদীন পিতা-মৃত-ডাঃ আজমল হোসেন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৭৪	০১/২০১০-১১	মেহেদী বিল্লাহ পিতা-মৃত-ডাঃ আজমল হোসেন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৭৫	০১/২০১০-১১	জাহিদী বিল্লাহ পিতা-মৃত-ডাঃ আজমল হোসেন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৭৬	০১/২০১০-১১	তামান্না আরজুমান পিতা-মৃত-ডাঃ আজমল হোসেন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৭৭	০১/২০১০-১১	নুসরাত আরজুমান পিতা-মৃত-ডাঃ আজমল হোসেন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৭৮	০১/২০১০-১১	সরমিন আক্তার পিতা-মৃত মোঃ খায়রুল মোমিন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৭৯	০১/২০১০-১১	মোঃ ওয়াসিক আবু জানা পিতা-মৃত-	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৮০	০১/২০১০-১১	নওশিন নাজিয়া পিতা-মৃত মোঃ খায়রুল মোমিন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৮১	০১/২০১০-১১	মোঃ ফারুকুল ইসলাম পিতা-মৃত আশরাফ আলী মোল্লা	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৮২	০১/২০১০-১১	সেলিনা বেগম জং-মৃত ফিরোজ আহমদ	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৮৩	০১/২০১০-১১	আশরাফুল আরেফিন ইমন পিতা-মৃত-ফিরোজ আহমদ	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৮৪	০১/২০১০-১১	আহসানুল আরাফাত পিতা-মৃত-ফিরোজ আহমদ	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	
১০৮৫	০১/২০১০-১১	মনোয়ারা বেগম জং-মোঃ আবু জাফর ফকির	সাং-আদাঘাট, উপজেলা-রামপাল, বাগেরহাট।	
১০৮৬	০১/২০১০-১১	আকতারুজ্জামান পিতা-মৃত-আব্দুস সত্তার শেখ	সাং-বড়কাঠালি, উপজেলা-রামপাল, বাগেরহাট।	
১০৮৭	০১/২০১০-১১	মোঃ জাহিদুল ইসলাম পিতা-মৃত-আব্দুস সত্তার শেখ	সাং-বড়কাঠালি, উপজেলা-রামপাল, বাগেরহাট	
১০৮৮	০১/২০১০-১১	মোঃ শাহিদুল ইসলাম পিতা-মৃত-আব্দুস সত্তার শেখ	সাং-বড়কাঠালি, উপজেলা-রামপাল, বাগেরহাট	
১০৮৯	০১/২০১০-১১	মোঃ হাফিজুর রহমান পিতা-মৃত-আশফাক আলী শেখ	সাং-সুলতানিয়া উপজেলা-রামপাল, বাগেরহাট।	
১০৯০	০১/২০১০-১১	মোসাঃ আম্বিয়া বেগম জং-মৃত-আশফাক আলী শেখ		
১০৯১	০১/২০১০-১১	আব্দুল আলিম শেখ পিতা-মৃত-আকিত শেখ	সাং-আদাঘাট,উপজেলা-রামপাল, বাগেরহাট।	
১০৯২	০১/২০১০-১১	মোঃ বাবুল শেখ পিতা-মৃত-আলিম শেখ	সাং-আদাঘাট,উপজেলা-রামপাল, বাগেরহাট।	
১০৯৩	০১/২০১০-১১	মোঃ রেজাউল শেখ পিতা-মৃত-আলিম শেখ	সাং-আদাঘাট,উপজেলা-রামপাল, বাগেরহাট।	
১০৯৪	০১/২০১০-১১	বেল্লাল গাজী পিতা-কুব্বত গাজী	সাং-আদাঘাট,উপজেলা-রামপাল, বাগেরহাট।	
১০৯৫	০১/২০১০-১১	মোঃ আবু সাইদ পিতা-সমশের আলী	সাং-বিদ্যুৎ উন্নয়ন বোর্ড কে আলী রোড, সরুই বাগেরহাট।	
১০৯৬	০১/২০১০-১১	রুনুজা বেগম জং-মোঃ আবু সাইদ	সাং-বিদ্যুৎ উন্নয়ন বোর্ড কে আলী রোড, সরুই বাগেরহাট।	
১০৯৭	০১/২০১০-১১	আকবর আলী মৃধা পিতা-মৃত-রাহেন উদ্দিন মৃধা	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১০৯৮	০১/২০১০-১১	মোঃ আজমল আলী মৃধা পিতা-মৃত-রাহেন উদ্দিন মৃধা	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১০৯৯	০১/২০১০-১১	মোঃ ইসমাইল মৃধা পিতা-মৃত-রাহেন উদ্দিন মৃধা	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১১০০	০১/২০১০-১১	মোঃ আসাদুর রহমান মৃধা পিতা-মৃত-রাহেন উদ্দিন মৃধা	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১১০১	০১/২০১০-১১	মোসাঃ সেলিনা বেগম পিতা-মৃত-রাহেন উদ্দিন মৃধা	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১১০২	০১/২০১০-১১	মোসাঃ জরিনা বেগম পিতা-মৃত-রাহেন উদ্দিন মৃধা	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১১০৩	০১/২০১০-১১	মোসাৎ জেবুন্নেছা বেগম	সাং-বর্ণি, উপজেলা-রামপাল,	

		পিতা-জিন্নতুল্যা		
১০৪০	০১/২০১০-১১	মোসাঃ তাছলিমা বেগম জং- মৃত নুর ইসলাম	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৪১	০১/২০১০-১১	মোঃ শফিউল আলম পিতা-মৃত নুর ইসলাম	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৪২	০১/২০১০-১১	মোঃ নজরুল ইসলাম পিং মৃত জহুরুল হক হাওলাদার		
১০৪৩	০১/২০১০-১১	সাহারা খাতুন জং-নজরুল ইসলাম	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৪৪	০১/২০১০-১১	তাহেরা বেগম জং-একরামুল হক	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৪৫	০১/২০১০-১১	এনামুল কবির পিতা-মৃত-নেছার উদ্দিন	সাং-বণি, রামপাল, বাগেরহাট	
১০৪৬	০১/২০১০-১১	অসিউলবারী পিতা-মৃত-নেছার উদ্দিন	সাং-বণি, রামপাল, বাগেরহাট	
১০৪৭	০১/২০১০-১১	মোঃ মারুফ শেখ পিতা-মৃত-নেছার উদ্দিন	সাং-বণি, রামপাল, বাগেরহাট	
১০৪৮	০১/২০১০-১১	মোসাঃ জাকিয়া বেগম পিতা-মৃত-নেছার উদ্দিন	সাং-বণি, রামপাল, বাগেরহাট	
১০৪৯	০১/২০১০-১১	বোরহান ফরাজী পিতা-মৃত-আজিজুর রহমান ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১০৫০	০১/২০১০-১১	মোঃ মাছুদ ফরাজী পিতা-মৃত-আজিজুর রহমান ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১০৫১	০১/২০১০-১১	বিলকিস বেগম পিতা-মৃত-আজিজুর রহমান ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১০৫২	০১/২০১০-১১	নারগিস বেগম পিতা-মৃত-আজিজুর রহমান ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১০৫৩	০১/২০১০-১১	পারগিস বেগম পিতা-মৃত-আজিজুর রহমান ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১০৫৪	০১/২০১০-১১	মোসাঃ রোজিনা বেগম পিতা-মৃত-আজিজুর রহমান ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১০৫৫	০১/২০১০-১১	রুনা আক্তার পিতা-মৃত-আজিজুর রহমান ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১০৫৬	০১/২০১০-১১	মোসাঃ শরিফা বেগম পিতা-মৃত-আজিজুর রহমান ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১০৫৭	০১/২০১০-১১	মোসাঃ কদবানু জং-মৃত-আজিজুর রহমান ফরাজী	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
১০৫৮	০১/২০১০-১১	সামছুর রহমান পিতা-মৃত-জহুরুল হক হাওলাদার	সাং-আদাঘাট, উপজেলা-রামপাল, বাগেরহাট।	
১০৫৯	০১/২০১০-১১	আকবর আলী শেখ পিতা-মৃত-আফছার উদ্দিন শেখ	সাং-বর্নি, উপজেলা-রামপাল, বাগেরহাট।	
১০৬০	০১/২০১০-১১	ফেরদৌস হাওলাদার পিতা-মৃত-নূর উদ্দিন হাওলাদার	সাং-মানিক নগর, উপজেলা-রামপাল, বাগেরহাট।	
১০৬১	০১/২০১০-১১	মোঃ ইসমাইল হোসেন গাজী পিতা-মৃত-ওমেদ আলী গাজী	সাং-কাপাশডাঙ্গা, উপজেলা-রামপাল, বাগেরহাট।	
১০৬২	০১/২০১০-১১	অজয় কুমার দাশ পিতা-মৃত-হৃদয় নাথ দাশ	সাং-রণজিতপুর, উপজেলা-রামপাল, বাগেরহাট।	
১০৬৩	০১/২০১০-১১	সঞ্জয় কুমার দাশ পিতা-মৃত-হৃদয় নাথ দাশ	সাং-রণজিতপুর, উপজেলা-রামপাল, বাগেরহাট।	
১০৬৪	০১/২০১০-১১	শ্যামল কুমার দাশ পিতা-মৃত-হৃদয় নাথ দাশ	সাং-রণজিতপুর, উপজেলা-রামপাল, বাগেরহাট।	
১০৬৫	০১/২০১০-১১	সুধারাণী দাশ জং-মৃত-হৃদয় নাথ দাশ	সাং-রণজিতপুর, উপজেলা-রামপাল, বাগেরহাট।	
১০৬৬	০১/২০১০-১১	মোঃ নজরুল ইসলাম পিতা-মৃত-আঃ গণি	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১০৬৭	০১/২০১০-১১	মোঃ ফুয়াদুল ইসলাম পিতা-নজরুল ইসলাম	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১০৬৮	০১/২০১০-১১	মোঃ রিয়াদুল ইসলাম পিতা-নজরুল ইসলাম	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১০৬৯	০১/২০১০-১১	মোসাঃ লাভলী খানম পিতা-নজরুল ইসলাম	সাং-বর্ণি, উপজেলা-রামপাল, বাগেরহাট।	
১০৭০	০১/২০১০-১১	মোঃ এনামুল কাদির পিতা-মৃত-জয়নাল আবেদীন	সাং-১৪ নং হাজী মহসীন রোড, খুলনা	

১০০৭	০১/২০১০-১১	জয়ন্তি রানী দাস পিতা মৃঃ মাধব চন্দ্র দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০০৮	০১/২০১০-১১	সুবেদ্রা রানী দাস পিতা মৃঃ মাধব চন্দ্র দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০০৯	০১/২০১০-১১	রামপ্রসাদ দাস পিতা মৃঃ কালিপদ দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০১০	০১/২০১০-১১	কৃষ্ণ পদ দাস পিতা মৃঃ কালিপদ দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০১১	০১/২০১০-১১	সরোজ কুমার দাস পিতা মৃঃ মহাদেব চন্দ্র দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০১২	০১/২০১০-১১	আবু জাফর শেখ পিতা মৃঃ আবুল হাসান শেখ	সাং-শ্যামবাগাত,ফকিরহাট, বাগেরহাট	
১০১৩	০১/২০১০-১১	মোঃ আঃ হাই শেখ পিতা মৃঃ আবুল হাসান শেখ	সাং-শ্যামবাগাত,ফকিরহাট, বাগেরহাট	
১০১৪	০১/২০১০-১১	মোঃ অহিদুজ্জামান শেখ পিতা মৃঃ আবুল হাসান শেখ	সাং-শ্যামবাগাত,ফকিরহাট, বাগেরহাট	
১০১৫	০১/২০১০-১১	রমেছা বেগম জং মৃঃ আবুল হাসান শেখ	সাং-শ্যামবাগাত,ফকিরহাট, বাগেরহাট	
১০১৬	০১/২০১০-১১	মোসাঃ নুরজাহান বেগম জং-মোঃ খলিলুর রহমান	সাং-কাপাশডাঙ্গা, রামপলা, বাগেরহাট	
১০১৭	০১/২০১০-১১	মোঃ মতলেব আলী হালদার পিতা-মোঃ কেরামত আলী	সাং-লক্ষীখোলা, বটিয়াঘাটা, খুলনা	
১০১৮	০১/২০১০-১১	এস, এম ফকরুল ইসলাম পিতা-মৃত-রহমত আলী শেখ	সাং-৪৭ নং বানরগাতী শহীদ সোহরাওয়ার্দী কলেজ রোড, খুলনা	
১০১৯	০১/২০১০-১১	মোঃ সাইফুল ইসলাম পিতা-মাওলানা আঃ খালেক	সাং-হাজী ইসমাইল রোড, কাশেম বাদ লেন, খুলনা	
১০২০	০১/২০১০-১১	রাবেয়া বেগম জং-মোঃ মাহাতাব উদ্দিন শেখ	সাং-সাপমারিকাটাখালী, রামপাল, বাগেরহাট	
১০২১	০১/২০১০-১১	কামরুল ইসলাম পিতা-মৃত-হেলাল উদ্দিন গোলদার	সাং-রাজনগর, রামপাল, বাগেরহাট	
১০২২	০১/২০১০-১১	গোলাম কিবরিয়া পিতা-মৃত-হেলাল উদ্দিন গোলদার	সাং-রাজনগর, রামপাল, বাগেরহাট	
১০২৩	০১/২০১০-১১	আসাদুজ্জামান (মুকুল) পিতা-মৃত-হেলাল উদ্দিন গোলদার	সাং-রাজনগর, রামপাল, বাগেরহাট	
১০২৪	০১/২০১০-১১	মোজাম্মেল হোসেন (মিন্টু) পিতা-মৃত-হেলাল উদ্দিন গোলদার	সাং-রাজনগর, রামপাল, বাগেরহাট	
১০২৫	০১/২০১০-১১	আফরোজা বেগম পিতা-মৃত-হেলাল উদ্দিন গোলদার	সাং-রাজনগর, রামপাল, বাগেরহাট	
১০২৬	০১/২০১০-১১	নাজমা বেগম পিতা-মৃত-হেলাল উদ্দিন গোলদার	সাং-রাজনগর, রামপাল, বাগেরহাট	
১০২৭	০১/২০১০-১১	পারভীন বেগম পিতা-মৃত-হেলাল উদ্দিন গোলদার	সাং-রাজনগর, রামপাল, বাগেরহাট	
১০২৮	০১/২০১০-১১	মোসাঃ হালিমা বেগম জং-আজিজুল শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০২৯	০১/২০১০-১১	মোঃ বাবুল আক্তার পিং মৃত নূর ইসলাম হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩০	০১/২০১০-১১	মোঃ বজলুর রহমান পিং মৃত জহুরুল হক হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩১	০১/২০১০-১১	মোঃ ফজলুর রহমান পিং মৃত জহুরুল হক হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩২	০১/২০১০-১১	হামিদা খাতুন জং-মৃত জহুরুল হক হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩৩	০১/২০১০-১১	মোসাঃ রোকেয়া বেগম পিং মৃত জহুরুল হক হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩৪	০১/২০১০-১১	মোস্তাহিদুল পিতা-কালাম মোড়েল	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩৫	০১/২০১০-১১	মনিরুল পিতা-কালাম মোড়েল	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩৬	০১/২০১০-১১	মহিবুল পিতা-কালাম মোড়েল	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩৭	০১/২০১০-১১	বাবু পিতা-কালাম মোড়েল	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩৮	০১/২০১০-১১	রত্না বেগম পিতা-কালাম মোড়েল	সাং-আদাঘাট, রামপাল, বাগেরহাট	
১০৩৯	০১/২০১০-১১	কালাম মোড়ল	সাং-আদাঘাট, রামপাল, বাগেরহাট	

		পিতা মৃঃ আজিজ হাওলাদার		
৯৭৫	০১/২০১০-১১	মোঃ আতিকুল ইসলাম পিতা- আঃ মজিদ হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৭৬	০১/২০১০-১১	মোঃ তরিকুল ইসলাম পিতা- আঃ মজিদ হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৭৭	০১/২০১০-১১	মোঃ রফিকুল ইসরাম পিতা- আঃ মজিদ হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৭৮	০১/২০১০-১১	রোকছানা বেগম পিতা- আঃ মজিদ হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৭৯	০১/২০১০-১১	মোঃ সাকাওয়াত শেখ পিতা মৃঃ ছায়েম উদ্দিন শেখ	সাং-বর্নি, রামপাল, বাগেরহাট	
৯৮০	০১/২০১০-১১	মোঃ তোফাজ্জেল হোসেন পিতা মৃঃ ছায়েম উদ্দিন	সাং-বর্নি, রামপাল, বাগেরহাট	
৯৮১	০১/২০১০-১১	মোসাঃ রশিদা খাতুন পিতা মৃঃ ছায়েম উদ্দিন	সাং-বর্নি, রামপাল, বাগেরহাট	
৯৮২	০১/২০১০-১১	মোসাঃ তরিকুন্নেছা পিতা মৃঃ ছায়েম উদ্দিন	সাং-বর্নি, রামপাল, বাগেরহাট	
৯৮৩	০১/২০১০-১১	মোসাঃ ফজিলাতুন্নেছা পিতা মৃঃ ছায়েম উদ্দিন	সাং-বর্নি, রামপাল, বাগেরহাট	
৯৮৪	০১/২০১০-১১	মোৎ জাকির হোসেন পিতা মৃঃ আফছার উদ্দিন	সং-দূর্গাপুর, উপজেলা-রামপাল, বাগেরহাট	
৯৮৫	০১/২০১০-১১	আব্দুস সালাম শেখ পিতা মৃঃ ছোলায়মান আলী	সাং-বর্নি, রামপাল, বাগেরহাট	
৯৮৬	০১/২০১০-১১	মোসাঃ কুলছুম বেগম জং-আব্দুল ছালাম শেখ	সাং-বর্নি, রামপাল, বাগেরহাট	
৯৮৭	০১/২০১০-১১	মিহির কুমার দাস পিতা মৃঃ বিরেন্দ্র নাথ দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৮৮	০১/২০১০-১১	শংকর প্রশাদ দাস পিতা মৃঃ হরিপদ দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৮৯	০১/২০১০-১১	নিরঞ্জন কুমার দাস পিতা মৃঃ সতিশ চন্দ্র দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯০	০১/২০১০-১১	নরেন্দ্র নাথ দাস পিং সতিশ চন্দ্র দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯১	০১/২০১০-১১	পরেশ কুমার দাস পিং সতিশ চন্দ্র দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯২	০১/২০১০-১১	সমীর চন্দ্র দাস পিং সতিশ চন্দ্র দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯৩	০১/২০১০-১১	উজ্জল কুমার দাস পিতা মৃঃ শ্যামল কুমার দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯৪	০১/২০১০-১১	কুমারেশ চন্দ্র দাস পিতা মৃঃ রবীন্দ্র নাথ দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯৫	০১/২০১০-১১	সুধাংশু কুমার দাস পিতা মৃঃ বিজয় লাল দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯৬	০১/২০১০-১১	নারায়ন চন্দ্র দাস পিতা মৃঃ বিজয় লাল দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯৭	০১/২০১০-১১	দুলাল কৃষ্ণ দাস পিতা মৃঃ বিজয় লাল দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯৮	০১/২০১০-১১	পংকোজ কুমার দাস পিতা মৃঃ বিজয় লাল দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৯৯৯	০১/২০১০-১১	শিব পদ দাশ পিতা মৃঃ বিজয় লাল দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০০০	০১/২০১০-১১	বিকাশ চন্দ্র দাস পিতা মৃঃ গুরুপদ দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০০১	০১/২০১০-১১	সুশান্ত কুমার দাস পিতা মৃঃ জিতেন্দ্র নাথ দাস	সাং-রনজিতপুর, বাগেরহাট	
১০০২	০১/২০১০-১১	সুশান্ত কুমার দাস পিতা মৃঃ জিতেন্দ্র নাথ দাস	সাং-রনজিতপুর, বাগেরহাট	
১০০৩	০১/২০১০-১১	সুনিল কুমার দাস পিতা মৃঃ নটবর দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০০৪	০১/২০১০-১১	পরিমল দাস পিতা মৃঃ জটাধর দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০০৫	০১/২০১০-১১	খোকন চন্দ্র দাস পিতা মৃঃ জটাধর বয়াতি	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
১০০৬	০১/২০১০-১১	দুলালী রানী দাস পিতা মৃঃ মাধব চন্দ্র দাস	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	

৯৪২	০১/২০১০-১১	চিত্ত রঞ্জন দাশ পিতা-মৃত-মতিলাল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৯৪৩	০১/২০১০-১১	মুরারী মোহন দাশ পিতা-মৃত-মতিলাল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৯৪৪	০১/২০১০-১১	মুকুন্দ কুমার দাশ পিতা-মৃত-মতিলাল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৯৪৫	০১/২০১০-১১	বিষ্ণু পদ দাশ পিতা-মৃত-মতিলাল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৯৪৬	০১/২০১০-১১	শীব পদ দাশ পিতা-মৃত-মতিলাল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৯৪৭	০১/২০১০-১১	মোঃ আপ্তাব ফকির পিতা-মৃত ইতিম আলী ফকির	সাং-ভট্টবালিয়াঘাটা, বাগেরহাট সদর	
৯৪৮	০১/২০১০-১১	মোঃ মাহতাব আলী ফকির পিতা-মৃত ইতিম আলী ফকির	সাং-ভট্টবালিয়াঘাটা, বাগেরহাট সদর	
৯৪৯	০১/২০১০-১১	মোঃ মোকছেদ আলী ফকির পিতা-মৃত ইতিম আলী ফকির	সাং-ভট্টবালিয়াঘাটা, বাগেরহাট সদর	
৯৫০	০১/২০১০-১১	হেমায়েতুল ইসলাম পিতা-মৃত শমশের আলী	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৫১	০১/২০১০-১১	মোঃ মুরাদ শেখ পিতা-মৃত-শমশের আলী	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৫২	০১/২০১০-১১	সুফিয়া বেগম জং-মোহাম্মদ শাহজাহান শেখ	সাং-বড়গুভদিয়া, ফকিরহাট, বাগেরহাট	
৯৫৩	০১/২০১০-১১	মানছুরা বেগম পিতা-মৃত এশার উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৫৪	০১/২০১০-১১	জোবেদা বেগম পিতা-মৃত-এশার উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৫৫	০১/২০১০-১১	মোসাঃ বিউটি বেগম জং মৃঃ মনিরুল বারি	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৫৬	০১/২০১০-১১	মোসাঃ তাছলিমা বেগম স্বামী মৃঃ মোঃ ফারুক শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৫৭	০১/২০১০-১১	মোঃ শাকিরা বেগম পিতা মৃঃ পারুক শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৫৮	০১/২০১০-১১	মোঃ বোরহান উদ্দিন পিতা মৃত-মোঃ মনিরুল বারি	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৫৯	০১/২০১০-১১	মোঃ নঈম শেখ পিতা মৃত-মোঃ মনিরুল বারি	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৬০	০১/২০১০-১১	মোসাঃ লেভনা ইয়াসমিন পিতা মৃত-মোঃ মনিরুল বারি	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৬১	০১/২০১০-১১	আছমা খাতুন পিতা মৃঃ আঃ গনি	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৬২	০১/২০১০-১১	সোহরাব শেখবেগম পিতা মৃঃ নবুল্লা শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৬৩	০১/২০১০-১১	মোঃ কামরুল ইসলাম পিং সোহরাব শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৬৪	০১/২০১০-১১	মোঃ আজিজুল ইসলাম পিং সোহরাব শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৬৫	০১/২০১০-১১	মোঃ সিরাজুল ইসলাম পিং সোহরাব শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৬৬	০১/২০১০-১১	শিরিনা বেগম পিং সোহরাব শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৬৭	০১/২০১০-১১	মেরিনা বেগম পিং সোহরাব শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৬৮	০১/২০১০-১১	পারভীন আক্তার পিং সোহরাব শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৬৯	০১/২০১০-১১	মিশারুল উসলাম পিং সোহরাব শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৭০	০১/২০১০-১১	মোঃ হাবিবুর রহমান ফকির পিতা মৃঃ মাহমুদ ফকির	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৭১	০১/২০১০-১১	মোঃ ইকবাল ফকির পিতা মৃঃ মাহমুদ আলী ফকির	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৭২	০১/২০১০-১১	মোসাঃ সরমিনা খাতুন পিতা মৃঃ মাহমুদ আলী ফকির	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৭৩	০১/২০১০-১১	মাহমুদা বেগম জং মৃঃ মাহমুদ আলী ফকির	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৯৭৪	০১/২০১০-১১	আঃ মজিদ হাওলাদার	সাং-আদাঘাট, রামপাল, বাগেরহাট	

		জং-ইউসুফ পাইক		
৯১০	০১/২০১০-১১	সেলিম জাহাঙ্গীর পিতা মোঃ লিয়াকত আলী শেখ	সাং-বর্ণি,রামপাল, বাগেরহাট	
৯১১	০১/২০১০-১১	মোসাঃ আনোয়ারা বেগম জং-মৃত-মোঃ আলী আকুঞ্জী	সাং-বর্ণি,রামপাল, বাগেরহাট	
৯১২	০১/২০১০-১১	গোলাম মোস্তফা পিতা-মৃত-আব্দুল শেখ	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৯১৩	০১/২০১০-১১	জায়েদা বেগম জং-গোলাম মোস্তফা শেখ	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৯১৪	০১/২০১০-১১	মোঃ ইব্রাহীম ফকির পিতা-মৃত-মোঃ দবিরউদ্দিন ফকির	সাং-শিয়ালীডাঙ্গা, বটিয়াঘাটা, খুলনা	
৯১৫	০১/২০১০-১১	মোসাঃ আছমা আক্তার জং-মোঃ লিয়াকত আলী	সাং-বর্ণি,রামপাল, বাগেরহাট	
৯১৬	০১/২০১০-১১	মোঃ আকবর আলী সরদার পিতা-মৃত কাওছার আলী	সাং-বর্ণি,রামপাল, বাগেরহাট	
৯১৭	০১/২০১০-১১	লিয়াকত আলী সরদার পিতা-মৃত-কওছার আলী	সাং-বর্ণি,রামপাল, বাগেরহাট	
৯১৮	০১/২০১০-১১	মোঃ নিজাম শেখ পিতা-মৃত মুক্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৯১৯	০১/২০১০-১১	বেবী বেগম পিতা-মৃত মুক্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৯২০	০১/২০১০-১১	রোমেছা বেগম জং-মৃত-তোজাম শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৯২১	০১/২০১০-১১	মোঃ কবির হোসেন পিতা-মৃত মোজাম্মেল হোসেন	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৯২২	০১/২০১০-১১	মোঃ মনিরুল ইসলাম পিতা-মৃত মোজাম্মেল হোসেন	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৯২৩	০১/২০১০-১১	পান্না বেগম পিতা-মৃত মোজাম্মেল হোসেন	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৯২৪	০১/২০১০-১১	মোসাঃ লাভলী বেগম জং মোঃ নাজু শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৯২৫	০১/২০১০-১১	মোঃ হাবিবুর রহমান শেখ পিতা-মৃত আদিল উদ্দিন শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৯২৬	০১/২০১০-১১	মোঃ লুৎফর রহমান পিতা-মৃত আদিল উদ্দিন শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৯২৭	০১/২০১০-১১	মোঃ আব্দুর রহমান পিতা-মৃত আদিল উদ্দিন শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৯২৮	০১/২০১০-১১	ছকিনা বেগম পিতা-মৃত আদিল উদ্দিন শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৯২৯	০১/২০১০-১১	সাহারা বানু পিতা-মৃত আদিল উদ্দিন শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৯৩০	০১/২০১০-১১	জায়েদা বেগম পিতা-মৃত আদিল উদ্দিন শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৯৩১	০১/২০১০-১১	জয়নাব বেগম পিতা-মৃত আদিল উদ্দিন শেখ	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৯৩২	০১/২০১০-১১	মোঃ মোজাহেরুল ইসলাম পিতা-মৃত-মোঃ আঃ মকিত শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৩৩	০১/২০১০-১১	মোঃ শিয়াব শেখ পিতা-মৃত-মোঃ আঃ মকিত শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৩৪	০১/২০১০-১১	তাছমিদা খাতুন পিতা-মৃত-মোঃ আঃ মকিত শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৩৫	০১/২০১০-১১	মাহামুদা বেগম জং-মৃত-মোঃ আঃ মকিত শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৩৬	০১/২০১০-১১	বিমল চন্দ্র দাশ পিতা-মৃত-গোপাল চন্দ্র দাশ	সাং-মাসকাটা, ফকিরহাট, বাগেরহাট	
৯৩৭	০১/২০১০-১১	মোঃ মুছাদ্দেক আলী শেখ পিতা-মৃত-মোকছেদুর রহমান	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৩৮	০১/২০১০-১১	মোঃ জাহাঙ্গীর শেখ পিতা-মৃত-মোকছেদুর রহমান	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৩৯	০১/২০১০-১১	মোঃ ইসা শেখ পিতা-মৃত-মোকছেদুর রহমান	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯৪০	০১/২০১০-১১	এস, এম এ জালাল পিতা-মৃত-মাষ্টার সোলায়মান আলী	সাং-বর্ণিছায়রাবাদ, রামপাল, বাগেরহাট	
৯৪১	০১/২০১০-১১	স্বপন কুমার দাশ পিতা-মৃত-মতিলাল দাশ	সাং-সুনগর, বাগেরহাট সদর	

৮৭৭	০১/২০১০-১১	রিজি বেগম পিতা-মৃত মোখলেচ উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৭৮	০১/২০১০-১১	মাজেদা বেগম পিতা-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৭৯	০১/২০১০-১১	হোসনেয়ারা বেগম পিতা-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮০	০১/২০১০-১১	রাহিলা বেগম পিতা-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮১	০১/২০১০-১১	খালেদা বেগম পিতা-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮২	০১/২০১০-১১	হামিদা বেগম পিতা-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮৩	০১/২০১০-১১	মোঃ মহম্মদ আলী পিতা-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮৪	০১/২০১০-১১	শওকত শেখ পিতা-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮৫	০১/২০১০-১১	লিয়াকত শেখ পিতা-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮৬	০১/২০১০-১১	হেমায়েত শেখ পিতা-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮৭	০১/২০১০-১১	ময়না বেগম জং-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮৮	০১/২০১০-১১	আলেয়া বেগম জং-মৃত-ছাত্তার শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৮৮৯	০১/২০১০-১১	মাজেদা বেগম জং-মৃত-আতর আলী শেখ	সাং-কচুয়া, ফকিরহাট, বাগেরহাট	
৮৯০	০১/২০১০-১১	পরিমল কুমার দাশ পিতা-মৃত-গোপাল চন্দ্র দাশ	সাং-মাসকাটা,ফকিরহাট, বাগেরহাট	
৮৯১	০১/২০১০-১১	মোঃ নজরুল ইসলাম ইজারাদার পিতা-মৃত-রাশেদ ইজারাদার	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৮৯২	০১/২০১০-১১	আঃ মজিদ ইজারাদার পিতা-মৃত-রাশেদ ইজারাদার	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৮৯৩	০১/২০১০-১১	আঃ ছাত্তার ইজারাদার পিতা-মৃত-রাশেদ ইজারাদার	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৮৯৪	০১/২০১০-১১	আজিজুল ইজারাদার পিতা-মৃত-রাশেদ ইজারাদার	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৮৯৫	০১/২০১০-১১	তাছলিমা বেগম পিতা-মৃত-রাশেদ ইজারাদার	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৮৯৬	০১/২০১০-১১	শেখ মোঃ তারিকুল ইসলাম পিতা-মৃত-শেখ মোঃ আব্দুর রশিদ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৯৭	০১/২০১০-১১	মিসেস তাজকারা খানম পিতা-মৃত-শেখ মোঃ আব্দুর রশিদ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৯৮	০১/২০১০-১১	বদরুজাহান পিতা-মৃত-শেখ মোঃ আব্দুর রশিদ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৯৯	০১/২০১০-১১	তাহমিনা হক কুমকুম পিতা-মৃত-শেখ মোঃ আব্দুর রশিদ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৯০০	০১/২০১০-১১	মোঃ মোস্তাফিজুর রহমান পিতা-মাওঃ মতলুব হোসাইন	সাং-কদমদী,রামপাল, বাগেরহাট	
৯০১	০১/২০১০-১১	মোঃ মতুল হোসাইন পিতা-মৃত-হাজী ফয়েজ উদ্দিন	সাং-কদমদী,রামপাল, বাগেরহাট	
৯০২	০১/২০১০-১১	আব্দুল ওহাব শেখ পিতা-মৃত-ফয়েজ উদ্দিন	সাং-কদমদী,রামপাল, বাগেরহাট	
৯০৩	০১/২০১০-১১	মাসুদা বেগম জং-মাওঃ মতলুব হোসাইন	সাং-কদমদী,রামপাল, বাগেরহাট	
৯০৪	০১/২০১০-১১	মোসাঃ মাহমুদা বেগম জং-আব্দুলাহীল মারুফ	সাং-কদমদী,রামপাল, বাগেরহাট	
৯০৫	০১/২০১০-১১	মরিয়ম বেগম জং-মৃত-বরকতুল্যা শেখ	সাং-কদমদী,রামপাল, বাগেরহাট	
৯০৬	০১/২০১০-১১	সৈয়েদুর রহমান শেখ পিতা-মৃত-সোলায়মান শেখ	সাং-বর্ণি,রামপাল, বাগেরহাট	
৯০৭	০১/২০১০-১১	মোসাঃ নুর জাহান বেগম পিতা-মৃত-সোলায়মান শেখ	সাং-বর্ণি,রামপাল, বাগেরহাট	
৯০৮	০১/২০১০-১১	মোসাঃ রেজমিন বেগম জং-মৃত-সোলায়মান শেখ	সাং-বর্ণি,রামপাল, বাগেরহাট	
৯০৯	০১/২০১০-১১	মোসাঃ মঞ্জুয়ারা বেগম	সাং-বর্ণি,রামপাল, বাগেরহাট	

		পিতা-মৃত-শুকলাল দাশ		
৮৪৫	০১/২০১০-১১	সুনিল কুমার দাশ পিতা-মৃত-শুকলাল দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৪৬	০১/২০১০-১১	সুরেশ চন্দ দাশ পিতা-মৃত-শুকলাল দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৪৭	০১/২০১০-১১	জীবন কৃষ্ণ দাশ পিতা-মৃত-শুকলাল দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৪৮	০১/২০১০-১১	স্বপন কুমার দাশ পিতা-মৃত-শুকলাল দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৪৯	০১/২০১০-১১	বিশ্বজিত দাশ পিতা-অনিল কৃষ্ণ দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৫০	০১/২০১০-১১	বিষ্ণুপদ দাশ পিতা-অনিল কৃষ্ণ দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৫১	০১/২০১০-১১	অচিন্ত কুমার দাশ পিতা-মৃত-লক্ষিকান্ত দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৫২	০১/২০১০-১১	কালি দাশ দাশ পিতা-মৃত-মতিলাল দাশ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৮৫৩	০১/২০১০-১১	শীলা রাণী দাশ জং-কালি দাশ দাশ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৮৫৪	০১/২০১০-১১	আ, ন, ম কুদ্দুস শেখ পিতা-মৃত-জোহর আলী শেখ	সাং-বড়শুভদিয়া, ফকিরহাট, বাগেরহাট	
৮৫৫	০১/২০১০-১১	আমজাদ হোসেন পিতা-মৃত-সিরাজ উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৫৬	০১/২০১০-১১	নির্মল কুমার দাশ পিতা-মৃত-গোপাল চন্দ্র দাশ	সাং-মাসকাটা, ফকিরহাট, বাগেরহাট	
৮৫৭	০১/২০১০-১১	মোসা তারিকা বেগম জং-মোঃ আবুল হোসেন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৫৮	০১/২০১০-১১	ফজলুল হক পিতা-মৃত সৈয়েদুর রহমান	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৫৯	০১/২০১০-১১	মোসাঃ হামিদা বেগম পিতা-মৃত সৈয়েদুর রহমান	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৬০	০১/২০১০-১১	রাজিয়া ইসলাম পিতা-মৃত সৈয়েদুর রহমান	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৬১	০১/২০১০-১১	মোসাঃ ফরিদা বেগম জং-মৃত সৈয়েদুর রহমান	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৬২	০১/২০১০-১১	মোঃ আব্দুর রশিদ শেখ পিতা-মৃত বরকতুল্যা শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৬৩	০১/২০১০-১১	হোসনেয়ারা বেগম জং-মৃত-আলাল উদ্দিন শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৮৬৪	০১/২০১০-১১	মোঃ শেখ সাদী পিতা-মৃত-আলাল উদ্দিন শেখ	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৮৬৫	০১/২০১০-১১	নুরানী বেগম স্বামী -মোঃ সেলিম রেজা	সাং-আদাঘাট, রামপাল, বাগেরহাট	
৮৬৬	০১/২০১০-১১	শ, ম আনছার উদ্দিন পিতা-মৃত এশার উদ্দিন শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৬৭	০১/২০১০-১১	শেখ মোঃ সামছুর রহমান পিতা-মৃত এশার উদ্দিন শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৬৮	০১/২০১০-১১	মোঃ মুনছুর আলী গাজী পিতা-মৃত ইনছান	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৬৯	০১/২০১০-১১	মোঃ ওবায়দুল্লাহ গাজী পিতা-মৃত এনছান	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৭০	০১/২০১০-১১	সেলিনা বেগম পিতা-মৃত এশার উদ্দিন শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৭১	০১/২০১০-১১	কুলসুম বেগম জং-মৃত মোখলেচ উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৭২	০১/২০১০-১১	আলী আকবর শেখ পিতা-মৃত মোখলেচ উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৭৩	০১/২০১০-১১	মাফুজা বেগম পিতা-মৃত মোখলেচ উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৭৪	০১/২০১০-১১	হাফিজা বেগম পিতা-মৃত মোখলেচ উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৭৫	০১/২০১০-১১	সাকিরা বেগম পিতা-মৃত মোখলেচ উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮৭৬	০১/২০১০-১১	লাখি বেগম পিতা-মৃত মোখলেচ উদ্দিন	সাং-বর্ণি, রামপাল, বাগেরহাট	

৮১২	০১/২০১০-১১	মোঃ মনিরুল ইসলাম পিতা-মৃত-মোঃ মোমতাজুল করিম	সাং-৭৩ নং খানজাহান আলী রোড, খুলনা	
৮১৩	০১/২০১০-১১	মোসাঃ নিলুফার বুন পিতা-মৃত-মোঃ মোমতাজুল করিম	সাং-৭৩ নং খানজাহান আলী রোড, খুলনা	
৮১৪	০১/২০১০-১১	মোসাঃ জোবায়দা পারভীন(শিলু) পিতা-মৃত-মোঃ মোমতাজুল করিম	সাং-৭৩ নং খানজাহান আলী রোড, খুলনা	
৮১৫	০১/২০১০-১১	তাজকারা খাতুন জং-মোঃ নিজাম উদ্দিন	সাং-দিলখোলা রোড, খুলনা	
৮১৬	০১/২০১০-১১	মোঃ নিজাম উদ্দিন শেখ পিতা-মৃত মোঃ মানদার আলী শেখ	সাং-দিলখোলা রোড, খুলনা	
৮১৭	০১/২০১০-১১	হরেন্দ্র নাথ দাশ পিতা-মৃত-সতীশ চন্দ্র দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮১৮	০১/২০১০-১১	শ্যামল কুমার দাশ পিতা-মৃত-সুনীল কুমার দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮১৯	০১/২০১০-১১	শুভেন্দ্র কুমার দাশ পিতা-মৃত-সুনীল কুমার দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮২০	০১/২০১০-১১	কৃষ্ণা দাশ স্বামী-মাণষ দাশ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৮২১	০১/২০১০-১১	উমা দাশ জং-গোবিন্দ চন্দ্র দাশ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৮২২	০১/২০১০-১১	গোপাল দাশ পিতা-মৃত-সুরেন্দ্র নাথ দাশ	সাং-রণজিতপুর, বাগেরহাট সদর	
৮২৩	০১/২০১০-১১	সুব্রত দাশ পিতা-মৃত-মনিলাল দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮২৪	০১/২০১০-১১	অঞ্জন কুমার দাশ পিতা-মৃত-রবীন্দ্র নাথ দাশ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৮২৫	০১/২০১০-১১	মোঃ অলিউল্লাহ শেখ পিতা-মৃত-সহিদুল্লা শেখ	সাং-বর্ণি , রামপাল, বাগেরহাট	
৮২৬	০১/২০১০-১১	মোঃ আসাফ শেখ পিতা-সহিদুল্লা শেখ	সাং-বর্ণি , রামপাল, বাগেরহাট	
৮২৭	০১/২০১০-১১	বিদ্যুৎ দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮২৮	০১/২০১০-১১	মুকুল কুমার দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮২৯	০১/২০১০-১১	অচিন্ত কুমার হালদার পিতা-মৃত-মনিলাল হালদার	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮৩০	০১/২০১০-১১	মনিলাল দাশ পিতা-মৃত-অশ্বিনী কুমার দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮৩১	০১/২০১০-১১	রবীন্দ্র নাথ দাশ পিতা-মৃত-অশ্বিনী কুমার দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮৩২	০১/২০১০-১১	অমর দাশ পিতা-মৃত-অশ্বিনী কুমার দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮৩৩	০১/২০১০-১১	নির্মল দাশ পিতা-মৃত-অশ্বিনী কুমার দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮৩৪	০১/২০১০-১১	গৌতম কুমার দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৮৩৫	০১/২০১০-১১	মোসাঃ ফিরোজা বেগম পিতা-আঃ খালেক শেখ	সাং-গোবিন্দপুর, রামপালা, বাগেরহাট	
৮৩৬	০১/২০১০-১১	নারায়ন চন্দ্র দাশ পিতা-মৃত-পুলিন বিহারী দাশ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৮৩৭	০১/২০১০-১১	অশোক কুমার দাশ পিতা-মৃত-পুলিন বিহারী দাশ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৮৩৮	০১/২০১০-১১	অসীম কুমার দাশ পিতা-মৃত-পুলিন বিহারী দাশ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৮৩৯	০১/২০১০-১১	অসিৎ কুমার দাশ পিতা-মৃত-পুলিন বিহারী দাশ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৮৪০	০১/২০১০-১১	কালি দাশ দাশ পিতা-মৃত-মতিলাল দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৪১	০১/২০১০-১১	মুকুন্দ দাশ পিতা-মৃত-মতিলাল দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৪২	০১/২০১০-১১	হরিদাশ দাশ পিতা-মৃত-মতিলাল দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৪৩	০১/২০১০-১১	অনিল কৃষ্ণ দাশ পিতা-মৃত-দূর্গা চরণ দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	
৮৪৪	০১/২০১০-১১	অনিল কৃষ্ণ দাশ	সাং বেতাগা, ফকিরহাট, বাগেরহাট	

		পিতা-মৃত পরিমল দাশ		
৭৮০	০১/২০১০-১১	দিপ্ত দাশ পিতা-মৃত যতিন্দ্র নাথ দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৭৮১	০১/২০১০-১১	বিকাশ চন্দ্র দাশ পিতা-মৃত শচীন্দ্র নাথ দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৭৮২	০১/২০১০-১১	নির্মল দেব নাথ পিতা-মৃত অটল বিহারী দেবনাথ	সাং-ষাটতলা, ফকিরহাট, বাগেরহাট	
৭৮৩	০১/২০১০-১১	তপন দাশ পিতা-মৃত মনিলাল দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৭৮৪	০১/২০১০-১১	অসীম কুমার দাশ পিতা-রবীন্দ্র নাথ দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৭৮৫	০১/২০১০-১১	মোঃ মহোর আলী পিতা-মৃত আব্দুল ইজারাদার	সাং-কালেখারবেড়, রামপাল, বাগেরহাট	
৭৮৬	০১/২০১০-১১	স্বপন কুমার দাশ পিতা-মৃত মতিলল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৭৮৭	০১/২০১০-১১	চিত্ত রঞ্জন দাশ পিতা-মৃত মতিলল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৭৮৮	০১/২০১০-১১	মুরারী মোহন দাশ পিতা-মৃত মতিলল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৭৮৯	০১/২০১০-১১	মুকুন্দ কুমার দাশ পিতা-মৃত মতিলল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৭৯০	০১/২০১০-১১	বিষ্ণু পদ দাশ পিতা-মৃত মতিলল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৭৯১	০১/২০১০-১১	শীব পদ দাশ পিতা-মৃত মতিলল দাশ	সাং-সুনগর, বাগেরহাট সদর	
৭৯২	০১/২০১০-১১	আবুল বাশার মলি□ক পিতা-মৃত গোলাম রব্বানী মলি□ক	সাং-বর্ণি, রামপাল, বাগেরহাট	
৭৯৩	০১/২০১০-১১	মোসাঃ জেসমিন আরা রঞ্জু জং-মলি□ক মিজানুর রহমান	সাং-সন্তোষপুর, রামপাল, বাগেরহাট।	
৭৯৪	০১/২০১০-১১	মোঃ সুলতান আহম্মেদ শেখ পিতা-মৃত মোঃ আইজদ্দিন শেখ	সাং-সোনাডাঙ্গা, বাগেরহাট সদর	
৭৯৫	০১/২০১০-১১	মোঃ আঃ জলিল শেখ পিতা-মৃত রাশেদ শেখ	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
৭৯৬	০১/২০১০-১১	মোসাঃ সেলিনা খাতুন পিতা-মৃত রাশেদ শেখ	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
৭৯৭	০১/২০১০-১১	মোসাঃ তাছলিমা খাতুন পিতা-মৃত রাশেদ শেখ	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
৭৯৮	০১/২০১০-১১	মোসাঃ তছলিমা খাতুন পিতা-মৃত রাশেদ শেখ	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
৭৯৯	০১/২০১০-১১	আব্দুল জলিল ইজারাদার পিতা-মৃত আঃ গফুর ইজারাদার	সাং-বেলাই, রামপাল, বাগেরহাট	
৮০০	০১/২০১০-১১	মিলন কান্তি দাশ পিতা-মৃত হরিপদ দাশ	সাং-২৮৬ হাজী ইসমাইল রোড, খুলনা	
৮০১	০১/২০১০-১১	গোলক চন্দ্র দাশ পিতা-মৃত হরিপদ দাশ	সাং-২৮৬ হাজী ইসমাইল রোড, খুলনা	
৮০২	০১/২০১০-১১	অহিন্দ্র কুমার দাশ পিতা-মৃত হরিপদ দাশ	সাং-২৮৬ হাজী ইসমাইল রোড, খুলনা	
৮০৩	০১/২০১০-১১	অলোক কুমার দাশ পিতা-মৃত হরিপদ দাশ	সাং-২৮৬ হাজী ইসমাইল রোড, খুলনা	
৮০৪	০১/২০১০-১১	শ, ম খলিলুর রহমান পিতা-মৃত মোঃ কেয়াম উদ্দিন	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
৮০৫	০১/২০১০-১১	মোজাম্মেল হক পিতা-মৃত সৈয়দ আলী গাজী	সাং-শিয়ালী, বটিয়াঘাটা, খুলনা।	
৮০৬	০১/২০১০-১১	মোঃ খোরশেদ আলম শেখ পিতা-মৃত মোঃ ওমর আলী শেখ	সাং-বর্ণি, রামপাল, বাগেরহাট	
৮০৭	০১/২০১০-১১	মোঃ মোস্তাক আহামেদ পিতা-মৃত আঃ গফুর সরদার	সাং-মাছুয়াডাঙ্গা, রূপসা, খুলনা	
৮০৮		নুরুন নাহার জং-মৃত-আঃ গফুর সরদার	সাং-মাছুয়াডাঙ্গা, রূপসা, খুলনা	
৮০৯	০১/২০১০-১১	মোঃ সাইফুল ইসলাম পিতা-মৃত-মোঃ মোমতাজুল করিম	সাং-৭৩ নং খানজাহান আলী রোড, খুলনা	
৮১০	০১/২০১০-১১	মোঃ কামর□ল ইসলাম পিতা-মৃত-মোঃ মোমতাজুল করিম	সাং-৭৩ নং খানজাহান আলী রোড, খুলনা	
৮১১	০১/২০১০-১১	মোঃ শরিফুল ইসলাম পিতা-মৃত-মোঃ মোমতাজুল করিম	সাং-৭৩ নং খানজাহান আলী রোড, খুলনা	

৭৪৭	০১/২০১০-১১	শিরিনা বেগম পিতা-মৃত হাতেম আলী	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৪৮	০১/২০১০-১১	পারভীন বেগম পিতা-মৃত হাতেম আলী	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৪৯	০১/২০১০-১১	আলেয়া বেগম জং-মৃত হাতেম আলী	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৫০	০১/২০১০-১১	জেলেখা বিবি জং-হেমায়েত উদ্দিন	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৫১	০১/২০১০-১১	রাশিদা খাতুন জংআব্দু হামিদ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৭৫২	০১/২০১০-১১	আমেনা খাতুন স্বমী-সৈয়দ আলী গাজী	সাং-শুভদিয়া, ফকিরহাট, বাগেরহাট	
৭৫৩	০১/২০১০-১১	সিনিয়ারা বেগম জং-মোঃ মাহামুদ শেখ	সাং-ধনপোতা, ফকিরহাট, বাগেরহাট	
৭৫৪	০১/২০১০-১১	নুর জাহান বেগম পিতা-মৃত-আব্দুল জব্বার শেখ	সাং-ধনপোতা, ফকিরহাট, বাগেরহাট	
৭৫৫	০১/২০১০-১১	ফুলজান বেগম পিতা-মৃত-আব্দুল জব্বার শেখ	সাং-ধনপোতা, ফকিরহাট, বাগেরহাট	
৭৫৬	০১/২০১০-১১	মোসাঃ সুরাইয়া বেগম জং-মোঃ হাবিবুর রহমান	সাং-ভান্ডারকোট, বটিয়াঘাটা, খুলনা	
৭৫৭	০১/২০১০-১১	আব্দুল মান্নান বিশ্বাস পিতা-মৃত বারিক বিশ্বাস	সাং-ভান্ডারকোট, বটিয়াঘাটা, খুলনা	
৭৫৮	০১/২০১০-১১	মিসেস নাজনীনা খানম পিতা-মৃত বারিক বিশ্বাস	সাং-ভান্ডারকোট, বটিয়াঘাটা, খুলনা	
৭৫৯	০১/২০১০-১১	সুকিরা বেগম পিতা-মৃত বারিক বিশ্বাস	সাং-ভান্ডারকোট, বটিয়াঘাটা, খুলনা	
৭৬০	০১/২০১০-১১	হাসিনা বেগম পিতা-মৃত বারিক বিশ্বাস	সাং-ভান্ডারকোট, বটিয়াঘাটা, খুলনা	
৭৬১	০১/২০১০-১১	রিনু বেগম পিতা-মৃত বারিক বিশ্বাস	সাং-ভান্ডারকোট, বটিয়াঘাটা, খুলনা	
৭৬২	০১/২০১০-১১	ফাহিমা বেগম পিতা-মৃত বারিক বিশ্বাস	সাং-ভান্ডারকোট, বটিয়াঘাটা, খুলনা	
৭৬৩	০১/২০১০-১১	মিসেস ছায়রা বেগম জং-আঃ বারিক বিশ্বাস	সাং-ভান্ডারকোট, বটিয়াঘাটা, খুলনা	
৭৬৪	০১/২০১০-১১	রেহানা পারভীন জং-মোঃ ইয়াছিন মল্লিক	সাং-ভান্ডারকোট, বটিয়াঘাটা, খুলনা	
৭৬৫	০১/২০১০-১১	ছকো মোল্লা তা-মৃত-মফেজ মোল্লা	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
৭৬৬	০১/২০১০-১১	মোঃ নুর শেখ পিতা-মৃত উতার উদ্দিন	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৬৭	০১/২০১০-১১	মোঃ মোজাফ্ফর শেখ পিতা-মৃত উতার উদ্দিন শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৬৮	০১/২০১০-১১	নাহার বেগম স্বামী-মোজাফ্ফর শেখ	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৬৯	০১/২০১০-১১	মোঃ সুলতান আলী পিতা-মৃত মোঃ ইখতার উদ্দিন	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৭০	০১/২০১০-১১	মোঃ ফজর শেখ পিতা-মৃত মোঃ ইখতার উদ্দিন	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৭১	০১/২০১০-১১	মোঃ কাওছার আলী পিতা-মৃত মোঃ ইখতার উদ্দিন	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৭২	০১/২০১০-১১	নাছিমা বেগম পিতা-মৃত মোঃ ইখতার উদ্দিন	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৭৩	০১/২০১০-১১	মোঃ মনির হোসেন পিতা-মৃত মোঃ আব্দুল শেখ	সাং-কাপাশডাঙ্গা, রামপাল, বাগেরহাট	
৭৭৪	০১/২০১০-১১	শেখ মোস্তাব হোসেন পিতা-মৃত আব্দুল মান্নান	সাং-উত্তর গৌরম্ভা, রামপাল, বাগেরহাট	
৭৭৫	০১/২০১০-১১	শেখ মোস্তাইন হোসেন পিতা-মৃত আব্দুল মান্নান	সাং-উত্তর গৌরম্ভা, রামপাল, বাগেরহাট	
৭৭৬	০১/২০১০-১১	মোঃ আবুল কাশেম পিতা-মোঃ সমশের আলী	সাং-কদমদী, রামপাল, বাগেরহাট	
৭৭৭	০১/২০১০-১১	চিত্ত রঞ্জন দাশ পিতা-মৃত যতিন্দ্র নাথ দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৭৭৮	০১/২০১০-১১	দিপঙ্কর দাশ পিতা-মৃত যতিন্দ্র নাথ দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	
৭৭৯	০১/২০১০-১১	ধীমান দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট	

৭১৫	০১/২০১০-১১	মীর মোস্তফা আবু দাউদ পিতা-মৃত-মী মোঃ সুন্দর আলী	সাং-৪৬ হাজী রহমত আলী সড়ক পশ্চিম টুটপাড়া, খুলনা	
৭১৬	০১/২০১০-১১	মোঃ মাজেদ শেখ পিতা-মৃত-জহুর আলী শেখ	সাং-বড়শুভদিয়া, ফকিরহাট,বাগেরহাট।	
৭১৭	০১/২০১০-১১	শামিম আক্তার পিতা-আব্দুর রশিদ শেখ	সাং-বড়শুভদিয়া, ফকিরহাট,বাগেরহাট।	
৭১৮	০১/২০১০-১১	আব্দু আজম শেখ পিতা-মৃত-জোহর আলী শেখ	সাং-বড়শুভদিয়া, ফকিরহাট,বাগেরহাট।	
৭১৯	০১/২০১০-১১	এস, এম আঃ রব পিতা-মৃত-আলহাজ জোহর আলী শেখ	সাং-ছোটশুভদিয়া, ফকিরহাট,বাগেরহাট	
৭২০	০১/২০১০-১১	ফাহিমা আক্তার পিতা-মৃত আঃ বারিক বিশ্বাস	সাং-কুলটিয়া, বটিয়াঘাটা, খুলনা	
৭২১	০১/২০১০-১১	নাজনিন খানম পিতা-মৃত আঃ বারিক বিশ্বাস	সাং-কুলটিয়া, বটিয়াঘাটা, খুলনা	
৭২২	০১/২০১০-১১	হাসিনা বেগম পিতা-মৃত আঃ বারিক বিশ্বাস	সাং-কুলটিয়া, বটিয়াঘাটা, খুলনা	
৭২৩	০১/২০১০-১১	রিনু বেগম পিতা-মৃত আঃ বারিক বিশ্বাস	সাং-কুলটিয়া, বটিয়াঘাটা, খুলনা	
৭২৪	০১/২০১০-১১	ছায়েরা বেগম জং-মৃত আঃ বারিক বিশ্বাস	সাং-কুলটিয়া, বটিয়াঘাটা, খুলনা	
৭২৫	০১/২০১০-১১	কাজী আসাফুজ্জামান পিতা-কাজী আছর উদ্দিন	সাং-চাঁদপুর, রামপাল, বাগেরহাট	
৭২৬	০১/২০১০-১১	কাজী আসাদুজ্জামান পিতা-কাজী আছর উদ্দিন	সাং-চাঁদপুর, রামপাল, বাগেরহাট	
৭২৭	০১/২০১০-১১	কাজী আহসানুজ্জামান পিতা-কাজী আছর উদ্দিন	সাং-চাঁদপুর, রামপাল, বাগেরহাট	
৭২৮	০১/২০১০-১১	শ, ম শওকত রেজা পিতা-মৃত মেহের উদ্দিন	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭২৯	০১/২০১০-১১	এমারত আলী পিতা-মৃত-মেছের উদ্দিন শেখ	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩০	০১/২০১০-১১	জান্নাতুল ফেরদৌসী জং-মেজবাহ উদ্দিন শেখ মুক্ত	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩১	০১/২০১০-১১	মোহন মেখ পিতা-আনোয়ার শেখ	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩২	০১/২০১০-১১	শ, ম আব্দুর রব পিতা-মৃত মোঃ আব্দুর জব্বার	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩৩	০১/২০১০-১১	শ, ম রিজাউল করিম পিতা-মৃত মোঃ আব্দুর জব্বার	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩৪	০১/২০১০-১১	মিজানুর রহমান পিতা-মৃত মোঃ আব্দুর জব্বার	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩৫	০১/২০১০-১১	মোসাঃ সামছুন্নাহার পিতা-মৃত মোঃ আব্দুর জব্বার	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩৬	০১/২০১০-১১	মোসাঃ জাহানারা পিতা-মৃত মোঃ আব্দুর জব্বার	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩৭	০১/২০১০-১১	মোসাঃ নাজনিন পিতা-মৃত মোঃ আব্দুর জব্বা	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩৮	০১/২০১০-১১	মনির ল ইসলাম পিতা মৃত মোঃ খোরশেদ	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৩৯	০১/২০১০-১১	জাহানারা বেগম জং-মৃত খোরশেদ আলম	সাং-প্রসাদনগর, রামপাল, বাগেরহাট	
৭৪০	০১/২০১০-১১	মোঃ আকবর আলী পিতা-মৃত আঃ মালেক	সাং-গোবিন্দপুর, রামপাল, বাগেরহাট	
৭৪১	০১/২০১০-১১	হোসনে আরা বিলকিস পিতা-মোঃ আকবর আলী	সাং-গোবিন্দপুর, রামপাল, বাগেরহাট	
৭৪২	০১/২০১০-১১	মোঃ আব্দুল জহুর ফকির পিতা-মৃত মোঃ করিম ফকির	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৪৩	০১/২০১০-১১	মোঃ আব্দুল শহিদ ফকির পিতা-মৃত.মোঃ করিম ফকির	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৪৪	০১/২০১০-১১	এম, এম হান্নান পিতা-মৃত হাতেম আলী	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৪৫	০১/২০১০-১১	মোঃ ফরহাদ হোসেন পিতা-মৃত হাতেম আলী	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	
৭৪৬	০১/২০১০-১১	এস, এম মুরাদ হোসেন পিতা-মৃত হাতেম আলী	সাং-চাকুলী, ফকিরহাট, বাগেরহাট	

		পিতা-মৃত-আঃ জব্বার শেখ	উপজেলা-ফকিরহাট, বাগেরহাট	
৬৮৪	০১/২০১০-১১	আঃ হামিদ শেখ পিতা-মৃত-আঃ জব্বার শেখ	সাং-ধনপোতা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৮৫	০১/২০১০-১১	আকলিমা বেগম পিতা-মৃত-আঃ জব্বার শেখ	সাং-ধনপোতা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৮৬	০১/২০১০-১১	লোক রঞ্জন পাল পিতা-মৃত অধীর কুমার পাল	সাং-কিসমত ভট্ট উপজেলা-বাগেরহাট সদর	
৬৮৭	০১/২০১০-১১	সুজিত কুমার রায় পিতা-মৃত-রশিক রায়	সাং-সুখদাড়া উপজেলা-বটিয়াঘাটা, খুলনা	
৬৮৮	০১/২০১০-১১	শ্যামল কুমার দাশ পিতা-মৃত সুনীল কুমার দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৮৯	০১/২০১০-১১	সুভেন্দ্র কুমার দাশ পিতা-মৃত-সুনীল কুমার দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৯০	০১/২০১০-১১	রোকেয়া বেগম জং-মৃত-আঃ কাদের শেখ	সাং-শহীদ সোহরাওয়ার্দী কলেজ রোড, বাইলেন, সোনাডাঙ্গা, খুলনা।	
৬৯১	০১/২০১০-১১	মোসাঃ কামরুন্নেছা বেগম জং- মোঃ রশিদুল হাছানা	সাং-শহীদ সোহরাওয়ার্দী কলেজ রোড, বাইলেন, সোনাডাঙ্গা, খুলনা।	
৬৯২	০১/২০১০-১১	মেহেরুন নেছা বেগম জং-মোঃ মিশারুল ইসলাম	সাং-শহীদ সোহরাওয়ার্দী কলেজ রোড, বাইলেন, সোনাডাঙ্গা, খুলনা।	
৬৯৩	০১/২০১০-১১	সানজিদা শেখ(মহুয়া) পিতা-মৃত-আঃ কাদের শেখ	সাং-শহীদ সোহরাওয়ার্দী কলেজ রোড, বাইলেন, সোনাডাঙ্গা, খুলনা।	
৬৯৪	০১/২০১০-১১	মোঃ এনায়েত হোসেন পিতা-মৃত হাজী কায়েম আলী	সাং-৫১ নং জাহিদুর রহমান সড়ক, খুলনা।	
৬৯৫	০১/২০১০-১১	মোঃ এনায়েত হোসেন পিতা-মৃত হাজী কায়েম আলী	সাং-৫১ নং জাহিদুর রহমান সড়ক, খুলনা।	
৬৯৬	০১/২০১০-১১	মোঃ আয়ুব আলী গাজী পিতা-মৃত আমির আলী গাজী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, বাগেরহাট	
৬৯৭	০১/২০১০-১১	মোঃ ওমর আলী গাজী পিতা-মৃত আমির আলী গাজী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, বাগেরহাট	
৬৯৮	০১/২০১০-১১	মোসাঃ রহিমা বেগম জং-মোঃ আয়ুব আলী গাজী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, বাগেরহাট	
৬৯৯	০১/২০১০-১১	এস, এম আফতার উদ্দিন আপ্তাহী পিতা-মৃত বিরাজ উদ্দিন শেখ	সাং-বর্ণি উপজেলা-রামপাল, বাগেরহাট	
৭০০	০১/২০১০-১১	মোসাঃ তহমিনা বেগম জং-এস,এম আফতার উদ্দিন আপ্তাহী	সাং-বর্ণি উপজেলা-রামপাল, বাগেরহাট	
৭০১	০১/২০১০-১১	সরজিত কুমার দাশ পিতা-মৃত-অজিত দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, বাগেরহাট	
৭০২	০১/২০১০-১১	ধ্রুব দাশ পিতা-মৃত অজিত দাশ	সাং-ষাটতলা ফকিরহাট, বাগেরহাট।	
৭০৩	০১/২০১০-১১	মোসাঃ মাছুদা বুলবুল(বুলি) জং-মীর মোহাম্মাদ আলী	সাং-বর্ণি উপজেলা-রামপাল, বাগেরহাট	
৭০৪	০১/২০১০-১১	মীর মোহাম্মদ আলী পিতা-মৃত-নুর আলী	সাং-বর্ণি উপজেলা-রামপাল, বাগেরহাট	
৭০৫	০১/২০১০-১১	জায়েদা বেগম পিতা-মৃত-নুর আলী মীর	সাং-বর্ণি উপজেলা-রামপাল, বাগেরহাট	
৭০৬	০১/২০১০-১১	মোসাঃ জোহরা বেগম জং-মৃত-নুর আলী মীর	সাং-বর্ণি উপজেলা-রামপাল, বাগেরহাট	
৭০৭	০১/২০১০-১১	শ, ম ওবায়দুর রহমান পিতা-মৃত-আলহাজ্ব কায়েম আলী শেখ	সাং-৩৯ নং শামছুর রহমান রোড, খুলনা	
৭০৮	০১/২০১০-১১	মেসাঃ হালিমা খাতুন জং-মৃত শেখ নজিবুর রহমান	সাং-১১ নং বাবুখান রোড, খুলনা	
৭০৯	০১/২০১০-১১	শেখ রেজউর রহমান পিতা-মৃত-শেখ নজিবুর রহমান	সাং-১১ নং বাবুখান রোড, খুলনা	
৭১০	০১/২০১০-১১	মেজর শেখ নাজমুর রহমান পিতা-মৃত শেখ নজিবুর রহমান	সাং-১১ নং বাবুখান রোড, খুলনা	
৭১১	০১/২০১০-১১	মোঃ মোহসীন হোসেন শেখ পিতা-মোঃ আঃ জব্বার শেক	সাং-৭/৯নং লবনচোরা ইসলাম পাড়া, খুলনা	
৭১২	০১/২০১০-১১	গোবিন্দ কুমার পাল পিতা-মৃত-বিজয় কৃষ্ণ পাল	সাং-২১/১ মুন্সী পাড়া ১ম গলি, খুলনা।	
৭১৩	০১/২০১০-১১	গৌরপদ পাল পিতা-মৃত-বিজয় কৃষ্ণ পাল	সাং-২১/১ মুন্সী পাড়া ১ম গলি, খুলনা।	
৭১৪	০১/২০১০-১১	তুষার কান্তি পাল পিতা-মৃত-বিজয় কৃষ্ণ পাল	সাং-২১/১ মুন্সী পাড়া ১ম গলি, খুলনা।	

৬৫১	০১/২০১০-১১	মোঃ জাহার ইজারাদার পিতা-মৃত-ছকোতুল্যা ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৫২	০১/২০১০-১১	আনজিরা বেগম জং-মৃত-মোঃ হাদি ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৫৩	০১/২০১০-১১	জাহাঙ্গীর ইজারাদার পিতা-মৃত-মোঃ হাদি ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৫৪	০১/২০১০-১১	চামেলী বেগম পিতা-মৃত-মোঃ হাদি ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৫৫	০১/২০১০-১১	ছাবিনা বেগম পিতা-মৃত-মোঃ হাদি ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৫৬	০১/২০১০-১১	লাভলী বেগম পিতা-মৃত-মোঃ হাদি ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৫৭	০১/২০১০-১১	মোঃ এশার উদ্দিন সানা পিতা-মোঃ বারিক সানা	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, বাগেরহাট	
৬৫৮	০১/২০১০-১১	এস, এম জাহিদুজ্জামান(লাভলু) পিতা-মৃত-আমিন উদ্দিন শেখ	সাং-শিবনগর উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৫৯	০১/২০১০-১১	এস, এম কামরুজ্জামান পিতা-আলহাজ্ব আঃ মান্নান শেখ	সাং-শিবনগর উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৬০	০১/২০১০-১১	আলহাজ্ব আঃ মান্নান শেখ পিতা-মৃত-আমিন উদ্দিন শেখ	সাং-শিবনগর উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৬১	০১/২০১০-১১	মোসাঃ হাসনা হেনা স্বামী-কায়কোবাদ	সাং-কিসমত লক্ষীখোলা উপজেলা-বটিয়াঘাটা. খুলনা	
৬৬২	০১/২০১০-১১	শান্তি দাশ জং-মৃত-দরিকা নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৬৩	০১/২০১০-১১	শান্তি দাশ জং-মৃত-দরিকা নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৬৪	০১/২০১০-১১	অনুপম দাশ জং-মৃত-সচীপদ দাশ	সাং-৪নং সাউথসেন্টাল রোড, খুলনা	
৬৬৫	০১/২০১০-১১	দূর্গা রাণী দাশ জং-মৃত-নিমাই চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৬৬	০১/২০১০-১১	নারায়ন চন্দ্র দাশ পিতা-মৃত কনেক চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৬৭	০১/২০১০-১১	রীতিকা রাণী দাশ জং-মৃত-পিযুশ কান্তি দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৬৮	০১/২০১০-১১	রাখি দাশ পিতা-মৃত-পিযুশ কান্তি দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৬৯	০১/২০১০-১১	চুমকি দাশ পিতা-মৃত-পিযুশ কান্তি দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৭০	০১/২০১০-১১	কাজী আসাফুজ্জামান পিতা-মৃত-কাজী আছর উদ্দিন	সাং-চাঁদপুর উপজেলা-রামপাল, বাগেরহাট	
৬৭১	০১/২০১০-১১	জয়নাল শেখ পিতা-এমডি আঃ মজিদ শেখ	সাং-ভট্টবালিয়াঘাটা উপজেলা-বাগেরহাট সদর	
৬৭২	০১/২০১০-১১	এম, এ সোবহান পিতা-এমডি আঃ মজিদ শেখ	সাং-ভট্টবালিয়াঘাটা উপজেলা-বাগেরহাট সদর	
৬৭৩	০১/২০১০-১১	এমডি আঃ মজিদ শেখ পিতা-মৃত মোঃ কদম আলী শেখ	সাং-ভট্টবালিয়াঘাটা উপজেলা-বাগেরহাট সদর	
৬৭৪	০১/২০১০-১১	মোঃ আল আমিন ইজারাদার পিতা-মৃত-খলিল ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, বাগেরহাট	
৬৭৫	০১/২০১০-১১	মোঃ বিলাল ইজারাদার পিতা-মৃত-খলিল ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, বাগেরহাট	
৬৭৬	০১/২০১০-১১	মোঃ ফারুক ইজারাদার পিতা-মৃত-খলিল ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, বাগেরহাট	
৬৭৭	০১/২০১০-১১	ফরিদা বেগম জং-মৃত-খলিল ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, বাগেরহাট	
৬৭৮	০১/২০১০-১১	রোকেয়া বেগম জং-মৃত আঃ গফুর ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, বাগেরহাট	
৬৭৯	০১/২০১০-১১	সুভাষ চন্দ্র পাল পিতা-মৃত হরশিত চন্দ্র পাল	সাং-কিসমত ভট্ট উপজেলা-বাগেরহাট সদর	
৬৯০	০১/২০১০-১১	মোঃ বিল্লাল হোসেন মোল্লা পিতা-আব্দুল মালেক মোল্লা	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, বাগেরহাট	
৬৮১	০১/২০১০-১১	আব্দুল মালেক মোল্লা পিতা-মৃত ইমান উদ্দিন মোল্লা	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, বাগেরহাট	
৬৮২	০১/২০১০-১১	মোঃ আছর আলী শেখ পিতা-মৃত-আঃ জব্বার শেখ	সাং-ধনপোতা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৮৩	০১/২০১০-১১	আঃ রাজ্জাক শেখ	সাং-ধনপোতা	

		পিতা মৃঃ নটবর দাশ	উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১৯	০১/২০১০-১১	পুলক দাশ পিতা মৃঃ দারিকা নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২০	০১/২০১০-১১	মধু সুধন দাশ পিতা মৃঃ দারিকা নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২১	০১/২০১০-১১	দিপক কুমার দাশ পিতা-মৃত-হিরালাল দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২২	০১/২০১০-১১	সঞ্জয় কুমার দাস পিতা-মৃত-হিরালাল দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২৩	০১/২০১০-১১	সুব্রত কুমার দাশ পিতা-মৃত-নকুলেশ্বর দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২৪	০১/২০১০-১১	সুপ্রিয় কুমার দাশ পিতা-মৃত-নকুলেশ্বর দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২৫	০১/২০১০-১১	অলিপ কুমার দাশ পিতা-মৃত-অনুপ কুমার দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২৬	০১/২০১০-১১	ননি গোপাল দাশ পিতা-মৃত-ত্রৈলক্ষ নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২৭	০১/২০১০-১১	কৃষ্ণ পদ দাশ পিতা-মৃত-ত্রৈলক্ষ নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২৮	০১/২০১০-১১	অমুল কুমার দাশ পিতা-মৃত-বিপিন বিহারী দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬২৯	০১/২০১০-১১	মোঃ সেলিম জাহাঙ্গীর পিতা-লিয়াকত আলী শেখ	সাং-বর্ণি, উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৩০	০১/২০১০-১১	মোঃ লিয়াকত আলী শেখ পিতা-মৃত-মেছের শেখ	সাং-বর্ণি, উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৩১	০১/২০১০-১১	ফুরজাহান বেগম জং-মোঃ লিয়াকত আলী শেখ	সাং-বর্ণি, উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৩২	০১/২০১০-১১	আনোয়ারা খাতুন জং-মোহাম্মদ মুন্সী	সাং-বর্ণি, উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৩৩	০১/২০১০-১১	জুয়েল দাশ পিতা-মৃত কুমারেশ দাশ	সাং-সাটতলা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৩৪	০১/২০১০-১১	হরেন্দ্র নাথ দাশ পিতা-মৃত-সতীশ চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, বাগেরহাট	
৬৩৫	০১/২০১০-১১	মোঃ আকরাম হোসেন পিতা-মৃত-আজগর আলী	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৩৬	০১/২০১০-১১	মোঃ আজমল হোসেন পিতা-মৃত-আজগর আলী	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৩৭	০১/২০১০-১১	মোঃ আসলাম হোসেন পিতা-মৃত-আজগর আলী	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৩৮	০১/২০১০-১১	মোঃ আকবর হোসেন পিতা-মৃত-আজগর আলী	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৩৯	০১/২০১০-১১	নিরূপমা বেগম পিতা-মৃত-আজগর আলী	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৪০	০১/২০১০-১১	সুফিয়া বেগম পিতা-মৃত-আজগর আলী	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৪১	০১/২০১০-১১	মেহেদী হাছান পিতা-মৃত-শের আলী হাজরা	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৪২	০১/২০১০-১১	মোসাঃ রজিনা বেগম(ঝর্না) পিতা-মৃত-শের আলী হাজরা	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৪৩	০১/২০১০-১১	মোসাঃ রাজিয়া ইয়াসমিন পিতা-মৃত-শের আলী হাজর	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৪৪	০১/২০১০-১১	সৌমেন চক্রবর্তী পিতা-অলোক চক্রবর্তী	সাং-বেতাগা উপজেলা-ফকিরাহট, বাগেরহাট	
৬৪৫	০১/২০১০-১১	হিমাংশু রায় পিতা-মৃত-মনোহর রায়	সাং-কাপাশডাঙ্গা উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৪৬	০১/২০১০-১১	জিতেন্দ্র নাথ রায় পিতা-মৃত-মনোহর রায়	সাং-কাপাশডাঙ্গা উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৪৭	০১/২০১০-১১	মোঃ জাহার ইজারাদার পিতা-মৃত ছোকাতুল্যা ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৪৮	০১/২০১০-১১	মোঃ আনছার আলী পিতা-মৃত-ছকোতুল্যা ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৪৯	০১/২০১০-১১	মোঃ কাওছার আলী ইজারাদার পিতা-মৃত-ছকোতুল্যা ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	
৬৫০	০১/২০১০-১১	মোঃ নওশের আলী ইজারাদার পিতা-মৃত-ছকোতুল্যা ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপালা, জেলা-বাগেরহাট।	

৫৮৬	০১/২০১০-১১	এস, এম বদরুজ্জামান পিতা-মৃত আঃ মতলেব শেখ	সাং-৯ নং পৈপাড়া হাজী ইসমাইল লিংক রোড. সোনাডাঙ্গা. খুলনা	
৫৮৭	০১/২০১০-১১	এস, এম বদরুদোজা পিতা-এস, এম বদরুজ্জামান	সাং-৯ নং পৈপাড়া হাজী ইসমাইল লিংক রোড. সোনাডাঙ্গা. খুলনা	
৫৮৮	০১/২০১০-১১	নিয়াজ ফতেমা পিতা এস,এম বদরুজ্জামান	সাং-৯ নং পৈপাড়া হাজী ইসমাইল লিংক রোড. সোনাডাঙ্গা. খুলনা	
৫৮৯	০১/২০১০-১১	এস, এম মেহেদী বিল্লাহ পিতা-মৃত-ডাঃ আজমল হোসেন	সাং-৪১ নং সাউথসেন্ট্রাল রোড, খুলনা	
৫৯০	০১/২০১০-১১	মোঃ জাহিদি মিল্লা পিতা মৃঃ ডাঃ আজমল হোসেন	সাং-৪১ নং সাউথসেন্ট্রাল রোড, খুলনা	
৫৯১	০১/২০১০-১১	আবুদোজানা পিতা মৃঃ খায়রুল	সাং-৪১ নং সাউথসেন্ট্রাল রোড, খুলনা	
৫৯২	০১/২০১০-১১	আবু জাফর শেক পিতা-শমশের আলী শেখ	সাং-কদমদী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৯৩	০১/২০১০-১১	শাহিন শেখ পিতা-মৃত-নজরুল ইসলাম	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৯৪	০১/২০১০-১১	তুহিন শেখ পিতা মৃঃ নজরুল ইসলাম	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৯৫	০১/২০১০-১১	হাসান শেখ পিতা মৃঃ নজরুল ইসলাম	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৯৬	০১/২০১০-১১	হোসেন শেখ পিতা মৃঃ নজরুল ইসলাম	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৯৭	০১/২০১০-১১	জায়েদা বেগম জং মৃঃ নজরুল ইসলাম	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৯৮	০১/২০১০-১১	জাহানারা বেগম পিতা মৃঃ আশাদ আলী শেখ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৯৯	০১/২০১০-১১	মনিরা বেগম পিতা মৃঃ আশাদ আলী শেখ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০০	০১/২০১০-১১	মোঃ আলিমুন কবির শিমুল	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০১	০১/২০১০-১১	মোঃ ইমান হোসেন পলাশ পিতা মৃঃ নুর মহম্মদ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০২	০১/২০১০-১১	মর্জিনা বেগম জং মৃঃ নুর মহম্মদ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০৩	০১/২০১০-১১	মোতাহার হোসেন পিতা-মৃত-আপ্তাব উদ্দিন	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০৪	০১/২০১০-১১	জাফর শেখ পিতা মৃঃ আপ্তব উদ্দিন শেখ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০৫	০১/২০১০-১১	মোশারফ হোসেন পিতা মৃঃ আপ্তব উদ্দিন শেখ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০৬	০১/২০১০-১১	এস,এম জহুরুল হক পিতা মৃঃ আপ্তব উদ্দিন শেখ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০৭	০১/২০১০-১১	শরিফুল শেখ পিতা মৃঃ আপ্তব উদ্দিন শেখ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০৮	০১/২০১০-১১	বাবুল শেখ পিতা মৃঃ আপ্তব উদ্দিন শেখ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০৯	০১/২০১০-১১	হাজরা বেগম পিতা মৃঃ আপ্তব উদ্দিন শেখ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১০	০১/২০১০-১১	মোঃ কামাল হোসেন পিতা জহুর শেখ	সাং-কচুয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১১	০১/২০১০-১১	মান্নান শেখ পিতা-মৃত-ইনছান উদ্দিন শেখ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১২	০১/২০১০-১১	লুৎফর রহমান শেখ পিতা-মৃত-ইনছান উদ্দিন শেখ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১৩	০১/২০১০-১১	মোঃ মোজাফ্ফর শেখ পিতা-মৃত-ইনছান উদ্দিন শেখ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১৪	০১/২০১০-১১	আকলিমা বেগম পিতা-মৃত-ইনছান উদ্দিন শেখ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১৫	০১/২০১০-১১	সেলিনা বেগম পিতা-মৃত-ইনছান উদ্দিন শেখ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১৬	০১/২০১০-১১	জামিরা বেগম সর্ব পিং মৃঃ এনছান উদ্দিন শেখ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১৭	০১/২০১০-১১	অশোক কুমার দাশ পিতা-মৃত-নটবর দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১৮	০১/২০১০-১১	কালাচাঁদ দাশ	সাং-বেতাগা	

৫৫৩	০১/২০১০-১১	মোঃ মোশারেফ সানা পিতা-আঃ বারিক সানা	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৫৪	০১/২০১০-১১			
৫৫৫	০১/২০১০-১১	মোঃ আবুল বাশার সানা পিতা-আঃ বারিক সানা	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৫৬	০১/২০১০-১১			
৫৫৭	০১/২০১০-১১	মোঃ এশারদ্দিন সানা পিতা-আঃ বারিক সানা	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৫৮	০১/২০১০-১১	মোঃ কামাল হোসেন শেখ পিতা-আরশাদ আলী শেখ	সাং-কালিকা প্রসাদ রামপাল, বাগেরহাট	
৫৫৯	০১/২০১০-১১	আসাদুর রহমান শেখ পিতা-আরশাদ আলী শেখ	সাং-কালিকা প্রসাদ রামপাল, বাগেরহাট	
৫৬০	০১/২০১০-১১	মাসুদ করিম শেখ পিতা-আরশাদ আলী শেখ	সাং-কালিকা প্রসাদ রামপাল, বাগেরহাট	
৫৬১	০১/২০১০-১১	মোসাঃ রোকেয়া সুলতানা স্বামী মৃঃ কাজী মোঃ মিজানুর রহমান	সাং-শ্রীফলতলা রামপাল, বাগেরহাট	
৫৬২	০১/২০১০-১১	নাবালক কাজী জরিন রহমান মিম পিতা কাজি মিজানুর রহমান	সাং-শ্রীফলতলা রামপাল, বাগেরহাট	
৫৬৩	০১/২০১০-১১	কাজী ইউনুচ আলী পিতা মৃঃ জাকের আলী কাজী	সাং-শ্রীফলতলা রামপাল, বাগেরহাট	
৫৬৪	০১/২০১০-১১	আলেয়া বেগম জং কাজী ইউনুচ আলী	সাং-শ্রীফলতলা রামপাল, বাগেরহাট	
৫৬৫	০১/২০১০-১১	হাফেজ মোঃ সাইফুল আলম পিতা-মৃঃ মোঃ রুহুল আমীন শেখ	সাং-শংকর নগর রামপাল, বাগেরহাট	
৫৬৬	০১/২০১০-১১	লতিফা কামাল জং মোঃ মোস্তফা কামাল	সাং-চাকুলী ফকিরহাট বাগেরহাট	
৫৬৭	০১/২০১০-১১	মোসাঃ হাসিনা বেগম পিতা-মৃঃ মোঃ মুস্তাফিজুর রহমান	সাং-শংকর নগর রামপাল, বাগেরহাট	
৫৬৮	০১/২০১০-১১	মোসাঃ শাহীনা আক্তার ইাত পিতা-মৃঃ মোঃ বারিক বিশ্বাস	সাং-বটিয়াঘাটা, খুলনা,	
৫৬৯	০১/২০১০-১১	নাজমুন নাহার খুসবু পিতা-মৃঃ আঃ বারি বিশ্বাস	সাং-কুলাটিয়া উপজেলা-বটিয়াঘাটা,খুলনা	
৫৭০	০১/২০১০-১১	মনিরা পারীন স্বামী মল্লিক রফিকুল ইসলাম	সাং-বালিয়াডাঙ্গা ফকিরহাট, বাগেরহাট	
৫৭১	০১/২০১০-১১	ফিরোজা বেগম স্বামী লিয়াকত আলী গোলদার	সাং-চিত্রা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৭২	০১/২০১০-১১	মোসাঃ মানছুরা বেগম পিতা-মৃত-আলম হালদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৭৩	০১/২০১০-১১	নাজমা নাছরিন পিতা-মৃত-শেখ আঃ মান্নান	সাং-গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৭৪	০১/২০১০-১১	নাছিমা বেগম স্বামী-আশরাফ আলী শেখ	সাং-স্বল্প বাহিরদিয়া উপজেলা-রুপসা, জেলা-খুলনা	
৫৭৫	০১/২০১০-১১	রোকেয়া বেগম স্বামী-মোঃ আব্দুল কুদ্দুস শেখ	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৭৬	০১/২০১০-১১	আছমা বেগম স্বামী মৃত-শেখ মোহাম্মদ আলী	সাং-ঝনঝনিয়া উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৭৭	০১/২০১০-১১	আফরোজা পিতা মৃত-শেখ মোহাম্মদ আলী	সাং-ঝনঝনিয়া উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৭৮	০১/২০১০-১১	আমেনা খাতুন পিতা মৃত-শেখ মোহাম্মদ আলী	সাং-ঝনঝনিয়া উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৭৯	০১/২০১০-১১	মহিউদ্দিন শেখ পিতা-মৃত রেয়াজ উদ্দিন শেখ	সাং-আদাঘাট উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৮০	০১/২০১০-১১	সাহিদা খাতুন জং মৃঃ রফিকুল সরদার	সাং-আদাঘাট উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৮১	০১/২০১০-১১	রাবেয়া খাতুন জং মৃঃ এমান আলী	সাং-আদাঘাট উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৫৮২	০১/২০১০-১১	নিয়াজ ফতেমা পিতা এস,এম বদরুজ্জামান	সাং-৯ নং পৈপাড়া হাজী ইসমাইল লিংক রোড. সোনাডাঙ্গা. খুলনা।	
৫৮৩	০১/২০১০-১১	ওলিনুর নাহার জং এস,এম বদরুজ্জামান।	সাং-৯ নং পৈপাড়া হাজী ইসমাইল লিংক রোড. সোনাডাঙ্গা. খুলনা	
৫৮৪	০১/২০১০-১১	এস, এম বদরুজ্জামান পিতা-মৃত আঃ মতলেব শেখ	সাং-৯ নং পৈপাড়া হাজী ইসমাইল লিংক রোড. সোনাডাঙ্গা. খুলনা	
৫৮৫	০১/২০১০-১১	ওলিনুর নাহার জং এস,এম বদরুজ্জামান	সাং-৯ নং পৈপাড়া হাজী ইসমাইল লিংক রোড. সোনাডাঙ্গা. খুলনা	

৫২১	০১/২০১০-১১	মোসাঃ নুরজাহার বেগম জং-মৃত মোঃ আজিজ শেখ	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫২২	০১/২০১০-১১	নরোত্তম মজুমদার পিতা-মৃত-সুধির মজুমদার	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫২৩	০১/২০১০-১১	সুনিল কুমার দাশ পিতা-মৃত-নটবর দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫২৪	০১/২০১০-১১	উজ্জল কুমার দাশ পিতা-মৃত-শ্যামপল কুমার দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫২৫	০১/২০১০-১১	মোঃ মিজানুর রহমান পিতা-মৃত-মোঃ আঃ জব্বার শেখ	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫২৬	০১/২০১০-১১	হারান চন্দ্র রায় পিতা-মৃত-অভয় চরণ রায়	সাং-জিন্নপাড়া শিপইয়ার্ড খুলনা	
৫২৭	০১/২০১০-১১	তুষার কান্তি রায় পিতা-মৃত-অভয় চরণ রায়	সাং-জিন্নপাড়া শিপইয়ার্ড খুলনা	
৫২৮	০১/২০১০-১১	তুহিস কুমার রায় পিতা-মৃত-অভয় চরণ রায়	সাং-জিন্নপাড়া শিপইয়ার্ড খুলনা	
৫২৯	০১/২০১০-১১	শিশির কুমার রায় পিতা-মৃত-অভয় চরণ রায়	সাং-জিন্নপাড়া শিপইয়ার্ড খুলনা	
৫৩০	০১/২০১০-১১	অলোক দাশ পিতা-মৃত-অতুল দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫৩১	০১/২০১০-১১	মুকুন্দ মিস্ত্রী পিতা-মৃত-নিরোধ মিস্ত্রী	সাং-মইদাড়া উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৩২	০১/২০১০-১১	শ, ম আনছার উদ্দিন পিতা-মৃত-মোঃ এশার উদ্দিন শেখ	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৩৩	০১/২০১০-১১	আঃ ছালাম শেখ পিতা-মৃত-মোঃ মোসলেম শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৩৪	০১/২০১০-১১	সায়রা আক্তার পিতা মৃঃ আঃ ছালাম শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৩৫	০১/২০১০-১১	মোসাঃ জয়নব বিবি পিতা মৃঃ জোহর আলী ফরাজি	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৩৬	০১/২০১০-১১	মোঃ মাসুদ ফরাজি পিতা মৃঃ আজিজুর রহমান	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৩৭	০১/২০১০-১১	মোঃ শুকুর আলী ফরাজি পিতা মৃঃ জোহর আলী ফরাজি	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৩৮	০১/২০১০-১১	ঋষি কেশ দাশ পিতা-মৃত-জনার্ধন দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫৩৯	০১/২০১০-১১	মধুসুধন দাশ পিতা-মৃত-অতুল চন্দ্র দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট,জেলা-বাগেরহাট	
৫৪০	০১/২০১০-১১	মোঃ সাইদুর রহমান পিতা-মৃত-বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৪১	০১/২০১০-১১	মোঃ জমির আলী পিতা-মৃত-বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৪২	০১/২০১০-১১	মোঃ ছাদেক আলী পিতা-মৃত-বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৪৩	০১/২০১০-১১	মোঃ জহির উদ্দিন শেখ পিতা-মৃত-রহিম উদ্দিন শেখ	সাং-আদাঘাট উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৪৪	০১/২০১০-১১	নরায়ন চন্দ্র দাশ পিতা-মৃত-অতুল চন্দ্র দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫৪৫	০১/২০১০-১১	জগদিশ চন্দ্র দাশ পিতা-মৃত-দূর্গা দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫৪৬	০১/২০১০-১১	শ ম আব্দুর রব পিতা-মৃত-মোৎ আঃ জব্বার শেখ	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৪৭	০১/২০১০-১১	নাজমুল হুদা ইজারাদার পিতা-মৃত-রাহেন উদ্দিন ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৪৮	০১/২০১০-১১	ভানু বেগম ওরফে সাহারা পিতা-মৃত রাহেন উদ্দিন ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৪৯	০১/২০১০-১১	সাফিয়া বেগম পিতা মৃঃ রাহেন উদ্দিন	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৫০	০১/২০১০-১১	রাজিয়া খাতুন পিতা মৃঃ জিয়াদ আলী	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫৫১	০১/২০১০-১১	মোঃ রাসেল মোল্লা পিতা-আবু জাফর মোল্লা	সাং-২২ নং জিন্নাপাড়া উপজেলা-খুলনা সদর, জেলা-খুলনা	
৫৫২	০১/২০১০-১১	জাফর মোল্লা পিতা-এলাহি মোল্লা	সাং-২২ নং জিন্নাপাড়া উপজেলা-খুলনা সদর, জেলা-খুলনা	

		পিতা-মৃত-ফজর ঢালী	উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৮৯	০১/২০১০-১১	বিদ্যা দাশ পিতা-মৃত-কিরণ চন্দ্র দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট সদর, বাগেরহাট	
৪৯০	০১/২০১০-১১	মনিবর বাচাড় পিতা-মৃত-ঠাকুরদাশ বাচাড়	সাং-পারচালনা উপজেলা-দাকোপ, জেলা-খুলনা	
৪৯১	০১/২০১০-১১	গোবিন্দ বাছাড় পিতা-মৃত-ঠাকুরদাশ বাচাড়	সাং-পারচালনা উপজেলা-দাকোপ, জেলা-খুলনা	
৪৯২	০১/২০১০-১১	গৌতম বাছাড় পিতা-মৃত-ঠাকুরদাশ বাচাড়	সাং-পারচালনা উপজেলা-দাকোপ, জেলা-খুলনা	
৪৯৩	০১/২০১০-১১	হাবিবুর রহমান শেখ পিতা-মৃত-সৈয়দ আলী শেখ	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৯৪	০১/২০১০-১১	মহর আলী পিতা মৃঃ হরমত উল্লা শেখ	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৯৫	০১/২০১০-১১	মাহাবুবর রহমান পিতা মৃঃ সৈয়দ আলী	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৯৬	০১/২০১০-১১	লুৎফর রহমান পিতা মৃঃ সৈয়দ আলী	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৯৭	০১/২০১০-১১	আতাউর রহমান পিতা মৃত-সৈয়দ আলী	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৯৮	০১/২০১০-১১	কুলসুম বেগম পিতা মৃঃ সৈয়দ আলী	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৯৯	০১/২০১০-১১	হামিদা বেগম জং মহর আলী শেখ	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০০	০১/২০১০-১১	মোসাঃ ফাতেমা বেগম, জং হাবিবুর রহমান	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০১	০১/২০১০-১১	মোসাঃ জাহানারা বেগম জং মাহাবুবর রহমান	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০২	০১/২০১০-১১	নাছিমা বেগম জং লুৎফর রহমান	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০৩	০১/২০১০-১১	নিলুফা বেগম জং আতাউর রহমান	সাং-ধণপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০৪	০১/২০১০-১১	সুভাষ চন্দ্র রায় পিতা-মৃত-শরৎ চন্দ্র রায় চৌধুরী	সাং-তেকাটিয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০৫	০১/২০১০-১১	আঃ ওয়াদুদ মোড়ল পিতা-মৃত-বারেক মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০৬	০১/২০১০-১১	মোঃ রাজ্জাক মোড়ল পিতা-মৃত-বারেক মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০৭	০১/২০১০-১১	মোসাঃ জেসমিন বেগম পিতা-মৃত-বারেক মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০৮	০১/২০১০-১১	মোসাঃ পারভিন বেগম পিতা-মৃত-বারেক মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫০৯	০১/২০১০-১১	মোসাঃ তাছলিমা বেগম পিতা-মৃত-বারেক মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫১০	০১/২০১০-১১	মোসাঃ আয়শা বেগম জং মৃঃ বারেক মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫১১	০১/২০১০-১১	হাবিবুর রহমান মোড়ল পিতা-মৃত-মোঃ রাশেদ মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫১২	০১/২০১০-১১	মতিয়ার রহমান মোড়ল পিতা-মৃত-মোঃ রাশেদ মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫১৩	০১/২০১০-১১	জোহরা বেগম পিতা-মৃত-মোঃ রাশেদ মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫১৪	০১/২০১০-১১	ফাতেমা বেগম পিতা-মৃত-মোঃ রাশেদ মোড়ল	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫১৫	০১/২০১০-১১	মিহির কুমার দাশ পিতা-মৃত-বীরেন্দ্র নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫১৬	০১/২০১০-১১	শেখ শাহজাহান পিতা-মৃত মোঃ আজিজ শেখ	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫১৭	০১/২০১০-১১	মোসাঃ মাহেনুর বেগম পিতা-মৃত মোঃ আজিজ শেখ	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫১৮	০১/২০১০-১১	মোসাঃ কহিনুর বেগম পিতা-মৃত মোঃ আজিজ শেখ	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫১৯	০১/২০১০-১১	মোসাঃ শাহিনুর বেগম পিতা-মৃত মোঃ আজিজ শেখ	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৫২০	০১/২০১০-১১	মোসাঃ উম্মে নুর বেগম পিতা-মৃত মোঃ আজিজ শেখ	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	

৪৫৬	০১/২০১০-১১	আজাহার শেখ পিতা মৃঃ আঃ গফুর	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৫৭	০১/২০১০-১১	মোজঃহিদ শেখ পিতা মৃঃ আঃ গফুর	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৫৮	০১/২০১০-১১	রেহানা পিতা মৃঃ আঃ গফুর	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৫৯	০১/২০১০-১১	বিরানা পিতা মৃঃ আঃ গফুর	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৬০	০১/২০১০-১১	খুকু মনি পিতা মৃঃ আঃ গফুর	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৬১	০১/২০১০-১১	আয়তুন্নেছা জংমৃঃ আঃ গফুর	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৬২	০১/২০১০-১১	গোবিন্দ্র চন্দ্র দাশ পিতা-মৃত-লক্ষিকান্ত দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৬৩	০১/২০১০-১১	অনুকুল দাস পিতা-মৃত-লক্ষিকান্ত দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৬৪	০১/২০১০-১১	দেবাশিষ দাশ পিতা-মৃত-সতিশ চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৬৫	০১/২০১০-১১	মিহির কুমার দাস পিতা-মৃত-সতিশ চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৬৬	০১/২০১০-১১	আশিষ কুমার দাস পিতা-মৃত-সতিশ চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৬৭	০১/২০১০-১১	মিকাইল শেখ পিতা-গামাউন শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৬৮	০১/২০১০-১১	সুনিল কুমার দাশ পিতা-মৃত-বোমকেশ দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৬৯	০১/২০১০-১১	সুবোধ কুমার দাস পিতা-মৃত-বোমকেশ দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৭০	০১/২০১০-১১	সুজিত কুমার দাস পিতা-মৃত-বোমকেশ দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৭১	০১/২০১০-১১	সুরঞ্জন কুমার দাস পিতা-মৃত-বোমকেশ দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৭২	০১/২০১০-১১	স্বপন কুমার পাল পিতা-মৃত-সুরাজ চন্দ্র পাল	সাং-সৈয়দপুর উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৭৩	০১/২০১০-১১	সুফল কুমার পাল পিতা-মৃত-সুরাজ চন্দ্র পাল	সাং-সৈয়দপুর উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৭৪	০১/২০১০-১১	সুব্রত কুমার পাল পিতা-মৃত-সুরাজ চন্দ্র পাল	সাং-সৈয়দপুর উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৭৫	০১/২০১০-১১	মোঃ হাতেম আলী শেখ পিতা-আঃ মতলেব শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৭৬	০১/২০১০-১১	আব্দুর ছত্তার শেখ পিতা শরিয়তুল্লা শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৭৭	০১/২০১০-১১	নারায়ন চন্দ্র দাশ পিতা-মৃত-পুলিন বিহারী দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৭৮	০১/২০১০-১১	অশোক কুমার দাশ পিতা-মৃত-পুলিন বিহারী দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৭৯	০১/২০১০-১১	অসিম কুমার দাস পিতা-মৃত-পুলিন বিহারী দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৮০	০১/২০১০-১১	অসিৎ কুমার দাস পিতা-মৃত-পুলিন বিহারী দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৮১	০১/২০১০-১১	কুমারেশ চন্দ্র দাশ পিতা-মৃত-রবিন্দ্র নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৮২	০১/২০১০-১১	মোঃ হুজ্জত আলী পিতা-মৃত-জহুর আলী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল,স জেলা-বাগেরহাট	
৪৮৩	০১/২০১০-১১	মোঃ ইয়াছিন ফারাজি পিতা-মৃত-জহুর আলী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল,স জেলা-বাগেরহাট	
৪৮৪	০১/২০১০-১১	মোসাঃ সুফিয়া বেগম পিতা-মৃত-জহুর আলী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল,স জেলা-বাগেরহাট	
৪৮৫	০১/২০১০-১১	মোসাঃ কহিনুর বেগম পিতা-মৃত-জহুর আলী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল,স জেলা-বাগেরহাট	
৪৮৬	০১/২০১০-১১	ঋত্তিক কুমার দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৮৭	০১/২০১০-১১	সুনিল কুমার দাশ পিতা-মৃত-কিরণ চন্দ্র দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট সদর, বাগেরহাট	
৪৮৮	০১/২০১০-১১	মোঃ আব্বাস উদ্দিন ঢালী	সাং-গৌরম্ভা	

		পিতা-মৃত-লুৎফর রহমান	উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪২৪	০১/২০১০-১১	মোঃ নাহিদুজ্জামান পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪২৫	০১/২০১০-১১	মোসাঃ নুরুন্নাহার বেগম পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪২৬	০১/২০১০-১১	মোসাঃ নারগিছ নাহার বেগম পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪২৭	০১/২০১০-১১	মোসাঃ পাপিয়া বেগম পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪২৮	০১/২০১০-১১	মোসাঃ রাজিয়া বেগম পুতুল পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪২৯	০১/২০১০-১১	মোসাঃ নাদিরা বেগম পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩০	০১/২০১০-১১	মোসাঃ নাছিমা বেগম ডালু পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩১	০১/২০১০-১১	মোসা সাহানা বেগম পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩২	০১/২০১০-১১	মোসাঃ তহমিনা বেগম পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩৩	০১/২০১০-১১	মোসাঃ হাছিনা বানু পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩৪	০১/২০১০-১১	মোসাঃ খালেদা ভানু জং মৃঃ লুৎফর রহমান শেখ	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩৫	০১/২০১০-১১	মোঃ আজমির হোসেন বাপন পিতা মৃঃ মোঃ আছাদুজ্জামান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩৬	০১/২০১০-১১	মোসাঃ সুমা খাতুন পিতা মৃঃ মোঃ আছাদুজ্জামান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩৭	০১/২০১০-১১	মোসাঃ আখি তারা পিতা মৃঃ মোঃ আছাদুজ্জামান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩৮	০১/২০১০-১১	মোসাঃ আছমিনআরা বেগম আলো জং মৃঃ মোঃ আছাদুজ্জামান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৩৯	০১/২০১০-১১	সুব্রত দাশ পিতা-মৃত-মনিলাল দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৪০	০১/২০১০-১১	হরিপদ দাশ পিতা-মৃত-নগেন্দ্র নাথ দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৪১	০১/২০১০-১১	নিরঞ্জন কুমার পাল পিতা-মৃত-মাধব চন্দ্র পাল	সাং-ধনপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৪২	০১/২০১০-১১	মনিরুজ্জামান পিতা-মৃত-কয়েম শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৪৩	০১/২০১০-১১	মলিন পাল পিতা-মৃত-মাধব চন্দ্র পাল	সাং-ধনপোতা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৪৪	০১/২০১০-১১	সোয়েবুল ইসলাম পিতা-মৃত-মনছুর আলী শেখ	সাং-গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৪৫	০১/২০১০-১১	ধ্রুব কুমার দাশ পিতা-মৃত-বিজয় লাল দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৪৬	০১/২০১০-১১	মানস রঞ্জন দাস পিতা-মৃত-বিজয় লাল দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৪৭	০১/২০১০-১১	সমির কুমার দাশ পিতা-মৃত-বিজয় লাল দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪৪৮	০১/২০১০-১১	লিয়াকত সরদার পিতা-মৃত-কাওছার সরদার	সাং-বর্ণি উপজেলা-রামপাল , জেলা-বাগেরহাট	
৪৪৯	০১/২০১০-১১	আকবর সরদার পিতা-মৃত-কাওছার সরদার	সাং-বর্ণি উপজেলা-রামপাল , জেলা-বাগেরহাট	
৪৫০	০১/২০১০-১১	এস,এম বদরুজ্জামান পিতা-মৃত-আব্দুল মতলেব শেখ	সাং-৯ নং হাজী ইসমাইল লিংক রোড পৈপাড়া, সোনাডাঙ্গা, খুলনা	
৪৫১	০১/২০১০-১১	মোঃ রেজাউল ইজারাদার পিতা-মৃত-রাহেন ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৫২	০১/২০১০-১১	জাহেদা বেগম পিতা-মৃত-রাহেন ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৫৩	০১/২০১০-১১	মোঃ আতাউর রহমান পিতা-মৃত-আবদুল হাকিম শেখ	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৫৪	০১/২০১০-১১	রুস্তম শেখ পিতা-মৃত-আবদুল হাকিম শেখ	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪৫৫	০১/২০১০-১১	মোঃ গোলজার শেখ পিতা মৃঃ আঃ গফুর	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	

			বাগেরহাট	
৩৯৩	০১/২০১০-১১	সোজিব কুমার দাস পিং-গোপাল চন্দ্র দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট সদর,জেলা-বাগেরহাট	
৩৯৪	০১/২০১০-১১	রাজিব কুমার দাস পিং-গোপাল চন্দ্র দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট সদর,জেলা-বাগেরহাট	
৩৯৫	০১/২০১০-১১	সোহাগ কুমার দাস পিং-গোপাল চন্দ্র দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট সদর,জেলা-বাগেরহাট	
৩৯৬	০১/২০১০-১১	শেখ একরামূল কবির পিতা-মৃত-ডাঃ এম এ তালেব	সাং-চাকুলী উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৯৭	০১/২০১০-১১	শেখ সিরাজুল মুনির পিতা-মৃত-ডাঃ এম এ তালেব	সাং-চাকুলী উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৯৮	০১/২০১০-১১	মাসুদা বেগম জং-মৃত-ডাঃ এম এ তালেব	সাং-চাকুলী উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৯৯	০১/২০১০-১১	মোঃ মুনছুর আলী পিতা-মৃত-মোঃ ইদ্রিস আলী শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪০০	০১/২০১০-১১	মোসাঃ নিলুফা বেগম পিতা-মৃত-মোঃ ইদ্রিস আলী শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪০১	০১/২০১০-১১	মোসাঃ এলিচা খাতুন পিতা-মৃত-মোঃ ইদ্রিস আলী শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪০২	০১/২০১০-১১	মোসাঃ ফাতেমা বেগম জং-মৃত-মোঃ ইদ্রিস আলী শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪০৩	০১/২০১০-১১	শংকর প্রসাদ দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪০৪	০১/২০১০-১১	মোঃ মারুফ গাজী পিতা-মৃত-আলেম গাজী	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪০৫	০১/২০১০-১১	মোঃ রকিব উদ্দিন পিতা-মৃত-আঃ গণি শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪০৬	০১/২০১০-১১	মোঃ রুহুল আমীন শেখ পিতা-মৃত-আঃ গণি শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪০৭	০১/২০১০-১১	মোঃ রাজু শেখ পিতা-মৃত-আঃ গণি শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪০৮	০১/২০১০-১১	মোসাঃ গোলজান বেগম পিতা-মৃত-আঃ গণি শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪০৯	০১/২০১০-১১	মোসাঃ ফুরজাহান বেগম পিতা-মৃত-আঃ গণি শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪১০	০১/২০১০-১১	মোসাঃ আফুজান বেগম পিতা-মৃত-আঃ গণি শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪১১	০১/২০১০-১১	মোসাঃ আছমা বেগম পিতা-মৃত-আঃ গণি শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪১২	০১/২০১০-১১	মোসাঃ রহিমা বেগম জং -মৃত-আঃ গণি শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪১৩	০১/২০১০-১১	মোমেনা বেগম জং-মৃত মালেক শেখ	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪১৪	০১/২০১০-১১	আনোয়ারা খাতুন জং কেরামত আলী	সাং-রনসেন উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪১৫	০১/২০১০-১১	রশিদা বেগম জং-সেকেন্দার শেখ	সাং-চুনহরি পূর্ব পাড়া উপজেণা-দাকোপ, খুলনা	
৪১৬	০১/২০১০-১১	চন্দন দাশ পিতা-মৃত-কৃষ্ণ দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪১৭	০১/২০১০-১১	তপন দাশ পিতা-মৃত-মনিলাল দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪১৮	০১/২০১০-১১	সুভাষ চন্দ্র মন্ডল পিতা-মৃত-জিতেন্দ্র নাথ মন্ডল	সাং-বারইআবাদ উপজেলা-বটিয়াঘাটা, জেলা-খুলনা	
৪১৯	০১/২০১০-১১	প্রভাশ মন্ডল পিং জিতেন্দ্র মন্ডল	সাং-বারইআবাদ উপজেলা-বটিয়াঘাটা, জেলা-খুলনা	
৪২০	০১/২০১০-১১	রত্না রানী মোন্ডল পিং সুভাষ চন্দ্র মন্ডল	সাং-বারইআবাদ উপজেলা-বটিয়াঘাটা, জেলা-খুলনা	
৪২১	০১/২০১০-১১	অচিন্ত কুমার হালদার পিতা-মৃত-মনিলাল দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৪২২	০১/২০১০-১১	এবিএম কামরুজ্জামান পিতা-মৃত-লুৎফর রহমান	সাং-সায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৪২৩	০১/২০১০-১১	মোঃ ফারুকুজ্জামান বাবলু	সাং-সায়রাবাদ	

		পিতা মৃঃ সুভাষ চন্দ্র দাস	উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৬১	০১/২০১০-১১	হরিপদ দাস পিতা মৃঃ শশিভূষন দাস	সাং-চাদেরঢোন উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৬২	০১/২০১০-১১	সন্জিৎ দাস পিতা মৃঃ শশিভূষন দাস	সাং-চাদেরঢোন উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৬৩	০১/২০১০-১১	শেখর রঞ্জন দাস পিতা মৃঃ শশিভূষন দাস	সাং-চাদেরঢোন উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৬৪	০১/২০১০-১১	স্বপন দাস পিতা মৃঃ শশিভূষন দাস	সাং-চাদেরঢোন উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৬৫	০১/২০১০-১১	মোঃ আব্দুল লতিফ শেখ পিতা-মৃত-মোঃ আজিমুদ্দিন শেখ	সাং-ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৬৬	০১/২০১০-১১	এস, এম ফারুক হোসেন পিতা-মৃত-জহুরুল হক	সাং-চাকুলী উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৬৭	০১/২০১০-১১	ফরিদা পারভিন পিতা মৃঃ জহুরুল হক	সাং-চাকুলী উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৬৮	০১/২০১০-১১	ফরিদা পারভিন পিতা মৃঃ জহুরুল হক	সাং-চাকুলী উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৬৯	০১/২০১০-১১	জিতেন্দ্র নাথ রায় পিতা-মৃত-মনোহর রায়	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৭০	০১/২০১০-১১	মোসাঃ সাজেদা খাতুন জাং-মোক্তার হোসেন	সাং-শিয়ালীডাঙ্গা উপজেলা-বটিয়াঘাটা, জেলা-খুলনা	
৩৭১	০১/২০১০-১১	ফাতেমা খাতুন পিতা-মৃত-শেখ আবুল হাসান	সাং-শ্যামবাগাত উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৭২	০১/২০১০-১১	শারমিন সুলতানা রিনা পিতা-মৃত-শেখ আবুল হাসান	সাং-শ্যামবাগাত উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৭৩	০১/২০১০-১১	রেহেনা পারভিন পিতা-মৃত-শেখ আবুল হাসান	সাং-শ্যামবাগাত উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৭৪	০১/২০১০-১১	মাহাবুবা সোবহান পিতা-মৃত-শেখ আবুল হাসান	সাং-শ্যামবাগাত উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৭৫	০১/২০১০-১১	লুৎফুন্নেছা পিতা-মৃত-শেখ আবুল হাসান	সাং-শ্যামবাগাত উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৭৬	০১/২০১০-১১	স্বপন কুমার দাশ পিতা-মৃত-পঞ্চানন দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট, জেলা-বাগেরহাট	
৩৭৭	০১/২০১০-১১	রতন কৃষ্ণ দাস পিতা-মৃত-পঞ্চানন দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট, জেলা-বাগেরহাট	
৩৭৮	০১/২০১০-১১	সমীর কৃষ্ণ দাস পিতা-মৃত-পঞ্চানন দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট, জেলা-বাগেরহাট	
৩৭৯	০১/২০১০-১১	চরন বালা দাস স্বামী-মৃত-পঞ্চানন দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট, জেলা-বাগেরহাট	
৩৮০	০১/২০১০-১১	সঞ্জিত দাশ পিতা-মৃত-শশী ভূষন দাশ	সাং-চাদেরঢোন উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৮১	০১/২০১০-১১	হরিপদ দাস পিতা-মৃত-শশী ভূষন দাশ	সাং-চাদেরঢোন উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৮২	০১/২০১০-১১	শেখর রঞ্জন দাস পিতা-মৃত-শশী ভূষন দাশ	সাং-চাদেরঢোন উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৮৩	০১/২০১০-১১	স্বপন দাস পিতা-মৃত-শশী ভূষন দাশ	সাং-চাদেরঢোন উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৩৮৪	০১/২০১০-১১	হিমাংশু কুমার রায় পিতা-মৃত-মনোহর রায়	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৮৫	০১/২০১০-১১	মোঃ ফার্ক হালাদার পিতা-মৃত-নাছের হাওলাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৮৬	০১/২০১০-১১	মোঃ মারুফ হাওলাদার পিতা-মৃত-নাছের হাওলাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৮৭	০১/২০১০-১১	কাজী আসাফুজ্জামান পিতা-মৃত-কাজী আছর উদ্দিন	সাং-চাঁদপুর উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৮৮	০১/২০১০-১১	কাজী আলিফুজ্জামান পিতা-মৃত-কাজী আছর উদ্দিন	সাং-চাঁদপুর উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৮৯	০১/২০১০-১১	ঐ	সাং-চাঁদপুর উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৯০	০১/২০১০-১১	মোঃ সেলিম শেখ পিতা-মোঃ ফজর আলী	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৯১	০১/২০১০-১১	লেখন শেখ পিতা-মোঃ ফজর আলী	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৯২	০১/২০১০-১১	অর্জিতা রাণী দাশ জং-গোপাল চন্দ্র দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট সদর,জেলা-	

৩২৯	০১/২০১০-১১	মনোয়ারুল হক পিতা-মৃত-হাজী নেছার উদ্দিন	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৩০	০১/২০১০-১১	মাহাফুজুল হক পিতা-মৃত-হাজী নেছার উদ্দিন	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৩১	০১/২০১০-১১	এবি এম হুমায়ুন কবির পিতা-মৃত-আঃ কাদের	১৩/১ টুটপাড়া সেন্ট্রালরোড খুলনা	
৩৩২	০১/২০১০-১১	মিসেস পাপিয়া সুলতানা স্বামী-এবি এম হুমায়ুন কবির	১৩/১ টুটপাড়া সেন্ট্রালরোড খুলনা	
৩৩৩	০১/২০১০-১১	আঃ সোবহান ফকির পিতা-মোঃ শাহাদাত ফকির	৭৭ নদক্ষিণ টুটপাড়া বাইতুল আমান মহল্লা, খুলনা	
৩৩৪	০১/২০১০-১১	মোঃ কবির হাওলাদার পিতা-মৃত-সাহেব আলী হাওলাদার	সাং-রণসেন উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৩৫	০১/২০১০-১১	ছাব্বির হাওলাদার পিতা মৃঃ সাহেব আলী হাওলাদার	সাং-রণসেন উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৩৬	০১/২০১০-১১	শহিদুল হাওলাদার পিতা মৃঃ সাহেব আলী হাওলাদার	সাং-রণসেন উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৩৭	০১/২০১০-১১	ফুলজান বেগম জং-শেখ হুমায়ুন কবির	সাং-চাঁদপুর উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৩৮	০১/২০১০-১১	রহিমা খাতুন স্বামী মৃঃ আব্দুল ছত্তার মোল্লা	সাং-চাঁদপুর উপজেলা-রামপাল জেলা-বাগেরহাট	
৩৩৯	০১/২০১০-১১	সেকেন্দার আলী মোল্লা পিতা-মৃত-আব্দুল জব্বার মোল্লা	সাং-চাঁদপুর উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৪০	০১/২০১০-১১	শেখ মনিরুজ্জামান পিতা-মৃত শেখ মকবুল হোসেন	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল জেলা-বাগেরহাট	
৩৪১	০১/২০১০-১১	মোসাঃ আরিফা বেগম পিতা-মৃত-শেখ মকবুল হোসেন	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৪২	০১/২০১০-১১	এস, এম শাহতাবুজ্জামান পিতা-মৃত-শেখ মকবুল হোসেন	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৪৩	০১/২০১০-১১	শরিফা বেগম পিতা মৃঃ শেখ মকবুল হোসেন	সাং-উত্তর গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৪৪	০১/২০১০-১১	মোঃ বজলুর রহমান পিতা-মৃত-মোঃ আবুবকর সরদার	সাং-বর্ণি ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৪৫	০১/২০১০-১১	স,ম অলিউর রহমান পিতা মৃঃ আঃ রতিফ সরদার	সাং-বর্ণি ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৪৬	০১/২০১০-১১	মোঃ মিশকাতুর রহমান পিতা-মৃত-নেছার উদ্দিন শেখ	সাং-বর্ণি উপজেলা-রামপাল,জেলা-বাগেরহাট	
৩৪৭	০১/২০১০-১১	মোসাঃ জোস্না বেগম জং-মৃত-মোঃ জালাল আকুঞ্জী	সাং-বর্ণি উপজেলা-রামপাল,জেলা-বাগেরহাট	
৩৪৮	০১/২০১০-১১	মোসাঃ জোস্না বেগম জং-মৃত-মোঃ জালাল আকুঞ্জী	সাং-বর্ণি উপজেলা-রামপাল,জেলা-বাগেরহাট	
৩৪৯	০১/২০১০-১১	মোঃ আছাদুজ্জামান সরদার পিতামৃত-ইউনুছ সরদার	সাং-বর্ণি উপজেলা-রামপাল,জেলা-বাগেরহাট	
৩৫০	০১/২০১০-১১	মোঃ সহিদ ইজারাদার পিতা-মৃত-জহুর ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৫১	০১/২০১০-১১	রিজিয়া বেগম জং-মৃত-হেলাল উদ্দিন	সাং-চাঁদপুর উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩৫২	০১/২০১০-১১	সুভাষ চন্দ্র দাশ পিতা-মৃত-নগেন্দ্র নাথ দাশ	সাং-ষাটতলা উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৫৩	০১/২০১০-১১	সরোজিত দেওয়ান পিতা-মৃত-দীন বন্ধু দেওয়ান	সাং-বরণপাড়া উপজেলা-বটিয়াঘাটা, জেলা-খুলনা	
৩৫৪	০১/২০১০-১১	শ্রীশ চন্দ্র দাস পিতা-মৃত-গুরুচরণ দাশ	সাং-ষাটতলা উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৫৫	০১/২০১০-১১	নিখিল চন্দ্র দাশ পিতা-মৃত-নিরঞ্জন দাশ	সাং-চাদেরঢোন উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৫৬	০১/২০১০-১১	বিজয় কৃষ্ণ দাস পিতা-মৃত-নিরঞ্জন দাশ	সাং-চাদেরঢোন উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৫৭	০১/২০১০-১১	বিমলেন্দু দাস পিতা মৃঃ নিশিকান্ত দাস	সাং-চাদেরঢোন উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৫৮	০১/২০১০-১১	ভঞ্জন দাস পিতা মৃঃ সুভাষ চন্দ্র দাস	সাং-চাদেরঢোন উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৫৯	০১/২০১০-১১	সুবোধ কুমার দাস পিতা মৃঃ সুভাষ চন্দ্র দাস	সাং-চাদেরঢোন উপজেলা-ফকিরাহট, জেলা-বাগেরহাট	
৩৬০	০১/২০১০-১১	দুর্জয় কুমার দাস	সাং-চাদেরঢোন	

২৯৭	০১/২০১০-১১	মোঃ আল আমিন ফরাজি পিতা-মৃত-গোলাম ফরাজি	সাং-কাপাশডাংগা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৯৮	০১/২০১০-১১	রোজিনা বেগম স্বামী-মোঃ আল আমিন ফরাজি	সাং-কাপাশডাংগা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৯৯	০১/২০১০-১১	নারগিস বেগম পিতা মৃঃ আজিজুল ফরাজি	সাং-কাপাশডাংগা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৩০০	০১/২০১০-১১	রোনা বেগম পিতা মৃঃ আঃ আজিজুল ফরাজি	সাং-কাপাশডাংগা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৩০১	০১/২০১০-১১	কদভানু বেগম স্বামী মৃঃ মোঃ আজিজুল ফরাজি	সাং-কাপাশডাংগা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৩০২	০১/২০১০-১১	রবীন্দ্র নাথ বালা পিতা-মৃত-সুকচাঁদ বালা	সাং-বাশেরহুলা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৩০৩	০১/২০১০-১১	পঞ্চান্ন বালা পিতা-মৃত-সুকচাঁদ বালা	সাং-বাশেরহুলা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৩০৪	০১/২০১০-১১	সুভাস হালদার পিতা-মৃত-দেবেন্দ্র নাথ হালদার	সাং-বরনপাড়া উপজেলা-বটিয়াঘাটা, খুলনা	
৩০৫	০১/২০১০-১১	সুনিল হালদার ওরফে সুশীল হালদার পিতা মৃঃ দেবেন্দ্র নাথ হালদার	সাং-বরনপাড়া উপজেলা-বটিয়াঘাটা, খুলনা	
৩০৬	০১/২০১০-১১	প্রদীপ্ত হালদার পিতা মৃঃ পুলিন হালদার	সাং-বরনপাড়া উপজেলা-বটিয়াঘাটা, খুলনা	
৩০৭	০১/২০১০-১১	কালিপদ হালদার পিতা-মৃত-অন্নদাচরন হালদার	সাং-বরনপাড়া উপজেলা-বটিয়াঘাটা, খুলনা	
৩০৮	০১/২০১০-১১	প্রফুল্ল হালদার পিতা-মৃত-সতীশ হালদার	সাং-বরনপাড়া উপজেলা-বটিয়াঘাটা, খুলনা	
৩০৯	০১/২০১০-১১	ভবেন হালদার পিতা মৃঃ সতিশ হালদার	সাং-বরনপাড়া উপজেলা-বটিয়াঘাটা, খুলনা	
৩১০	০১/২০১০-১১	আবুল কালাম আজাদ পিতা-আঃ ছাত্তার	সাং-১২২ টুটপাড়া মেইন রোড,খুলনা	
৩১১	০১/২০১০-১১	আফরোজা বেগম স্বামী শেখ আবুল কালাম আজাদ	সাং-১২২ টুটপাড়া মেইন রোড,খুলনা	
৩১২	০১/২০১০-১১	আবু ফুরায়রা পিতা শেখ আবুল কালাম আজাদ	সাং-১২২ টুটপাড়া মেইন রোড,খুলনা	
৩১৩	০১/২০১০-১১	সাজেদা পারভিন রুপা পিতা শেখ আবুল কালাম আজাদ	সাং-১২২ টুটপাড়া মেইন রোড,খুলনা	
৩১৪	০১/২০১০-১১	মোসাঃ খালেদা পারভিন বুবলি পিতা শেখ আবুল কালাম আজাদ	সাং-১২২ টুটপাড়া মেইন রোড,খুলনা	
৩১৫	০১/২০১০-১১	আসাদুজ্জামান মুন্সী পিতা-মৃত-রিয়াজ উদ্দিন মুন্সি	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩১৬	০১/২০১০-১১	অহেদ মুন্সি পিতা মৃঃ রিয়াজ উদ্দিন মুন্সি	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩১৭	০১/২০১০-১১	আঃ ছামাদ মুন্সি পিতা মৃঃ রিয়াজ উদ্দিন মুন্সি	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩১৮	০১/২০১০-১১	আমজাদ মুন্সিপিতা পিতা- মৃঃ আঃ হামিদ মুন্সি	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩১৯	০১/২০১০-১১	মোঃ মুসা শেখ পিতা-মৃত-রজ্জব আলী	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩২০	০১/২০১০-১১	আব্দুল লতিফ মুন্সি পিতা-মৃত-মোমিন উদ্দিন মুন্সি	সাং-বর্নি ছায়রাবাদ উপজেলাড়রামপাল, জেলা-বাগেরহাট।	
৩২১	০১/২০১০-১১	মোঃ মইনুল হক পিতা-মৃত-আবু জাফর	সাং-৩৮ নং সামছুর রহমান রোড় জেলা-খুলনা।	
৩২২	০১/২০১০-১১	গিয়াস উদ্দিন পিতা মৃঃ নুর উদ্দিন	সাং ৪ নং নিউ সার্কুলার রোড খুলনা	
৩২৩	০১/২০১০-১১	খায়রুজ্জামান মিন্টু পিতা মৃঃ রফি উদ্দিন আহম্মেদ	সাং-৩৮ নং সামছুর রহমান রোড খুলনা	
৩২৪	০১/২০১০-১১	ফিরোজ মুন্সি পিতা-আব্দুল মুন্সি	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩২৫	০১/২০১০-১১	লোকমান মুন্সি পিতা-মৃত-আঃ আজিজ মুন্সি	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩২৬	০১/২০১০-১১	এম একরামুল হক পিতা-মৃত-নেছার উদ্দিন	সাং-৪৩ নং হাজী মহসীন রোড জেলা-খুলনা।	
৩২৭	০১/২০১০-১১	এস, এম একরামুল হক পিতা-মৃত-হাজী নেছার উদ্দিন	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	
৩২৮	০১/২০১০-১১	মঞ্জুরুল হক পিতা-মৃত-হাজী নেছার উদ্দিন	সাং-বর্নি উপজেলা-রামপাল, জেলা-বাগেরহাট	

		পিতা-মৃত-ছদরতুল্যা ইজারাদার	উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৬৫	০১/২০১০-১১	মোঃ মোজাহার ইজারদার মোঃ শফিকুল ইজারদার	সাং-কালেখালবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৬৬	০১/২০১০-১১	অনিতা রাণী মন্ডল জং-নির্মল মন্ডল	সাং-চুনারাবাদ উপজেলা-বটিয়াঘাটা, জেলা-খুলনা	
২৬৭	০১/২০১০-১১	শেখ কামাল আহম্মেদ পিতা-মৃত শেখ মফজুল আহাম্মেদ	২নং সেন্টাল ব্লক পুরাতন কলোনী খালিশপুর, খুলনা	
২৬৮	০১/২০১০-১১	নাইমা জব্বার রওশন বানু জং শেখ-কামাল আহম্মদ	২নং সেন্টাল ব্লক পুরাতন কলোনী খালিশপুর, খুলনা	
২৬৯	০১/২০১০-১১	শেখ মোগফুর আহাম্মেদ পিতা-মৃত শেখ মফজুল আহাম্মেদ	২নং সেন্টাল ব্লক পুরাতন কলোনী খালিশপুর, খুলনা	
২৭০	০১/২০১০-১১	মনিরুজ্জামান ইজারাদার পিতা-মৃত-আফছার ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৭১	০১/২০১০-১১	মোঃ আমজাদ হোসেন মৃঃ আফছার ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৭২	০১/২০১০-১১	মোঃ আবজাল হোসেন মৃঃ আফছার ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৭৩	০১/২০১০-১১	আব্দুল হালিম মৃঃ আফছার ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৭৪	০১/২০১০-১১	আম্বিয়া বেগম মৃঃ আফছার ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল,জেলা-বাগেরহাট।	
২৭৫	০১/২০১০-১১	আয়শা বেগম মৃঃ আফছার ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল,জেলা-বাগেরহাট।	
২৭৬	০১/২০১০-১১	হাছিনা বেগম মৃঃ আফছার ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল,জেলা-বাগেরহাট।	
২৭৭	০১/২০১০-১১	সুফিয়া বেগম মৃঃ আফছার ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল,জেলা-বাগেরহাট।	
২৭৮	০১/২০১০-১১	জোহরা বেগম জং মৃঃ আফছার ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল,জেলা-বাগেরহাট।	
২৭৯	০১/২০১০-১১	মোঃ আলী আকবর পিতা-মোঃ নিজাম উদ্দিন	সাং-গোবিন্দপুর উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৮০	০১/২০১০-১১	মোঃ আবুল কাইয়ুম ইজারাদার পিতা-মৃত-ইয়াকুব আলী ইজারাদার	সাং-প্রসাদ নগর উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৮১	০১/২০১০-১১	মোঃ মাহাবুবর রহমান মোল্লা পিতা-মৃত-মোঃ আঃ রহমান মোল্লা	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৮২	০১/২০১০-১১	মোঃ বজলুর রহমান পিতা-মৃত-আবু বক্কর সরদার	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৮৩	০১/২০১০-১১	এস, এম খায়রুজ্জামান পিতা-মৃত-রফি উদ্দিন আহমেদ	৩৮ নং সামসুর রহমান রোড, খুলনা	
২৮৪	০১/২০১০-১১	খুরশিদা আক্তার জং-মৃত-আবু আফজাল	সাং-বর্ণি ছয়রাবাদ উপজেলা-রামপাল,জেলা-বাগেরহাট।	
২৮৫	০১/২০১০-১১	গিয়াস উদ্দিন পিতা-মৃত-হাজী নূর উদ্দিন	সাং-৪নং নিউ সার্কুলার রোড,খুলনা	
২৮৬	০১/২০১০-১১	রোকেয়া বেগম স্বামী মৃঃ আব্দুল কাদের	সাং-বর্নি ছায়রাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৮৭	০১/২০১০-১১	মোস্তাজ গাজী পিতা-মৃত-মোকিত গাজী	সাং-বাশেরহুলা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
২৮৮	০১/২০১০-১১	গোপাল চন্দ্র দাশ পিতা-মৃত-সুরেন্দ্র নাথ দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট, জেলা-বাগেরহাট।	
২৮৯	০১/২০১০-১১	অর্জিতা রানী দাস জং-গোপাল চন্দ্র দাস	সাং-রণজিতপুর উপজেলা-বাগেরহাট, জেলা-বাগেরহাট।	
২৯০	০১/২০১০-১১	রাজিব কুমার দাস পিতা--গোপাল চন্দ্র দাস	সাং-রণজিতপুর উপজেলা-বাগেরহাট, জেলা-বাগেরহাট।	
২৯১	০১/২০১০-১১	সোহাগ কুমার দাস পিতা--গোপাল চন্দ্র দাস	সাং-রণজিতপুর উপজেলা-বাগেরহাট, জেলা-বাগেরহাট।	
২৯২	০১/২০১০-১১	পল্টু দাস পিতা--গোপাল চন্দ্র দাস	সাং-রণজিতপুর উপজেলা-বাগেরহাট, জেলা-বাগেরহাট।	
২৯৩	০১/২০১০-১১	আবিদ হোসেন শেখ পিতা-মৃত-মহম্মদ আলী শেখ	সাং-বর্নি উপজেলা-রামপাল,জেলা-বাগেরহাট।	
২৯৪	০১/২০১০-১১	পুস্পক রঞ্জন দাস পিতা-মৃত-হৃদয় নাথ দাস	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
২৯৫	০১/২০১০-১১	প্রনব কুমার দাস দাস পিতা-মৃত-হৃদয় নাথ দাস	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
২৯৬	০১/২০১০-১১	শেখ আতিয়ার রহমার পিতা-মৃত-মোঃ রশিদ শেখ	সাং-সোনাতুনিয়া উপজেলা-রামপাল, জেলা-বাগেরহাট।	

		পিতা-মৃত-বিজয় লাল দাশ		
২৩৩	০১/২০১০-১১	অসীম কুমার দাশ ২৩৪পিতা-মৃত-নিশি কান্ত দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২৩৪	০১/২০১০-১১	মিলন কান্তি দাস পিতা-মৃত-নিশি কান্ত দাশ		
২৩৫	০১/২০১০-১১	কানাই লাল দাস পিতা-মৃত-নিশি কান্ত দাশ		
২৩৬	০১/২০১০-১১	সংকর কুমার দাস পিতা-মৃত-মনিন্দ্র নাথ দাস	সাং-চাদেরঢোন উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২৩৭	০১/২০১০-১১	শিবেন্দ্র নাথ দাস পিতা-মৃত-মনিন্দ্র নাথ দাস		
২৩৮	০১/২০১০-১১	সঞ্জয় কুমার দাস পিতা-মৃত-মনিন্দ্র নাথ দাস		
২৩৯	০১/২০১০-১১	নির্মল কুমার দাস পিতা-মৃত-মনিন্দ্র নাথ দাস		
২৪০	০১/২০১০-১১	নিরঞ্জন কুমার দাশ পিতা-মৃত শতীশ চন্দ্র দাশ	সাং-বেতাগা, উপজেলা-ফকিরহাট জেলা-বাগেরহাট।	
২৪১	০১/২০১০-১১	নরেন্দ্র নাথ দাস পিতা-মৃত শতীশ চন্দ্র দাশ		
২৪২	০১/২০১০-১১	পরেশ কুমার দাস পিতা-মৃত শতীশ চন্দ্র দাশ		
২৪৩	০১/২০১০-১১	সমীর কুমার দাস পিতা-মৃত শতীশ চন্দ্র দাশ		
২৪৪	০১/২০১০-১১	বিমলেন্দু দাশ পিতা-মৃত-নিশিকান্ত দাশ	সাং-চাদের ঢোন উপজেলা ফকিরহাট, জেলা-বাগেরহাট।	
২৪৫	০১/২০১০-১১	অজয় কুমার দাশ পিতা-মৃত গৌর হরি দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২৪৬	০১/২০১০-১১	প্রদ্যুত কুমার দাস পিতা-মৃত গৌর হরি দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২৪৭	০১/২০১০-১১	বিদ্যুত কুমার দাস পিতা-মৃত গৌর হরি দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২৪৮	০১/২০১০-১১	দূর্জয় কুমার দাশ পিতা-মৃত-সুভাষ চন্দ্র দাশ	সাং-চাদেরঢোন উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২৪৯	০১/২০১০-১১	সুবোধ কুমার দাস পিতা মৃঃ সোনাতন দাস		
২৫০	০১/২০১০-১১	ভঞ্জন কুমার দাস পিতা মৃঃ সোনাতন দাস		
২৫১	০১/২০১০-১১	শেখ ফরহাদ হোসেন ব্যবস্থাপক বাংলাদেশ কৃষি ব্যাংক রামপাল শাখা	ব্যবস্থাপক বাংলাদেশ কৃষি ব্যাংক রামপাল শাখা	
২৫২	০১/২০১০-১১	মহিউদ্দিন ইজারাদার পিতা মৃঃ সফিউদ্দিন ইজারাদার	সাং-বর্নি উপজেলা-রামপাল, জেলা- বাগেরহাট	
২৫৩	০১/২০১০-১১	মোতাহার গাজী পিতা-মৃত খাদেম আলী গাজী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৫৪	০১/২০১০-১১	আজাহার গাজী পিতা-মৃত খাদেম আলী গাজী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৫৫	০১/২০১০-১১	মোসাঃ ডালিয়া বেগম পিতা-মৃত খাদেম আলী গাজী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৫৬	০১/২০১০-১১	মোসাঃ তাছলিমা বেগম জং-হুজ্জত আলী	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৫৭	০১/২০১০-১১	নুর মহাম্মদ ইজারাদার পিতা-মৃত-আব্দুল বারিক	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৫৮	০১/২০১০-১১	আব্দুর রাজ্জাক ইজারদার পিতা মৃঃ আঃ বারিক ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৫৯	০১/২০১০-১১	অহেদুজ্জামান ইজারদার পিতা মৃঃ আঃ বারিক ইজারদার	সাং-কালেখারবেড় উপজেলা-রামপাল,জেলা-বাগেরহাট	
২৬০	০১/২০১০-১১	ফাতেমা বেগম জং-এনছান উদ্দিন শেখ	সাং-ধনদাহ উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৬১	০১/২০১০-১১	নাজমুন্নাহার বেগম জং- আঃ বারিক শেখ	সাং-শ্রীকলস উপজেলা-রামপাল, জেলা-বাগেরহাট	
২৬২	০১/২০১০-১১	মোঃ আনছার আলী জোয়াদ্দার পিতা মৃঃ ইয়াকুব আলী জোয়াদ্দার	সাং-নোয়াইলতলা বটিয়াঘাটা, খুলনা	
২৬৩	০১/২০১০-১১	মোঃ মইন উদ্দিন জোয়াদ্দার পিতা মোঃ আনছার আলী জোয়াদ্দার	সাং-নোয়াইলতলা বটিয়াঘাটা, খুলনা	
২৬৪	০১/২০১০-১১	মোঃ শফিকুল ইজারাদার	সাং-কালেখালবেড়	

১৯০	০১/২০১০-১১	লক্ষী কান্ত দাস পিতা-মৃত-কৈলাস চন্দ্র দাস	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
১৯১	০১/২০১০-১১	মানষ দাস পিতা-মৃত-গোবরধন দাস	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
১৯২	০১/২০১০-১১	স্বপন কুমার দাস পিতা-মৃত-গোবরধন দাস		
১৯৩	০১/২০১০-১১	তৃপ্না দাস স্বাঃ মানষ দাস		
১৯৪	০১/২০১০-১১	উমা রানী দাস পিতা স্বপন কুমার দাস		
১৯৫	০১/২০১০-১১	মোঃ ইব্রাহিম শেখ পিতা-মোঃ ফরিদ উদ্দিন শেখ	সাং-তুলশিরাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
১৯৬	০১/২০১০-১১	ফরিদ উদ্দিন শেখ পিতা মৃঃ আপ্তাব শেখ	সাং ভরসাপুর উপজেলা-রামপাল, জেলা-বাগেরহাট	
১৯৭	০১/২০১০-১১	শেখ সরফরাজ পিতা ফরিদ উদ্দিন শেখ		
১৯৮	০১/২০১০-১১	মোস্তফা শেখ পিতা- ফরিদ উদ্দিন শেখ		
১৯৯	০১/২০১০-১১	নাঃ শেখ মিনহাজ পিতা শেখ সরফরাজ		
২০০	০১/২০১০-১১	আঃ আজিজ শেখ পিতা মৃঃ জোহর আলী	গ্রাম বড় সুভদিয়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২০১	০১/২০১০-১১	আবজাল হোসেন শেখ পিতা মৃঃ বেলায়েত হোসেন	সাং লকপুর উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২০২	০১/২০১০-১১	রহিমা বেগম স্বামী আবজাল হোসেন		
২০৩	০১/২০১০-১১	দিপঙ্কর দাস পিতা-মৃত-যতিন্দ্র নাথ দাস	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২০৪	০১/২০১০-১১	ধীমান দাস পিতা-মৃত-পরিমল দাশ		
২০৫	০১/২০১০-১১	দিপ্ত দাস পিতা-মৃত-পরিমল দাশ		
২০৬	০১/২০১০-১১	দীপক চন্দ্র দাশ পিতা-মৃত-কালিচরণ দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২০৭	০১/২০১০-১১	রামপ্রসাদ দাস পিতা মৃঃ নিতাই চন্দ্র দাস		
২০৮	০১/২০১০-১১	সোহেলী পাপিয়া জং-তরফদার শরিফুল ইসলাম	সাং-সরুই উপজেলা-বাগেরহাট সদর, বাগেরহাট	
২০৯	০১/২০১০-১১	মোঃ রকিবুল ইসলাম পিতা- তরফদার শরিফুল ইসলাম		
২১০	০১/২০১০-১১	আব্দুর রশিদ শেখ পিতা-মৃত-ছুনু শেখ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২১১	০১/২০১০-১১	হামিদ শেখ পিতা-মৃত-ছুনু শেখ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২১২	০১/২০১০-১১	শেখর চন্দ্র দাস পিতা-মৃত-হরিপদ দাস		
২১৩	০১/২০১০-১১	যতি প্রকাশ দাশ গুপ্ত পিতা-মৃত-নির্মণ কুমার দাশ গুপ্ত		
২১৪	০১/২০১০-১১	চিত্ত রঞ্জন দাশ পিতা-মৃত-যতিন্দ্র নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২১৫	০১/২০১০-১১	সুধির কুমার পাল পিতা-মৃত-রাজেন্দ্র নাথ পাল	সাং-চুলকাঠি উপজেলা-বাগেরহাট সদর, বাগেরহাট	
২১৬	০১/২০১০-১১	মিরা রানী পাল স্বামী-সুধির কুমার পাল	ঐ	
২১৭	০১/২০১০-১১	পুস্পক রঞ্জন দাস পিতা-মৃত-হৃদয় নাথ দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২১৮	০১/২০১০-১১	মুরারি মোহন দাস পিতা-মৃত-সঞ্জিত কুমার দাস	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২১৯	০১/২০১০-১১	সুকুমার দাশ পিতা-মৃত-বিজয় লাল দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
২৩০	০১/২০১০-১১	সুজিত কুমার দাস পিতা-মৃত-বিজয় লাল দাশ	ঐ	
২৩১	০১/২০১০-১১	বিল্ব কুমার দাস পিতা-মৃত-বিজয় লাল দাশ	ঐ	
২৩২	০১/২০১০-১১	দিবাকর দাস	ঐ	

		পিতা মৃঃ শরৎ চন্দ্র রায়		
১৫৮	০১/২০১০-১১	পার্থ বিশ্বাস পিতা মৃঃ অমৃত লাল বিশ্বাস	ঐ	
১৫৯	০১/২০১০-১১	মোঃ ইব্রাহীম ফকির পিতা-মৃত-ইজারদ্দিন ফকির	সাং-আদাঘাট উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৬০	০১/২০১০-১১	মুশফিকুর রহমান পিতা-মৃত-ছালাম উদ্দিন	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৬১	০১/২০১০-১১	প্রনব কুমার দাস পিতা-মৃত-হৃদয় নাথ দাস	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
১৬২	০১/২০১০-১১	মনিলাল দাশ পিতা-মৃত-কালিপদ দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট সদর, বাগেরহাট	
১৬৩	০১/২০১০-১১	সন্জয় দাস পিতা-মৃত-কালিপদ দাশ	ঐ	
১৬৪	০১/২০১০-১১	মৃনাল দাশ পিতা-মৃত-কালিপদ দাশ	ঐ	
১৬৫	০১/২০১০-১১	মৃত্যুঞ্জয় দাস পিতা-মৃত-কালিপদ দাশ	ঐ	
১৬৬	০১/২০১০-১১	মোঃ হাছান গাজী পিতা-মৃত-মোঃ মমিন উদ্দিন	সাং-সায়েরাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
১৬৭	০১/২০১০-১১	মোসাঃ সাহিদা বেগম জং-মৃত-আঃ করিম মোল্লা	সাং-কাপাশড়াঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
১৬৮	০১/২০১০-১১	মোঃ টুকু মোল্লা পিতা মৃত-আঃ করিম মোল্লা		
১৬৯	০১/২০১০-১১	মোঃ গফ্ফর মোল্লা পিতা মৃত-আঃ করিম মোল্লা		
১৭০	০১/২০১০-১১	মোসাঃ ফতেমা বেগম পিতা মৃত-আঃ করিম মোল্লা		
১৭১	০১/২০১০-১১	মোসাঃ হালিমা বেগম পিতা মৃত-আঃ করিম মোল্লা		
১৭২	০১/২০১০-১১	মোঃ কেয়াম উদ্দিন মোল্লা পিতা মৃত-ইমানি মোল্লা		
১৭৩	০১/২০১০-১১	চঞ্চল কুমার দাস পিতা-মৃত-সতিশ চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
১৭৪	০১/২০১০-১১	শংকর কুমার দাস পিতা-মৃত-সতিশ চন্দ্র দাশ		
১৭৫	০১/২০১০-১১	কমল কৃষ্ণ দাস পিতা-মৃত-সতিশ চন্দ্র দাশ		
১৭৬	০১/২০১০-১১	আঃ রহিম মোল্লা পিতা-মৃত-ইমানী মোল্লা	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
১৭৭	০১/২০১০-১১	মোসাঃ সাহিদা বেগম জং-মৃত-আঃ করিম মোল্লা		
১৭৮	০১/২০১০-১১	আছিয়া বেগম স্বামী ইমান আলী গাজী	সাং বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট	
১৭৯	০১/২০১০-১১	ছবুরা খাতুন স্বামী মারুফ শেখ	সাং-গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট	
১৮০	০১/২০১০-১১	মোঃ মোস্তাকিন শেখ পিতা-মৃত-মোঃ ছলেমান শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট	
১৮১	০১/২০১০-১১	মোসঃ খালেদা ভানু জং-মুত-লুৎফর রহমান	সাং-সায়েরাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট	
১৮২	০১/২০১০-১১	স্বপন কুমার দাস পিতা-মৃত-গৌবর ধন দাস	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
১৮৩	০১/২০১০-১১	মানষ দাস পিতা-মৃত-গৌবর ধন দাস	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
১৮৪	০১/২০১০-১১	চন্দন দাস পিতা মৃঃ কৃষ্ণ পদ দাস		
১৮৫	০১/২০১০-১১	রসমা রানী দাস পিতা মৃঃ কালিপদ দাস	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
১৮৬	০১/২০১০-১১	সরজিৎ দাস পিতা মৃঃ কালিপদ দাস		
১৮৭	০১/২০১০-১১	ইন্দ্রজিত দাস পিতা মৃঃ কালিপদ দাস		
১৮৮	০১/২০১০-১১	রসমা রানী দাস পিতা মৃঃ কালিপদ দাস	সাং ষাটতলা উপজেলা- ফকিরহাট, জেলা- বাগেরহাট	
১৮৯	০১/২০১০-১১	প্রজিৎ দাস পিতা মৃঃ কালিপদ দাস		

১২৫	০১/২০১০-১১	আজমল সরদার পিতা-আজিম উদ্দিন সরদার	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১২৬	০১/২০১০-১১	স, ম আব্দুর রব পিতা-মৃত-আঃ জব্বার শেখ	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১২৭	০১/২০১০-১১	স, ম শওকত রেজা পিতা-মৃত-মেছের উদ্দিন শেখ	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১২৮	০১/২০১০-১১	মোঃ মিজানুর রহমান পিতা-মৃত-আঃ জব্বার শেখ	ঐ	
১২৯	০১/২০১০-১১	মোঃ দাউদ আলী শেখ পিতা-মৃত-কলিম উদ্দিন	সাং-কদমদি উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৩০	০১/২০১০-১১	খোরশেদ আহমেদ পিতা-মৃত-শেখ মফজুল আহমেদ	সাং-২নং সেন্ট্রাল ব্লক পুরাতন কলোনী খালিশপুর, খুলনা	
১৩১	০১/২০১০-১১	শেখ মুকলেছ আহমেদ পিতা-মৃত-শেখ মফজুল আহমেদ	সাং-২নং সেন্ট্রাল ব্লক পুরাতন কলোনী খালিশপুর, খুলনা	
১৩২	০১/২০১০-১১	মিসেস মাকসুদা হাসান জং-আবুল হাসান	৭৬ নং শেরে বাংলা রোড হাজী বাড়ী খুলনা।	
১৩৩	০১/২০১০-১১	মিসেস মাকসুদা হাসান জং-আবুল হাসান	৭৬ নং শেরে বাংলা রোড হাজী বাড়ী খুলনা।	
১৩৪	০১/২০১০-১১	শামীমা বেগম জং-মৃত-শেখ হারুন অর রশিদ	সাবেক ১১৬ হাল ৯৯ নং সাউথ সেন্ট্রাল রোড, খুলনা।	
১৩৫	০১/২০১০-১১	নূর জাহান বেগম জং-মৃত-শেখ হারুন অর রশিদ	ঐ	
১৩৬	০১/২০১০-১১	ডাঃ আফরোজা বেগম জং-মৃত-শেখ হারুন অর রশিদ	ঐ	
১৩৭	০১/২০১০-১১	শেখ শাহিন উর রশিদ জং-মৃত-শেখ হারুন অর রশিদ	ঐ	
১৩৮	০১/২০১০-১১	শেখ রুসন উর রশিদ জং-মৃত-শেখ হারুন অর রশিদ	ঐ	
১৩৯	০১/২০১০-১১	মোঃ জালার ইজারাদার পিতা-মৃত-জহুর ইজারাদার	সাং-কালেখার বেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৪০	০১/২০১০-১১	শেখ নজরুল ইসলাম পিতা-শেখ হোসেন আলী	সাং-গোবিন্দপুর উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৪১	০১/২০১০-১১	তুষার কান্তি হালদার পিতা-মৃত-বিমল কৃষ্ণ হালদার	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
১৪২	০১/২০১০-১১	দুলাল কৃষ্ণ হালদার পিতা-মৃত-বিমল কৃষ্ণ হালদার	ঐ	
১৪৩	০১/২০১০-১১	শামীম আহসান পিতা-মৃত-আঃ মতিন শেখ	সাং-গৌরম্ভা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৪৪	০১/২০১০-১১	আশোক কুমার দেবনাথ পিতা-মৃত-অনন্ত কুমার দেব নাথ	সাং-চুলকাঠি উপজেলা-বাগেরহাট সদর, বাগেরহাট।	
১৪৫	০১/২০১০-১১	অশিত বরন দেব নাথ পিতা অনন্ত কুমার দেব নাথ	ঐ	
১৪৬	০১/২০১০-১১	অলোক কুমার দেব নাথ পিতা মৃঃ অনন্ত কুমার দেব নাথ	ঐ	
১৪৭	০১/২০১০-১১	অজয় দেব নাথ পিং- মৃঃ অধীর কুমার দেব নাথ	ঐ	
১৪৮	০১/২০১০-১১	অনিমেশ দেব নাথ পিং মৃঃ অধির কুমার দেব নাথ	ঐ	
১৪৯	০১/২০১০-১১	অনিল দেব নাথ পিং মৃঃ অটল বিহারী দেব নাথ	ঐ	
১৫০	০১/২০১০-১১	মোঃ বোরহান ফারাজী পিতা-মৃত-আজিজুর রহমান ফারাজী	সাং-কাপাশডাঙ্গা, উপজেলা-রামপাল জেলা-বাগেরহাট।	
১৫১	০১/২০১০-১১	মোঃ মাসুদ ফারাজি পিতা মৃঃ আজিজুর রহমান ফারাজি	ঐ	
১৫২	০১/২০১০-১১	মোসাঃ পারগিস বেগম পিতা মৃঃ আজিজুর রহমান ফারাজি	ঐ	
১৫৩	০১/২০১০-১১	মোসাঃ শরিফা বেগম স্বামী মৃঃ আজিজুর রহমান ফারাজি	ঐ	
১৫৪	০১/২০১০-১১	শ্যামল রায় পিতা-মৃত-ভরত রায়	ঐ	
১৫৫	০১/২০১০-১১	সুমতি রায় পিতা-মৃত-শরৎ চন্দ্র রায়	সাং-টেংরাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৫৬	০১/২০১০-১১	নিলু রানী রায় পিতা মৃঃ শরৎ চন্দ্র রায়	সাং জয়নগর উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১৫৭	০১/২০১০-১১	দুলু রানী রায়	ঐ	

			বানিয়াখামার, সোনাডাঙ্গা,খুলনা	
৯৪	০১/২০১০-১১	মোঃ মাফতানুর রহমান শেখ পিতা-মোঃ আমানত আলী শেখ	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৯৫	০১/২০১০-১১	এশার উদ্দিন সানা পিতা-বারিক সানা	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৯৬	০১/২০১০-১১	মোশারেফ সানা পিতা-বারিক সানা	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৯৭	০১/২০১০-১১	মোঃ আবুল বাসার সানা পিতা-বারিক সানা	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৯৮	০১/২০১০-১১	মোঃ নওশের সানা পিতা-বারিক সানা	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৯৯	০১/২০১০-১১	আসাদ সানা পিতা-বারিক সানা	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১০০	০১/২০১০-১১	হাজী পারভেজ হোসেন পিতা-গোলাম মোস্তফা শেখ	সাং-১৬ নং হাজী ইসমাইল রোড খুলনা	
১০১	০১/২০১০-১১	মোঃ তৌহিদুজ্জামান গাজী পিতা-মৃত-আঃ রশিদ গাজী	সাং-কাপাশডাঙ্গা, উপজেলা-রামপাল জেলা-বাগেরহাট।	
১০১	০১/২০১০-১১	মোঃ ওবায়েদুর রহমান গাজী পিতা-মৃত-আঃ রশিদ গাজী	সাং-কাপাশডাঙ্গা, উপজেলা-রামপাল জেলা-বাগেরহাট	
১০২	০১/২০১০-১১	মোঃ জাহিদুর রহমান গাজী পিতা-মৃত-আঃ রশিদ গাজী	ঐ	
১০৩	০১/২০১০-১১	মোঃ মাহাবুবর রহমান গাজী পিতা-মৃত-আঃ রশিদ গাজী	ঐ	
১০৪	০১/২০১০-১১	মোঃ হিরক গাজী পিতা-মৃত-আঃ রশিদ গাজী	ঐ	
১০৫	০১/২০১০-১১	মোঃ রাকিব হাসান পিতা-মৃত-আঃ রশিদ গাজী	ঐ	
১০৬	০১/২০১০-১১	মোসাঃ শিউলি বেগম পিতা-মৃত-আঃ রশিদ গাজী	ঐ	
১০৭	০১/২০১০-১১	মোসাঃ রত্না বেগম পিতা-মৃত-আঃ রশিদ গাজী	ঐ	
১০৮	০১/২০১০-১১	মোসাঃ রোজিনা বেগম পিতা-মৃত-আঃ রশিদ গাজী	ঐ	
১০৯	০১/২০১০-১১	মোসাঃ শাহানা বেগম জং-মৃত-আঃ রশিদ গাজী	ঐ	
১১০	০১/২০১০-১১	হাওলাদার মোহাম্মদ আলী পিতা-মৃত-হাওলাদার ফজলুল করিম	সাং-সুগন্ধি, উপজেলা-বাগেরহাট সদর জেলা-বাগেরহাট।	
১১১	০১/২০১০-১১	ফাতেমা খাতুন পিতা-মৃত-হাওলাদার ফজলুল করিম	ঐ	
১১২	০১/২০১০-১১	নুরজাহান বেগম জং-মৃত-শেখ আঃ ছত্তার	সাং-দক্ষিণ খানপুর উপজেলা-বাগেরহাট সদর,বাগেরহাট।	
১১৩	০১/২০১০-১১	নিজাম উদ্দিন শেখ পিতা-মৃত-রইজ উদ্দিন শেখ	সাং-গোবিন্দপুর উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১১৪	০১/২০১০-১১	মোঃ লোকমান হোসেন শেখ পিতা-মৃত-রইজ উদ্দিন শেখ	ঐ	
১১৫	০১/২০১০-১১	এস, এম হাসান আলী শেখ পিতা-মৃত-আঃ গণি শেখ	সাং-উজলকুড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১১৬	০১/২০১০-১১	শাহানারা ওরফে শাহনাজ জং-এম, এম হাসান আলী শেখ	ঐ	
১১৭	০১/২০১০-১১	আলআমিন শেখ জং-এম, এম হাসান আলী শেখ	সাং-উজলকুর উপজেলা-রামপাল, জেলা-বাগেরহাট	
১১৮	০১/২০১০-১১	সুশীল কুমার দাস পিতা-মৃত-নেপাল চন্দ্র দাস	সাং-ভবনা দাসপাড়া উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
১১৯	০১/২০১০-১১	মনোয়ারুল হক (মনি) পিতা-মৃত-নেছার উদ্দিন	সাং-৬৬ নং হাজী মহসীন রোড খুলনা।	
১২০	০১/২০১০-১১	মোঃ তোফানেছুল ইসলাম(এ্যালবো) পিতা-মৃত-মোস্তাজ শেখ	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১২১	০১/২০১০-১১	আমজাদ আলী মুন্সী পিতা-মৃত-হামিদ মুন্সী	ঐ	
১২২	০১/২০১০-১১	মোসাঃ হালিমা বেগম জং-নোয়াব আলী শেখ	ঐ	
১২৩	০১/২০১০-১১	মহসিন মোল্লা পিতা মৃঃ আঃ রহমান মোল্লা	সাং কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
১২৪	০১/২০১০-১১	মোঃ লুৎফর রহমান সরদার পিতা-আজিম উদ্দিন সরদার	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	

৬২	০১/২০১০-১১	হাজী জামাল উদ্দিন শেখ পিতা-মৃত-সেরমান উদ্দিন শেখ	সাং-তুলশিরাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৬৩	০১/২০১০-১১	জালাল উদ্দিন শেখ পিতা-মৃত-সেরমান উদ্দিন শেখ	সাং-তুলশিরাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৬৪	০১/২০১০-১১	রেজওয়ান আলী শেখ পিতা-মৃত-সেরমান উদ্দিন শেখ	সাং-তুলশিরাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৬৫	০১/২০১০-১১	মোঃ শেখ সরফরাজ পিতা-আলহাজ শেখ ফরিদুল ইসলাম	পশ্চিম জিন্নাহ পাড়া, ৯নং গলি, ৪নং হোল্ডিং, খুলনা।	
৬৬	০১/২০১০-১১	হাতেম আলী শেখ পিতা-মতলেব শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, বাগেরহাট	
৬৭	০১/২০১০-১১	মোঃ শওকাত শেখ পিতা-মেছের শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৬৮	০১/২০১০-১১	মোস্তাফিজ শেখ পিতা-মৃত-বদরুজ্জামান	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৬৯	০১/২০১০-১১	অনিল কুমার পাল পিতা-মৃত-যীতেন্দ্র নাথ পাল	সাং-কিসমতভট্ট উপজেলা-বাগেরহাট সদর, বাগেরহাট।	
৭০	০১/২০১০-১১	আজমল হোসেন মৃধা পিতা-মৃত-রায়হান মৃধা	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৭১	০১/২০১০-১১	কংশধর দাশ পিতা-মৃত-রাজ বিহারী দাশ	সাং-ষাটতলা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৭২	০১/২০১০-১১	মোঃ জাহাঙ্গীর শেখ পিতা-মৃত-জামাল উদ্দিন	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৭৩	০১/২০১০-১১	মোঃ আলমগীর শেখ পিতা-মৃত-জামাল উদ্দিন	ঐ	
৭৪	০১/২০১০-১১	মোঃ আলামিন শেখ পিতা-মৃত-জামাল উদ্দিন	ঐ	
৭৫	০১/২০১০-১১	মোঃ টুটুল গাজী পিতা-সিরাজ গাজী	সাং-কাপাশডাঙ্গা, উপজেলা-রামপাল জেলা-বাগেরহাট।	
৭৬	০১/২০১০-১১	মহোর আলী ইজারাদার পিতা-মৃত-আব্দুল ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৭৭	০১/২০১০-১১	মোঃ মুজিবর শেখ পিতা-ইলাহী শেখ	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৭৮	০১/২০১০-১১	ফিরোজ মুন্সী পিতা-মৃত-মজিদ মুন্সী	ঐ	
৭৯	০১/২০১০-১১	অমর চন্দ্র দাশ পিতা-মৃত-কেদার নাথ দাশ	সাং-বেতাগা, উপজেলা-ফকিরহাট জেলা-বাগেরহাট।	
৮০	০১/২০১০-১১	গোবিন্দ্র চন্দ্র দাশ পিতা-মৃত-লক্ষীকান্ত দাশ	ঐ	
৮১	০১/২০১০-১১	অনুকুল দাশ পিতা-মৃত-লক্ষীকান্ত দাশ	ঐ	
৮২	০১/২০১০-১১	মানস রঞ্জন দাশ পিতা-মৃত-বিজয় লাল দাশ	ঐ	
৮৩	০১/২০১০-১১	ধ্রুব কুমার দাশ পিতা-মৃত-বিজয় লাল দাশ	ঐ	
৮৪	০১/২০১০-১১	সমীর কুমার দাশ পিতা-মৃত বিজয় লাল দাশ	ঐ	
৮৫	০১/২০১০-১১	দেবাশীষ কুমার দাশ পিতা-মৃত-সতীশ চন্দ্র দাশ	ঐ	
৮৬	০১/২০১০-১১	মিহির কুমার দাশ পিতা-মৃত-সতীশ চন্দ্র দাশ	ঐ	
৮৭	০১/২০১০-১১	আশীষ কুমার দাশ পিতা-মৃত-সতীশ চন্দ্র দাশ	ঐ	
৮৮	০১/২০১০-১১	আব্দুর রহমান ইজারাদার পিতা-মৃত-নওশের ইজারাদার	ঐ	
৮৯	০১/২০১০-১১	মোঃ ছালাম শেখ পিতা-মৃত-সোলায়মান মাষ্টার	সাং-বর্ণি উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৯০	০১/২০১০-১১	মোঃ মুসা পিতা-মৃত-রজ্জব আলী শেখ	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৯১	০১/২০১০-১১	মোঃ ফারুক পিতা-মৃত-রজ্জব আলী শেখ	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৯২	০১/২০১০-১১	মোঃ নুর নবী পিতা-মৃত-রজ্জব আলী শেখ	সাং-সাপমারিকাটাখালী উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৯৩	০১/২০১০-১১	মোঃ আলিউর রহমান পিতা-মৃত-মোঃ মমিন উদ্দিন মোল্লা	সাং-২নং হাজেরা মেমোরিয়াল সরকারি প্রাথমিক বিদ্যালয় লেন, পশ্চিম	

		পিতা-মৃত-ত্রৈলক্ষ নাথ দাশ	উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৩১	০১/২০১০-১১	আসীম কুমার দাশ পিতা-মৃত-কার্তিক চন্দ্র দাশ	সাং-বেতাগা, উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৩২	০১/২০১০-১১	আসীৎ কুমার দাশ পিতা-মৃত-কার্তিক চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৩২	০১/২০১০-১১	নীলয় কুমার দাশ পিতা-মৃত-নির্মল কুমার দাশ	সাং-ভট্ট খামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৩৩	০১/২০১০-১১	মোঃ জামির আলী শেখ পিতা-মৃত-মোঃ বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৩৪	০১/২০১০-১১	মোঃ ছাদেক আলী শেখ পিতা-মৃত-মোঃ বছির উদ্দিন শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৩৫	০১/২০১০-১১	সমর চন্দ্র দাশ পিতা-মৃত-কেশব লাল দাশ	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৩৬	০১/২০১০-১১	অমর কৃষ্ণ দাশ পিতা-মৃত কেশব লাল দাশ	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৩৭	০১/২০১০-১১	দুলাল কৃষ্ণ দাশ পিতা-মৃত-মাধব চন্দ্র দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৩৮	০১/২০১০-১১	দিবাকর দাশ পিতা-মৃত-শীতল চন্দ্র দাশ	সাং-রণজিতপুর, উপজেলা-বাগেরহাট সদর, বাগেরহাট।	
৩৯	০১/২০১০-১১	নিরঞ্জন কুমার পাল পিতা-মৃত-কালিপদ পাল	সাং-কিসমতভট্ট উপজেলা-বাগেরহাট সদর,বাগেরহাট।	
৪০	০১/২০১০-১১	নাদিরা বেগম পিতা-আলহাজ সোহরাব উদ্দিন	ঐ	
৪১	০১/২০১০-১১	আসীম কুমার দাশ পিতা-মৃত-রবীন্দ্র নাথ দাশ	সাং-বেতাগ,ফকিরহাট, বাগেরহাট।	
৪২	০১/২০১০-১১	পদ্মা রাণী দাশী জং-মৃত-লক্ষী কান্ত দাশ	সাং-বেতাগা, ফকিরহাট, বাগেরহাট।	
৪৩	০১/২০১০-১১	আনছার আলী শেখ পিতা-মৃত-মোহাম্মদ ছিদ্দিক শেখ	সাং-কাপাশডাঙ্গা উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৪৪	০১/২০১০-১১	তাছলিমা বেগম জং-জাফর ইজারাদার	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৪৫	০১/২০১০-১১	অজয় কুমার দাশ পিতা-মৃত-হৃদয় নাথ দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট সদর, বাগেরহাট।	
৪৬	০১/২০১০-১১	সঞ্জয় কুমার দাশ পিতা-মৃত-হৃদয় নাথ দাশ	ঐ	
৪৭	০১/২০১০-১১	শ্যামল কুমার দাশ পিতা-মৃত-হৃদয় নাথ দাশ	সাং-রণজিতপুর উপজেলা-বাগেরহাট সদর,বাগেরহাট।	
৪৮	০১/২০১০-১১	মোঃ হাফিজুর রহমান পিতা-মহোর আলী	সাং-কালেখারবেড় উপজেলা-রামপাল, জেলা-বাগেরহাট।	
৪৯	০১/২০১০-১১	শ্যামল কুমার দাশ পিতা-মৃত-শচিন্দ্র নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫০	০১/২০১০-১১	বিকাশ চন্দ্র দাশ পিতা-মৃত-শচিন্দ্র নাথ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫১	০১/২০১০-১১	নীল কমল দাশ পিতা-মৃত-নির্মল কুমার দাশ	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫২	০১/২০১০-১১	মনোরঞ্জন দাশ পিতা-মৃত-নটবর দাশ	সাং-ভট্টখামার উপজেলা-ফকিরহাট, জেলা-বাগেরহাট	
৫৩	০১/২০১০-১১	প্রভা রাণী দাশ জং-ঠাকুর চন্দ্র দাশ	সাং বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৪	০১/২০১০-১১	আশীষ কুমার দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৫	০১/২০১০-১১	দীপক কুমার দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৬	০১/২০১০-১১	সমীর কুমার দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৭	০১/২০১০-১১	তাপস কুমার দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৮	০১/২০১০-১১	চম্পক কুমা দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৫৯	০১/২০১০-১১	আশীষ কুমার দাশ পিতা-মৃত-হরিপদ দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬০	০১/২০১০-১১	অজয় কুমার দাশ পিতা-গৌর হরি দাশ	সাং-বেতাগা উপজেলা-ফকিরহাট, জেলা-বাগেরহাট।	
৬১	০১/২০১০-১১	সেকেন্দার আলী শেখ পিতা-মৃত-সেরমান উদ্দিন শেখ	সাং-তুলশিরাবাদ উপজেলা-রামপাল, জেলা-বাগেরহাট।	

১৫১১	০১/২০১০-১১	আমেনা বেগম জং- হাতেম আলী	সাং-মানিকনগর, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫১২	০১/২০১০-১১	আবুল কালাম সরদার পিতা মৃঃ ছোলায়মান সরদার	সাং-সুলতানিয়া, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫১৩	০১/২০১০-১১	মোঃ রহিম শেখ পিতা বরকত উল□া শেখ	সাং-কালেখারবেড়, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫১৪	০১/২০১০-১১	বরকতুল□া শেখ পিতা-ছদর উদ্দিন শেখ	ঐ	
১৫১৫	০১/২০১০-১১	মোসাঃ তানিয়া পারভিন পিতা মোঃ আমানত আলী	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫১৬	০১/২০১০-১১	শেখ মোঃ আমজাদ আলী পিতা মৃঃ সেরাজ উদ্দিন শেখ	ঐ	
১৫১৭	০১/২০১০-১১	মোঃ আসাদ সানা পিতা মোঃ বারিক ছানা	সাং-কাপাশডাংগা, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫১৮	০১/২০১০-১১	নওশের আলী সানা পিতা মোঃ বারিক ছানা	ঐ	
১৫১৯	০১/২০১০-১১	মোঃ আকবর আলী মুন্সি পিতা মৃঃ রাহেন উদ্দিন মুন্সি	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫২০	০১/২০১০-১১	রোজিনা বেগম জং মোঃ আকবর আলী মুন্সি	ঐ	
১৫২১	০১/২০১০-১১	মোঃ আব্দুল হাই শেখ পিতা মৃঃ আঃ ছামাদ শেখ	সাং-ধনপোতা উপজেলা-ফকিরহাট, জেলা- বাগেরহাট	
১৫২২	০১/২০১০-১১	প্রশান্ত রায় পিতা মৃঃ উত্তম রায়	সাং-কাপাশডাংগা, উপজেলা-ফকিরহাট জেলা- বাগেরহাট	
১৫২৩	০১/২০১০-১১	মোঃ আবুল হাছান পিতা মোঃ জিল□র রহমান	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫২৪	০১/২০১০-১১	মোঃ হাফিজুর রহমান কাজী পিতা মৃঃ খলিলুর রহমান কাজি	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫২৫	০১/২০১০-১১	মোসাঃ জোহরা বেগম পিতা মৃঃ খলিলুর রহমান কাজি	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫২৬	০১/২০১০-১১	মোসাঃ লতিফা বেগম পিতা মৃঃ খলিলুর রহমান কাজি	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫২৭	০১/২০১০-১১	মোসাঃ তাসকারা বেগম পিতা মৃঃ খলিলুর রহমান কাজি	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫২৮	০১/২০১০-১১	জয়নাব খাতুন জং মোঃ জুলফিকার আলী শেখ	ঐ	
১৫২৯	০১/২০১০-১১	গোলেজান বেগম জং মোঃ জুলফিকার আলী শেখ	ঐ	
১৫৩০	০১/২০১০-১১	মোঃ আসাদুজ্জামান শেখ পিতা মোঃ জুলফিকার আলী শেখ	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫৩১	০১/২০১০-১১	মোঃ নুর□জ্জামান শেখ (টিটু) পিতা মোঃ জুলফিকার আলী শেখ	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫৩২	০১/২০১০-১১	মোঃ৫মোরশেদ লস্কর পিতা মৃঃ ছাদেক লস্কর	সাং-বর্নি, উপজেলা-রামপাল জেলা- বাগেরহাট	
১৫৩৩	০১/২০১০-১১	আব্দুস সালাম লস্কর পিতা মৃঃ ছাদেক লস্কর	ঐ	
১৫৩৪	০১/২০১০-১১	মোঃ মহর আলী লস্কর পিতা মৃঃ ছাদেক লস্কর	ঐ	
১৫৩৫	০১/২০১০-১১	মোঃ ছবেদ আলী লস্কর পিতা মৃঃ ছাদেক লস্কর	ঐ	
১৫৩৬	০১/২০১০-১১	মোসাঃ ফরিদা খাতুন পিতা মৃঃ ছাদেক লস্কর	ঐ	
১৫৩৭	০১/২০১০-১১	মোসাঃ জরিনা খাতুন পিতা মৃঃ ছাদেক লস্কর	ঐ	
১৫৩৮	০১/২০১০-১১	মোসাঃ সিরাতুন্নেছা পিতা মৃঃ ছাদেক লস্কর	ঐ	

মোঃ কামাল হোসেন
(সার্ভেয়ার)
এল,এ, শাখা, বাগেরহাট কালেক্টরেট

নিত্য গোপাল
ভূমি অধিগ্রহন কর্মকর্তা
বাগেরহাট

Frequently Asked Questions (FAQs) on Potential Environmental Impacts and Recommended Mitigation Measures of Khulna 1320 MW Coal Based Thermal Power Plant

Sl no	Frequently Asked Questions (FAQs)	Responses
1	Is the plant location at safe distance from the Sundarbans and the World Heritage site? Does it violation of the Environmental Conservation Rules (ECR) 1997 ?	The proposed plant location is 14 km away from the nearest boundary of Sundarbans and 69.6 km from the nearest world heritage site. As per the ECR 1997, no construction shall be made within the 10 km radius area from the Sundarbans Forest Boundary which has been declared as Ecological Critical Area (ECA), while the plant location is 14 km from the nearest boundary of the Sundarbans. Hence, the location complies with ECR 1997.
2	Will the Proposed Project result rise of local temperature due to heat radiation from the Chimney?	The temperature of the flue gas would be maximum 125^0C at Chimney's outlet which is lower than the other conventional technology. This heat will be dispersed easily to the atmosphere as the stack will be designed to 275m height following the DoE's standard. Moreover, there is no topographical barrier of heat dispersion like mountain/hilly area, dense city, tallest building, etc within the 20 km of the plant location that may trap the heat and cause rise of local temperature.
3	• Will the coal dust to be generated from coal stockyard be dispersed in nearby area and community? • Will the Coal dust to be generated during coal transportation pollute air quality of Sundarbans?	• Dust suppression system provided with automated sensor should be installed at Coal terminal, stock yard, plant site and ash disposal pond. • Conveyor system will be covered typed. At transfer points, water sprinkler should be installed. • Water sprinkler jets shall be provided to operate the sprinkler as and when required. • The entire stock yard should be covered with water sprinkler provided with automated moisture sensor.

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		Hence, there is no possibility of reaching the coal dust generated from ships' holds, unloading system, stockyard, conveyor belt to nearby community or Sundarbans.
4	Will the emitted ash from the power plant pollute air quality of Sundarbans and as well as nearby community ?	99.9% of the generated fly ash is to be arrested from the flue gas by installing most efficient Electrostatic Precipitator (ESP). The ESP shall limit the ash emission from the chimney (of 275 m) up to 100 µg/Nm^3, which is much below the ECR 1997 standard (200 µg/Nm^3). Similarly, Bottom ash shall be separated and managed by an efficient ash collection and management system.
5	Will the emission of SO_2 and NO_2 pollute the air quality of the Sundarbans as well as the locality?	All emissions will satisfy DoE and World Bank's Standard. Emission of SO2 and NOx from each unit shall be 819g/s and less than 750 µg/m^3 respectively satisfying World Bank's Standard (1,597 g/s and 750µg/m^3). The contribution of SO_2 and NO_2 in ambient air shall also be very low. In most of the time of a year wind flows northward while the Sundarbans is located southward of the project. So, the possibility of pollution of Sundarbans is very low.
6	Is there any scope of utilizing ash in our country ?	At present, ash demand in only cement industries of Bangladesh is about 2.1 million ton which is expected to become 3.75 million ton by 2020. It is estimated, around 0.75 million ton of fly ash might be produced annually from the proposed power plant. Hence, this generated ash may easily consumed by the cement industries of the country. Apart from this, ash might be utilized in agriculture (as fertilizer), embankment construction (with sand/earth), construction activities, brick making, land filling, etc
7	What would be contribution of the power plant in global warming?	The proposed power plant has been planned adopting supercritical boiler technology. Being

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		of super critical technology, the proposed power plant may emit around 7.9 million ton of CO_2 annually which is 10% less than other conventional technologies of coal based power plant. The increase in national per capita carbon emission on account of the operation of the proposed power plant is estimated to be miniscule. As such, contribution to global warming will also be less compared to other conventional coal based thermal power plant. However, a green belt shall be developed to compensate the carbon emission from the power plant.
8	Will the power plant release heavy metal?	The concentration of heavy metal in coal is extremely low. Major portion of the heavy metals shall remain with ash that shall be efficiently managed with ash handling and disposal system. The possibility of heavy metal pollution is very low.
9	Will the power plant cause Acid rain?	There is no possibility of Acid Rain The flue gas will easily be dispersed as there is no terrain effect and any other obstruction like building, dense city within 20 km radius of the plant that could cause fumigation and trapping of pollutants to form acid rain.
10	Is there any plan to fill or encroach the Maidara River and Passur River?	None of the portion of both Passur River and Maidara River shall be encroached. Rather, there is a dredging plan in the Passur river to improve navigability.
11	Is there any plan to built coal silo/stockyard in Sundarbans/Akram Points?	No coal silo/ stockyard be constructed in any location of the Sundarbans and its ECA. The coal stockyard shall be constructed at plant site.
12	Will the coal transportation through Sundarbans cause damage to Sundarbans?	Coal transportation shall be carried out following the existing navigational route of Mongla Port Authority (MPA). For the purpose of coal transportation, only one mother vessel may come in a week up to Akram Point and

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		then discharge coal to project site through Barges. Following the enforcement of ECR 1997, IMO Convention and other relevant laws.
13	Will there be any discharge of heated water from the plant?	The power plant has been planned considering close cycle cooling and circulating water system. No heated water shall be discharged to the river.
14	Will the project cause water pollution in the Passur River?	Water quality of the Passur river will not be changed due to operation of the power plant, as: • An integrated water and waste water treatment plant has been considered. • Provision has been kept for intent of reuse and recycling of water. • The plant will be designed in such a way so that no waste and waste water is discharge unmanaged and untreated. • No heated water will be discharged directly to the River.
15	Will there be any Black smog over the atmosphere of locality and the Sundarbans?	Forming black fume and smog is very unlikely as: • The concentrations of pollutants satisfy all emission standard of ECA 1995. • The flue gas will be emitted from the stack of 275m height above the atmospheric layer suitable for formation of black smog. • There is no topographical barrier like hills, dense city, etc in and around the project location that may trap air pollutants. • Cyclone and depression (common in that region) hinder long term trapping of the air pollutants
16	Will the electricity to be produced from the power plant (proposed)	No, but in future if Bangladesh is surplus in electricity, then electricity can be exported to