



**Bangladesh – India Friendship Power Company (Pvt.) Limited**  
**(A Joint Venture of NTPC Ltd. and BPDB)**

*Monitoring of Environment Parameter and Implementation of Environmental Management Plan during Construction Period along with Engineering Activities for 2X660 MW Maitree Super Thermal Power Project at Rampal in Bagerhat District*

## **30<sup>th</sup> Quarter Monitoring Report**

**Monitoring Period: August – October 2021**

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**March 2022**



Monitoring of Environment Parameter and Implementation of Environmental Management  
Plan during Construction Period along with Engineering Activities  
for 2x660 MW Maitree Super Thermal Power Project at Rampal, Bagerhat

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## Abbreviations and Acronyms

AAS	Atomic Absorption Spectrophotometer
AECL	Adroit Environment Consultants Ltd
As, Pb, Hg	Arsenic, Lead and Mercury
BCSIR	Bangladesh Council of Scientific and Industrial Research
BDS	Business Development Studies
BIFPCL	Bangladesh-India Friendship Power Company (Pvt.) Limited
BOD	Biochemical Oxygen Demand
BPDB	Bangladesh Power Development Board
BUET-BRTC	Bangladesh University of Engineering and Technology - Bureau of Research, Testing and Consultation
CDM	Clean Development Mechanism
CEGIS	Center for Environmental and Geographic Information Services
COD	Chemical Oxygen Demand
CPUE	Catch per Unit Effort
CSR	Corporate Social Responsibility
dBH	Diameter at Breast Height
DCR	Duplicate Carbon Receipt
DO	Dissolved Oxygen
DoE	Department of Environment
DPHE	Department of Public Health Engineering
EC	Electrical Conductivity
ECR	Environment Conservation Rules
EHS	Environmental Health Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering Procurement Construction
ESP	Exchangeable sodium percentage
FGD	Focus Group Discussion
FGD	Flue Gas Desulfurization
FSR	Fisheries Species Richness
GIS	Geographic Information System
GoB	Government of Bangladesh
GPS	Global Positioning System

GW	Groundwater
HS	Household Survey
IFC	International Finance Corporation
IGA	Income Generation Activities
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
Kg	Kilogram
KII	Key Informants Interview
MoPEMR	Ministry of Power, Energy and Mineral Resources
MW	Mega Watt
MSDS	Materials Safety Data Sheet
NTPC	National Thermal Power Corporation
OHSAS	Occupational Health and Safety Management Systems
PCU	Passenger Car Unit
PGCB	Power Grid Company of Bangladesh Ltd
PMU	Project Management Unit
PRA	Participatory Rural Appraisal
PWD	Public Works Department
QMR	Quarterly Monitoring Report
RRA	Rapid Rural Appraisal
RS	Remote Sensing
SAR	Sodium absorption ratio
SRDI	Soil Resources Development Institute
SRF	Sundarbans Reserve Forest
TDS	Total Dissolved Solid
TH	Total Hardness
ToR	Terms of References
TSS	Total Suspended Solid
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

## Units

dB	Decibel
hr	Hour
Kg	Kilogram
Km	Kilometre
KV	Kilo Volt
KW	Killo Watt
m	Meter
mg	Milligram
MW	Mega Watt
Nm	Normal Meter
ppm	parts per million
ppt	parts per trillion
ton/year	Ton Per Year
s	Seconds

## Units Conversion Table

### General Units

1°C = 274.15 K=33.8° F  
1 hectare = 10<sup>-2</sup> km<sup>2</sup> = 2.471 acres  
1 kilogram = 2.20 pound  
1 kilometre = 0.62137 mile  
1 liter = 0.001 cubic meter  
1 meter = 3.2808 feet  
1 metric ton = 1000 kg  
1 mg/L ≈ 1 g/m<sup>3</sup> ≈ 1 ppm (w/w)  
1 mg/m<sup>3</sup> = 1 µg /L  
1 pascal = 1 N/m<sup>2</sup> = 0.01 millibar  
1 square mile = 640 acre = 2.590 km<sup>2</sup>

### Energy Units

1 GWyr = 8.76 x 10<sup>9</sup> kW  
1 horsepower = 746 W  
1 KWh = 3412 Btu  
1 kWh = 859.85 kcal  
1 KWh = 3.6 x 10<sup>6</sup> J  
1MW=1000KW=10<sup>6</sup>W



## Glossary

<i>Aman:</i>	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.
<i>Aus:</i>	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 HYVT. (High yield variety) Aus.
<i>B Aus:</i>	Broadcast Aus
<i>Bazar:</i>	Market
<i>Beel:</i>	A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.
<i>Boro:</i>	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.
<i>Haat:</i>	Market place where market exchanges are carried out either once, twice or thrice a week, however not every day.
<i>Gear/Jaal:</i>	Different types of fishing net to catch fish from the water bodies.
<i>Kutchra:</i>	A house made of locally available materials with earthen floor, commonly used in the rural areas.
<i>Khal:</i>	A drainage channel usually small, sometimes man-made through which the water flows. These may or may not be perennial.
<i>Kharif:</i>	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).
<i>Perennial Khal:</i>	Water available in the khal all the year round.
<i>Pacca:</i>	Well-constructed building using modern masonry materials.
<i>Rabi:</i>	Dry agricultural crop growing season; mainly used for the cool winter season between November and February.
<i>Seasonal Khal:</i>	Water not available in the khal all the year round.
<i>T. Aman:</i>	Transplanted Aman
<i>Upazila:</i>	Upazila is an administrative subdivision of a District.



## Executive Summary

This 30<sup>th</sup> quarterly monitoring report covers the status of EMP (Environmental Management Plan) implementation for the concurrent period (during construction stage) as recommended in the EIA (Environmental Impact Assessment) study of power plant vide Memo No: DoE/Clearance/5062/2011 dt. 05/08/2013 as well as EIA report of Coal Transportation vide Memo No: DoE/Clearance/5532/2016 dtd.31/01/2018. During the month of October, 2021 CEGIS team carried out the monitoring activities covering every monitoring aspects as assigned in the ToR (Terms of Reference) and approval conditions of DoE along with valuable suggestions and recommendations from different national and international organizations. In other words, the aspects can briefly be addressed as monitoring of the Environmental Compliances and monitoring of the selected environmental parameters such as ambient air quality, noise level, water quality, land resource, traffic management status, water resources management status, agricultural resources monitoring, fisheries resources, Socio-economic monitoring, aquatic & terrestrial ecosystem monitoring and the Sundarbans Reserve Forest (SRF) health monitoring.

However, the present environmental compliance monitoring includes the status of EMP implementation based on physical observation, investigation and interviews/discussion to the proponents and project officials, contractor or sub-contractors, or relevant authorities. A comprehensive due diligence checklist was prepared to monitor the environmental compliance of different components e.g., Environmental and Social Management System and Action Plan; Labour and Working Condition; Community Health, Safety and Security; Biodiversity and Sustainable Management of Living Natural Resources.

The construction works is running amply amid the COVID situation. Most of the mechanical and electrical construction works are progressively installing. The Boiler, Turbine hall and Generator, cooling tower, Chimney and FGD, ESP, WTP, Ash silo, 275 m chimneys, Jetty area, covered coal storage, covered coal conveyer system, township area, internal road networks, permanent drainage networks are developing. EPC contractor i.e. Bharat Heavy Electricals Limited (BHEL) employed different local specialized sub-contractor i.e. KELLER, AFCON, POWER MAC etc. for progressing the construction works simultaneously.

The bridges and culvert area of the approach road is completed and extends up to the Block-B. Permanent entrance gate of the MSTPP power plant structure has been placed at the security check point. The main Administrative centre of BIFPCL and EPC contractor were shifted to the newly constructed buildings and accommodation facilities for the maximum professionals of BIFPCL has been made available to the newly constructed township named Padma Abason. According to the project planning, the first unit of Maitree Super Thermal Power plant would be in operation stage by September, 2021. But unfortunately, the COVID-19 outbreak has retarded the project progress up to June, 2022. Though, the project work was almost halted at the end of the March, 2020, it came into full pace in July, 2020. But, the second lockdown again slowed down the construction works. However, the construction activities are being continues within the project site by strictly maintaining the Government Decision on COVID Guidelines. EPC tried to expedite the contractors and sub-contractors for completion of the project works within the stipulated timeframe maintaining the instruction and health safety guideline of the existing pandemic.

In course of air quality monitoring it was observed that the concentration of major air pollutants was found comparatively lower in the Sundarbans area than that of other monitoring locations during the monitoring period. All the parameters were found to be within the standard limit set by ECR'97 except slight exceedance at BIFPCL residential area. Therefore, it is suggested to conduct dust suppression system at the sensitive locations through water spraying, limiting vehicle movement etc. However, major sources of criteria pollutants in and around the project site as observed were the piling activities, digging, tunnelling and burrowing works, jetty erection activities, major construction works, dust from unpaved roads and vehicle movement, construction materials and goods transportation activities through the roads and river Passur etc. Other sources of pollutants which may contribute to the existing pollution load are the small

industries like cement works and refinery industries etc., diffuse sources like wood stoves, fires, and wind generated dust etc.

Again, in course of the noise level monitoring it was found that, the noise levels at Chalna, NW corner of the project boundary (Kaigar daskati), Chunkuri-2, Maidara, Shapmari and Barni area were found to be within the standard limit (Noise control Rules, 2006; MoEF). On the other hand, two commercial zone namely Khan Jahan Ali bridge and Mongla ghat area were observed to be very much crowded during the monitoring tier and the noise levels (80.18 dB and 76.86 dB respectively) were exceeded the standard limit (Noise control Rules, 2006; MoEF). Similarly, the noise level was found to be 57.02 dB as observed much shipping activities along with tourisms at Harbaria which might be the reason behind the exceedence. On the other hand, the monitoring plot at Hiron Point was eroded heavily due to the dredging activities which increased the exposure of shoreline of the Bay of Bengal and thus the wave breaking sound became more vibrant in the monitoring plot. Hence, the noise level at the monitoring plot was observed to be increased ever than before during the monitoring tier and the abovementioned fact might be the reason behind the exceedance.

In course of water quality monitoring, pH was found slightly basic in nature. Salinity during monsoon has been recorded significantly lower than the pre-monsoon and winter seasons. Temperature and dissolved oxygen level was found in fair and favourable for the aquatic life forms. During the 29<sup>th</sup> quarter (monsoon, 2021), TDS and TH has been relatively lower with respect to the same seasons of last consecutive years. TSS of the rivers was also recorded lower than the previous year of pre-monsoon seasons. Nitrate ( $\text{NO}_3^-$ ) level remained relatively lower. Sulphate concentration should be re-investigate after getting the data from future quarterly monitoring season. The phosphate ( $\text{PO}_4^{3-}$ ) was found within the safe limit of aquatic organisms. In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and even no issues as well. Oil & grease concentration was found less than 2.0 mg/L at all sites which is less than the recommended concentration (10 mg/L) for Inland Surface Water. No TOC and PAH issues were raised so far in the Passur-Sibsa RS. Nevertheless, the physical characteristics of groundwater quality is still in good condition with slight variation in pH and salinity. The reason being saline water intrusion and infiltration due to excessive withdrawn of groundwater by the surrounding communities during the dry season. In addition, evaporation also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes in salinity.

Chemical characteristics of the groundwater quality are also found relatively good but exceeded on the permissible limit for Bangladesh (Drinking water standards, ECR' 1997). The observed groundwater is completely free from the metal pollution particularly Lead and Mercury. Arsenic pollution was recorded at Kapashdanga monitoring station during the April, 2021. Out of 29 monitoring seasons, only three times Arsenic became an issue temporarily with slightly higher concentrations than the drinking standards

On the other hand, Local Aman is planted in all monitoring locations except Baranpara and Bidyarban. Kapalirmet remain fallow as previous as aquaculture continues. However, agricultural practice and management remains similar to previous monitoring. Production and damage related data will be incorporated in 32nd monitoring report. No specific impact was drawn for livestock during this monitoring.

Similar to the earlier months monitoring report, vehicular movements were observed during the surveys were mostly for the regular construction activities of the Power Plant as the construction activities of the Power Plant are progressing heavily. Khulna Mongla Road at Khudir Bottola received the highest traffic volume compared to the other two locations namely Khulna Mongla Road at Gonai Bridge and Power plant access road at Gonabelai Bridge. It is to be mentioned here during the morning time traffic volume at Khudir Bottola was found to be lower whereas Khulna Mongla Road at Gonai Bridge and Power Plant access road at Gonabelai Bridge received higher traffic volume compared to the previous monitoring period.

Sediment sample analysis report of 29<sup>th</sup> monitoring (July, 2021 or wet season, 2021) is incorporated in this report. According to the analysis, only Mercury (Hg) touches average shale value (ASV) in two locations and average upper crust value (AUCV) in one location (jetty site) other two locations Hg valu is below ASV and AUCV. As and Pb concentration is within the ASV ans AUCV. In general, all elements concentration is reduced in all sampling locations. The maximum concentration for As, Pb and Hg is found in Jetty site



(project site), Mongla and Moidara & Harbaria respectively. Only As concentration in project site (jetty point), exceeds this monitoring average.

Monitoring of 30<sup>th</sup> quarter for fisheries resources have been conducted at 13 sampling sites which were set at the inception stage. Out of these sites, effective samplings were done at 11 sites as fishing in other sites in the river were not observed. Amongst the effective sites, eight (08) were in the river and three (03) were in the country side (shrimp farms). The followings are the key findings of the 30th quarter monitoring in the fiscal year of 2021-22. Changes in habitat uses were observed in every past fiscal year along with the current one (as compared to the fiscal year of 2014-2015, 2015-2016, 2017-2018, 2018-2019, 2019-20 and 2020-21), caused mainly due to biophysical changes like tidal effect, forest erosion and vegetation coverage, seasonal variability, food availability and also fisheries management practices.

Moreover, through analyzing the type of habitat uses by different age group of fish species (based on the length-based community structure model) two types of habitats were found i.e. i) feeding ground and ii) omni-ground. The omni-ground is comprised of other two habitats such as (a) nursery ground and (b) maturation and feeding ground. Shannon-Weiner diversity index has also been observed to vary between 30th quarters with that of all previous quarters. Highest Shannon-Weiner index was found at the Chandpai (0.64 out of 10 species) indicating moderate evenly distributed fish species. On the contrary, lowest evenness was found at the Akram Point (0.26 out of 20 species). However, maximum FSR was obtained in the Charaputia Khal (n=34), while very low FSR was recorded at the Maidara and Mongla Point (n=1). Fries of fin fish and shrimp were widely distributed from middle stretches to the down stretches (Chandpai, Harbaria and Charaputia), juveniles age group in Charaputia and Harbaria Point of the Passur River system. Adults of large-sized fishes were observed at the Akram Point, Harbaria, Charaputia and Maidara River in this quarter monitoring. Fish species like Paissa, Silonda and Poma attain the maximum abundance among the migratory fish species observed in the 30th quarter of monitoring. Moreover, among migratory species, Paissa and Bhola were observed to migrate long distances. In this monitoring, the highest productivity was found in Harbaria and the lowest productivity at the Mongla Point. The present study revealed that the highest catch susceptibility was also found in case of Charpata Jal (20.6 kg/haul).

In course of ecological monitoring it was found that Vegetation composition, plant diversity, vegetation canopy status, plant health, bird habitat status, dolphin occurrence in river systems have been monitored for this monitoring season. A total of 28 tree species were recorded from all the monitoring sites with Shanon-Winner diversity index of 1.22 which denotes the diversity is unchanged than previous monitoring tier. Canopy status improved at Rajnagar site due to reduction of stress from land development activities within the homestead. Except the health improvement of *Excocharia* tree, plant health at all other sites revealed unchanged. None of the site recorded bird nest but migratory and local migratory avifauna were sighted at 7 wetlands out of 8; and which of two sites were the evidence of migratory birds with low populations. Occurrences of dolphin revealed higher than previous monitoring all the surveyed river/khal reaches and this may be due to abundance of fishes and strictness of fishing activities within the dolphin habitat

In course of Sundarban reserve Forest health monitoring, various bio-indicators such as tree growth, species diversity, seedling regeneration capacity, phenmetaphore occurrence, crab hole density, canopy cover changes, Leaf Area Index, leaf phenology, pest, and diseases, soil physical and chemical properties were observed in the permanent sample plots (PSPs) along the Passur River over time. Monitoring result shows that Gewa (*Excoecaria agallocha*) and Sundari (*Heritiera fomes*) was the dominant species among all the PSPs followed by Passur (*Xylocarpus mekongensis*) and Kakra (*Bruguiera gymnorhiza*). Species diversity indices show that sample plots of Karamjol have more diversified compared to other PSPs. When similarity in species composition was considered, Akram point and Hiron point has similarity in species composition compared to Sutarkhali, Karamjol, and Harbaria. There was no significant variation in tree growth, pneumatophores density, canopy cover changes, and Leaf Area Index over the monitoring period except carb hole density which increase significantly from the previous monitoring period for all the PSPs. Among sites, the comparison shows that the average tree diameter is higher in Karamjol whereas lower at Akram Point. Pneumatophores density was comparatively very low in Akram point whereas highest in

karamjol PSPs. Akram point canopy cover was lower compared to the rest of PSPs canopy cover percentage. However, no significant variations among sites were observed. The seedling number increases in Karamjol and Harbaria but decreases in Akram point, Hiron point and Sutarkhali because of low seedling recruitment and survival rate. Among all the PSPs crab hole density shows an increasing trend which is a good indicator for forest health. In case of the Leaf Area Index (LAI), there was no significant variation observed among sites. No severe pest and disease attacks were observed in the monitoring PSPs except top dying symptom of Sundari (*Heritiera fomes*). Phenological changes were not observed in all PSPs. Overall, it can be said that forest health along the Passur River is in stable condition (i.e. no detrimental condition) except top dying of Sundari (*Heritiera fomes*) tree species.

Moreover, the Socio-economic monitoring was conducted to explore project impacts on livelihoods, working environment, community health and safety, and activities under the Corporate Social Responsibility (CSR). For the study, physical observation, consultation and informal interviews collected information from the PMU and local communities. It is found that presently, about 15% of local labourers work at the project site—special attention taken by PMU to tackle the spreading of coronavirus. There is no entrance of people without masks. In the labour sheds, local people have to follow social distancing, wash hands regularly and avoid gathering. The PMU has paid particular attention to monitoring the situation to prevent covid 19.

The Labor sheds were found clean with adequate toilet facilities, drainage, waste management, and drinking water. A mini hospital inaugurated with modern equipment, ICU bed and permanent doctor inaugurated to manage the workplace's emergency. Local communities are not facing any problems due to the construction activities. The plantation program is ongoing to improve the greenery environment. Following the 63 conditions, the green belt was created, whereas a mangrove forest was grown by the PMU. A caretaker from the Forest Department monitors and takes care of this forest. The number of plants is increasing day by day, and the forest coverage is potentially growing, changing the environment of this area.

The PMU arranges various programs under the CSR program. The Upazila administration organised traditional puppet shows, drama, and education kits distribution programs, whereas the MSTPP provided financial support under the CSR. Besides, regular medical campaigns are set to offer free medical services. A total of 1816 people received free treatment (September – November, 2021) under the OPD, mobile, boat, labour colony medical campaign and services from the medical centre. According to the officials of MSTPP, till now (November, 2021), a total of 59,309 people received free treatment from different medical campaigns. Finally, various suggestions and corrective action plans are given to improve the compliance status, which will be monitored in the coming period of social safeguard monitoring.

# 1. Introduction

## 1.1 Background

The scope of works as assigned has provisioned to monitor the environmental components, social indicators and the implementation status of EMP (Environmental Management Plan) during the construction phase of 2x660 MW Maitree Super Thermal Power Plant. As an independent environmental monitoring agency, CEGIS was engaged for conducting the said activities in accordance with the Power Plant EIA approval condition no. 32 and Coal Transportation EIA approval condition no.17.

The location of 2x660 MW MSTPP project encompasses Sapmari, Katakhal and Kaigar Daskati Mauza of Rajnagar Union under Rampal Upazila of Bagerhat District (**Figure 1.1**). The Power Plant lies in between latitude 22° 37' 0" N and 22° 34' 30" N and longitude 89° 32' 0" E and 89° 34' 5" E. The Plant site is located at about 23 km south from the Khulna City and near about 14 km from the north-west direction of nearest tip of the Sundarbans (considering the proposed chimney location). Location of the study area along with the distance from World heritage sites are presented in **Figure 1.1**.

The study area includes: i) Area covering 10 km radius from the Plant location, ii) Area within 5 km strip from both banks of the Passur river starting from the Plant site to Hiron point (**Figure 1.2**). As per the contract, the findings of the previously formulated quarterly monitoring reports have been submitted to BIFPCL.

Monitoring of Environmental parameters and associated data collection is being continued considering the spatial as well seasonal variations. However, in October, 2021 CEGIS team has carried out the 30<sup>th</sup> quarterly monitoring activities covering all the preselected monitoring parameters.

## 1.2 Objectives

The prime objectives of the study are:

- To monitor the important environment and social parameters during construction phase of the Power Plant and
- To monitor, the environmental compliances regarding EMP implementation during Power Plant's construction works and associated activities.

## 1.3 Criteria for Selection of Monitoring Sites/Locations

The monitoring sites have been selected considering the sensitivity and the ambience of the surroundings likely to be impacted from the Project related activities which includes-

- Wind speed and direction, sensitive receptors in and around the vicinity of the project site were considered for monitoring the ambient air quality. Potential areas were also identified and selected for noise level monitoring likely to be impacted by the project activities. Similarly, sites for water quality monitoring were selected considering the water resources (Maidara and other nearer water bodies, Passur River from Chalna to Hiron Point) likely to be impacted by the project activities.
- Potential locations for fisheries resources monitoring were selected considering the fish habitats, biodiversity, migration and production zones likely to be impacted by the project activities.
- Monitoring locations for ecosystem and biodiversity, Soil and land resources were selected considering the induced impacts of the Project related activities on the project surrounding areas.

- Monitoring of socio-economic conditions of the PAPs (Project Affected Peoples) and project surrounding communities were being carried out on the basis of their circumstances likely to be transformed and /or altered by the project activities.
- Locations for Sundarbans Reserve Forest (SRF) Health Monitoring were selected considering the potential access routes of coal transportation through Sundarbans Forest area and associated activities for different phases of the power plant development and operation which might have significant effects on Sundarbans's flora and fauna.
- Monitoring aspects for Environmental compliances regarding EMP implementation status in and around the project area has been set as per suggestions made in the EIA reports and approval conditions from DoE of both the Power Plant and Coal transportation studies respectively for ensuring environmental sustainability and social acceptability.



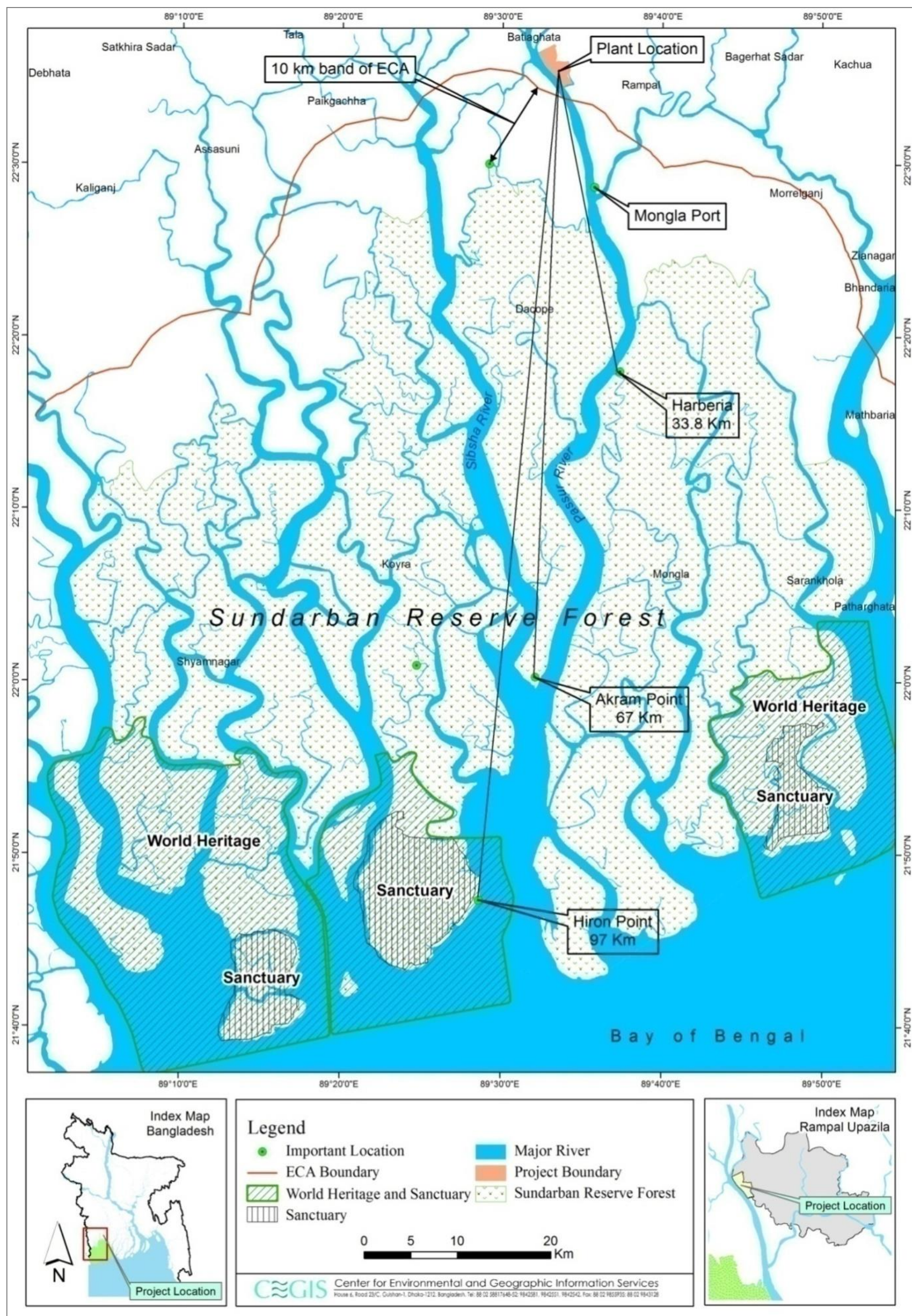


Figure 1.1: Location Map of the Study Area



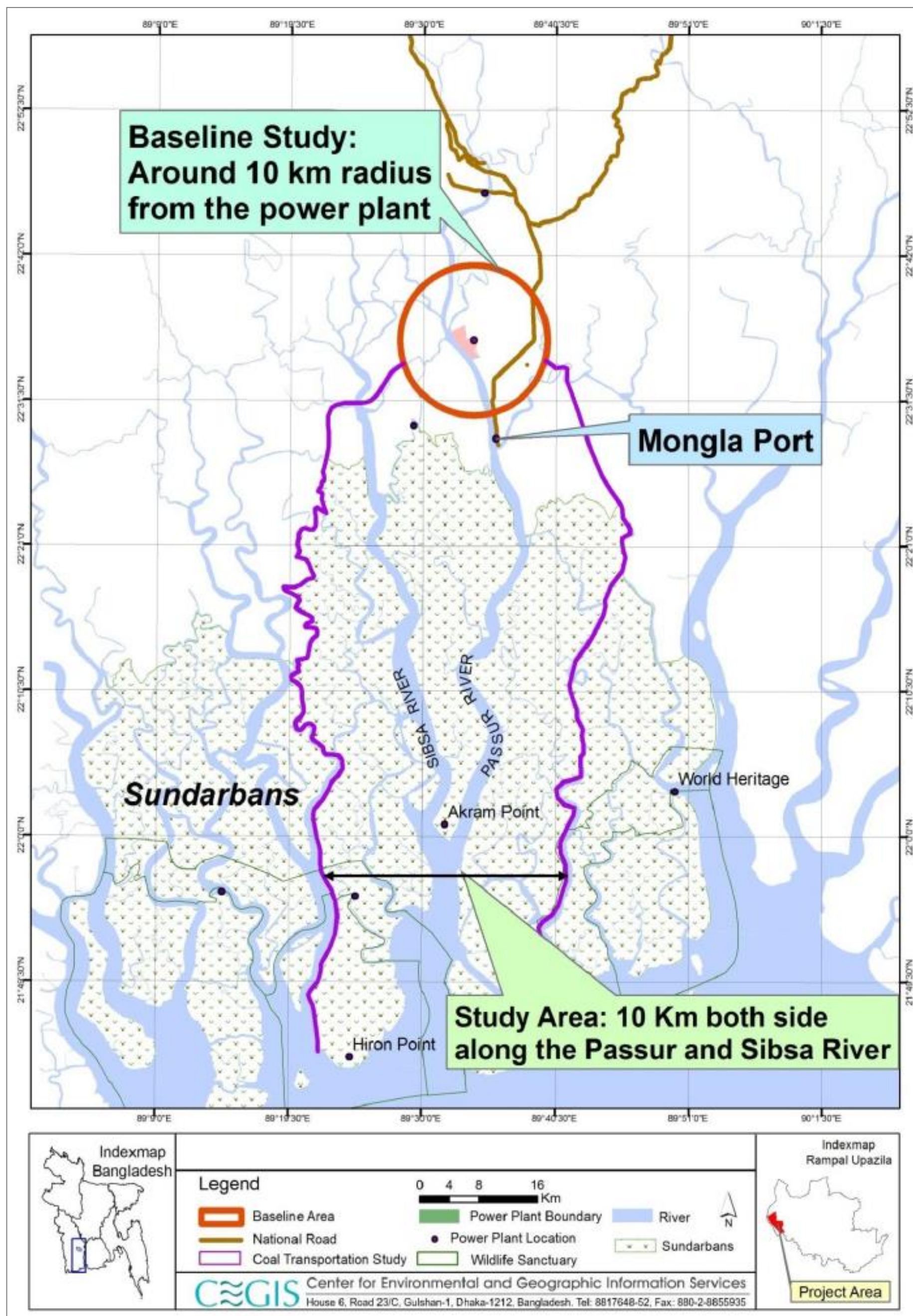


Figure 1.2: AOI of Environmental and Socio-economic Monitoring

## **1.4 Main Stakeholders**

### **1.4.1 Forest Department**

Monitoring of the Sundarbans Reserve Forest area need to be addressed as the conditions set out by the DoE. Hence, permission from the Forest Department is essential to carry out the said activities. The Forest Department has been providing the permission under certain conditions i.e. keeping close communication with the Forest Department, submission of the monitoring reports to the Forest Department along with the following activities:

- Inclusion of a Soil Scientist and a Botanist in the monitoring team,
- Monitoring of regeneration, in growths (seedlings), diseases and pests (if necessary, to carry out laboratory analysis),
- Monitoring of soil nutrients (macro, micro) and heavy metals,
- Monitoring of floral diversity, species richness and dominance,
- Measurement of carbon content both above and below the ground level,
- Assessment of impact on canopy cover, leaves phenology, flowers behaviour, pneumatophore and crab hole conditions.

However, BIFPCL forwards each copy of the earlier quarterly monitoring reports to the Chief Conservator of Forest, Bangladesh Forest Department, Agargaon, Dhaka and Conservator of Forest, Khulna Circle, Boyra, Khulna. Similarly, the report of 30<sup>th</sup> quarterly monitoring will also be forwarded to the same officials of the corresponding Departments.

### **1.4.2 Department of Environment (DoE)**

The monitoring plans, indicators, parameters, location have been selected and arranged by incorporating the suggestion(s) and approval condition(s) from both the Power Plant EIA study and Coal Transportation EIA study. The BIFPCL forwards the monitoring reports and data to DoE on a regular basis (Monthly and Quarterly). The monitoring reports are also presented to the Environmental Clearance Committee of the DoE during renewal of the site clearance. In addition, one representative from the local DoE office is involved in each monitoring visit to accompany the monitoring team.

### **1.4.3 Bangladesh India Friendship Power Company (Pvt.) Limited (BIFPCL)**

Bangladesh India Friendship Power Company (Pvt.) Limited (BIFPCL) is the Project Proponent of the proposed Power Project. The official(s) of BIFPCL has been assisting the study team from the beginning of the study. In addition, BIFPCL is thus far implementing the Environmental Management Plan (EMP) for ensuring environmental and social safeguarding of the Project surroundings including the Sundarbans Reserve Forest.

### **1.4.4 Local Community**

The Project Affected Peoples (PAPs) has been included in each of the social environment-monitoring program. The changes in important socio-economic indicators were examined through Focus Group Discussions (FGDs), Key informant interview(s) and other informal discussions with the local people in different locations of the project influenced area.

### **1.4.5 Major Component of Monitoring Study**

The Physical, Biological and Social aspects are monitored on regular basis and this quarterly monitoring report is furnished with the following subsequent chapters-

- Physical Environment covers monitoring of air quality, noise level, water quality, Soil and land resources, traffic management and the morphological study;
- Biological environment covers monitoring of fisheries resources, ecological resources and the Sundarbans Reserve Forest (SRF) health conditions;
- Socio-economic environment covers compensation, resettlement/rehabilitation, project related employment generation, labour and working condition, community health, security and safety, along with corporate social responsibilities.
- Environmental compliances monitoring includes Monitoring of Environmental and Social Management System Action Plan Implementation; Labour and working conditions; Community health, safety & security and Monitoring of biodiversity and sustainable management of living natural resources in and around the project area.



## 2. Physical Environment

### 2.1 Air Quality

Air is considered as one of the major environmental components and in this connection the parameters and monitoring locations of air quality were selected considering the major effects to be exerted by the power project activities during pre-construction, construction and operation stages. However, during the recent visit, all the preselected parameters and locations were monitored at locations to see if any major changes occurred due to concurrent construction and supporting erection activities of the project.

#### 2.1.1 Methodology

In general, Particulate Matters (i.e., PM<sub>2.5</sub>, PM<sub>10</sub>, and SPM), SO<sub>x</sub>, NO<sub>x</sub>, CO and O<sub>3</sub> are expected to be generated from the Power Plant activities at its different phases i.e. pre-construction, construction and operation. However, the monitoring locations as well as the indicators for this study were selected during the EIA study based on a number of criteria e.g., the sensitivity of the receptors, project activities like movement of coal-carrying vessels, coal trans-shipment point; wind speed, wind direction, atmospheric deposition (Wet and Dry) and atmospheric stability classes etc. A comprehensive discussion on the recently assessed air quality is reported in the following sections.

#### 2.1.2 Method of Sampling and Laboratory Testing

Respirable Dust Sampler (Model-Envirotech India APM-460 BL) and Fine Particulate Sampler (Model-Envirotech India APM-550) were used to collect air samples from the selected sites. The PM<sub>2.5</sub>, PM<sub>10</sub>, and SPM were tested by gravimetric method. The concentration was analyzed by West-Gaeke method. Likewise, the concentration of NO<sub>2</sub> was tested by Jacob and Hochheiser method and concentration of Carbon Monoxide (CO) and Ozone (O<sub>3</sub>) were measured by Metravi CO-10 meter and Tongdy O<sub>3</sub> Monitor respectively.

#### 2.1.3 Pollution Sources in the Sundarbans

The key sources of air pollution around Mongla Port area and project site can be considered as cement factories, non-regulated mechanized boats, cargo vessels and ships and other commercial activities. The non-regulated ships, mechanized boats, cargo vessels plying through the Sundarbans Reserve Forest (SRF) in connection with the Mongla Port operation; fishing activities; honey, Golpata and timber collection; tourism etc. could be big contributing sources of air pollutants i.e., Particulate matters (PM<sub>2.5</sub>, PM<sub>10</sub> and SPM), Oxides of Sulphur (SO<sub>x</sub>), Oxides of Nitrogen (NO<sub>x</sub>) and Green House Gases (GHGs) in the study area as well as across the Passur channel. However, an inventory of the existing emission types and sources for the study area has been provided in **Table A2** of **Appendix IV**.

#### 2.1.4 Monitoring Locations

Air quality is generally monitored at the fixed locations for each of the monitoring quarters. As per recommendations of DoE and experts panel, two additional locations were included along with the existing monitoring locations. The air quality monitoring activities are shown in **Figure 2.1** and monitoring locations are shown in **Figure 2.2**. Details of the monitoring plan are attributed in **Table 2.1**.



Figure 2.1: Acquisition of Air Quality Monitoring data

Table 2.1: Air Quality Monitoring Plan

Sl. No.	Monitoring Indicators	Locations	GPS Points	Frequency	Methods/ Tools/ Techniques
1	Particulate Matter (PM <sub>2.5</sub> , PM <sub>10</sub> and SPM) SO <sub>x</sub> , NO <sub>x</sub> , CO and O <sub>3</sub> .	South West corner of the Project boundary	89°33'34.5"E; 22°34'33.8"N	Each Quarter of the year	Method of testing PM <sub>2.5</sub> : Gravimetric
2		Proposed township area near Chimney location, Mauza: Sapmari Katakhal.	89°32'3.8"E; 22°36'32.5"N		Method of testing PM <sub>10</sub> : USEPA (1997) Method 201 or 201A (as appropriate)
3		North West corner of the Project boundary (Kaigar Daskati)	89°33'51.8"E; 22°36'1.06"N		Method of testing SO <sub>x</sub> : USEPA (2000) Method 6 or 6A or 6B or ISO (1998)
4		Barni, Gaurambha Union (4km North East from the chimney location)	89°34'37.7"E; 22°38'51.8"N		Method 11632 (as appropriate)
5		Chunkuri-2, Bajua Union (4km South West from the chimney location)	89°34'01.1"E; 22°32'3.3"N		Method of testing NO <sub>x</sub> : USEPA (2000) Method 7, 7A, 7B, 7C, 7D, or ISO (1993) Method 10396 (as appropriate).
6		Pankhali, Dacope, (4km North West from the Chimney location)	89°31'24.2"E; 22°36'6.7"N		
7		Mongla Port Area	89°35'50.4"E; 22°28'24.8"N		
8		Harbaria, Sundarbans	89°35'34.2"E 22°17'43.1"N		
9		Akram point, Sundarbans	89°30'54.1"E 22°23.50"N		
10		Hiron Point, Sundarbans	89°27'53.2"E; 21°46'27.60"N		
11		Khulna city near Khan Jahan Ali Bridge	89°35'35.5"E; 22°46'36.8"N		
12		Project site-1 (Proposed Township area)	89°33'13.7"E 22°35'43"N		
13		Access road bridge area	89°35'16.49" 22°34'37.11"N		



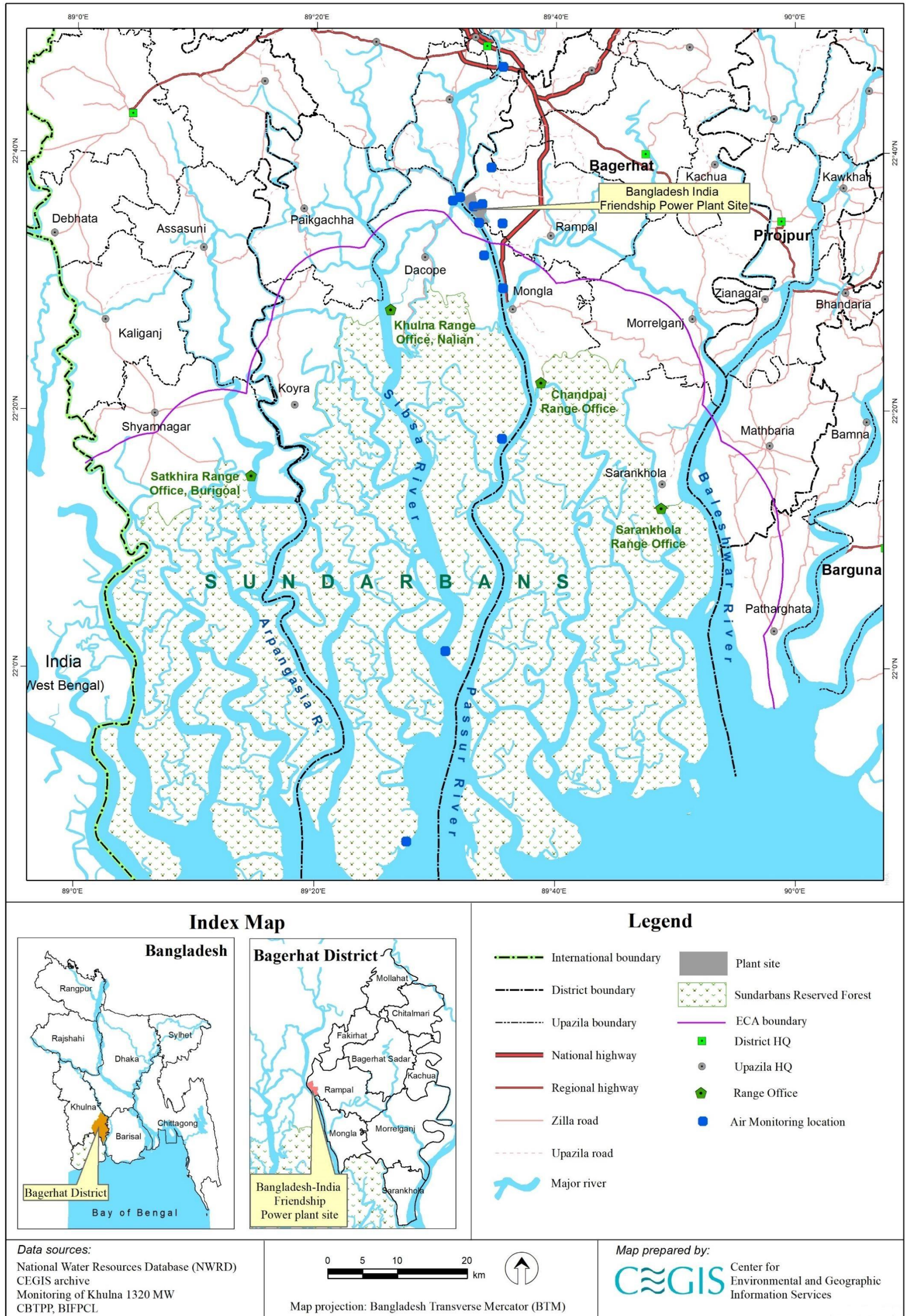


Figure 2.2: Air Quality Monitoring Locations





### 2.1.5 Status of Air Quality

In general, air quality is expressed in terms of the standards set forth for public health and welfare protection (against decreased visibility and damage to human being, animals, crops, vegetation etc.). The concentrations of the criteria pollutants along with the air pollution emission standards set by DoE are listed in **Table 2.2**. However, during this monitoring tier, the maximum value ( $79.64 \mu\text{g}/\text{m}^3$ ) of  $\text{PM}_{2.5}$  was found at Township area of Power Plant which found to be exceeded the standard set by DoE (ECR' 2005 i.e.  $65 \mu\text{g}/\text{m}^3$ ) whereas the minimum value ( $23.6 \mu\text{g}/\text{m}^3$ ) was recorded at Akram Point. On the other hand,  $\text{PM}_{10}$  concentration was found highest ( $124.55 \mu\text{g}/\text{m}^3$ ) at Khan Jahan Ali Bridge Toll palza area in Khulna and lowest ( $44.28 \mu\text{g}/\text{m}^3$ ) at Bajua area. Similar to the  $\text{PM}_{10}$ , the concentration of SPM was also found higher ( $195.17 \mu\text{g}/\text{m}^3$ ) at Khan Jahan Ali Bridge Toll palza area in Khulna and the minimum concentration ( $77.88 \mu\text{g}/\text{m}^3$ ) was observed at Bajua area.

However, in order to minimize the particulate matter concentration inside the power plant, the authority may take the necessary initiatives e.g. continuous or periodic water spraying on the connected road networks inside the power plant area, install water sprinkler system at the prominent infrastructures like office areas, township area etc. and the major construction area, strictly maintain the vehicular speed at the sensitive areas and properly maintain the EMPs as stated in the EIA study of the power plant.

On the contrary, the concentration of Sulphur dioxide ( $\text{SO}_2$ ) in ambient air was found much lower than the Bangladesh standard limit of ( $365 \mu\text{g}/\text{m}^3$ ) at all the sampling locations. Among those, the maximum concentration ( $26.18 \mu\text{g}/\text{m}^3$ ) was found at Khan Jahan Ali Bridge Toll palza area in Khulna while the minimum concentration ( $10.59 \mu\text{g}/\text{m}^3$ ) was recorded at Bajua area. Similarly, the values of  $\text{NO}_x$  were also observed well below than the Bangladesh standard value of  $100 \mu\text{g}/\text{m}^3$ . Maximum concentration ( $48.41 \mu\text{g}/\text{m}^3$ ) during this monitoring period was found Township area of Power plant area whereas the lowest concentration ( $16.27 \mu\text{g}/\text{m}^3$ ) was recorded at Hiron point of Sundarbans. The contributor of such  $\text{NO}_x$  emission may be from local human hauler, car, bus etc. and  $\text{SO}_2$  emission from industrial activities like brickworks, cement works, etc. in that area.

Furthermore, during the monitoring period in October, 2021 it was observed that the maximum values of CO and  $\text{O}_3$  were measured at Khan Jahan Ali bridge area ( $4.9 \mu\text{g}/\text{m}^3$ ) and Township area ( $68 \mu\text{g}/\text{m}^3$ ) respectively though the results were found much lower than the standard value ( $10,000 \mu\text{g}/\text{m}^3$  and  $157 \mu\text{g}/\text{m}^3$ ) respectively set in ECR' 2005. From the measured values, it can be concluded that effect of seasonal variations on the surrounding environment may be the prominent reason for increasing/decreasing of the concentrations of the criteria pollutants for the corresponding air sheds. All the monitoring results are attached in **Table A1 of Appendix IV**. The baseline emissions scenarios are appended in **Table A2 of Appendix IV**.

#### *Seasonal variations among the air quality parameters*

The values of all the criteria pollutants as averaged for the corresponding locations for the corresponding seasons were found to be higher in Khan Jahan Ali Bridge area than the project influence area followed by the Sundarbans reserve Forest (SRF) area. On the other hand, the concentration of the measured parameters was found to be higher in winter seasons of the monitoring periods except for  $\text{SO}_x$ ,  $\text{NO}_x$  and and were found to be higher in monsoon periods and CO concentration was found to be higher in post monsoon seasons. It can be mentioned here that the concentration was always observed to be much lower in SRF area than the other areas and never exceeded comparing to the standards set by DoE (ECR, 1997) (**Figure 2.3**)-

Table 2.2: Air Quality Monitoring Results (30<sup>th</sup> Quarterly Program)

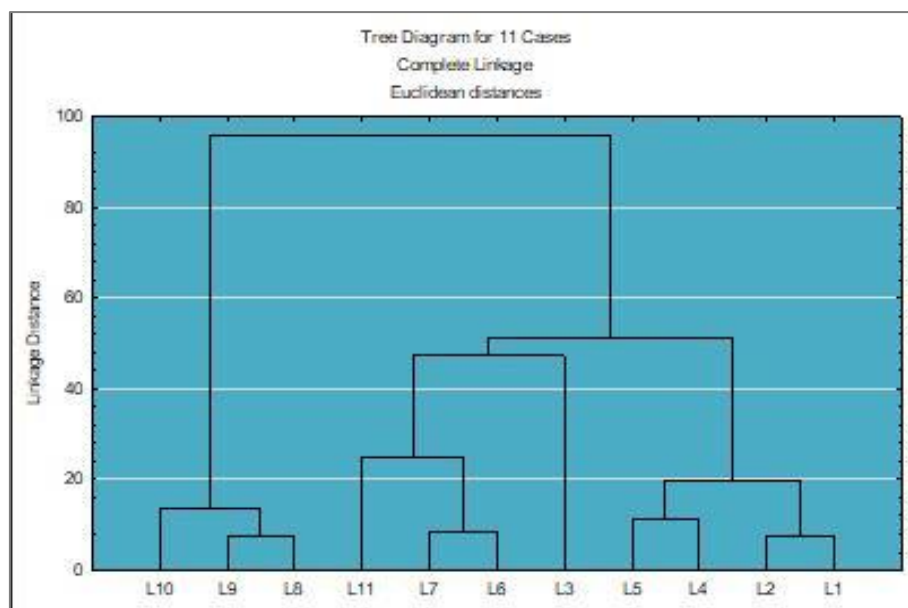
Sl. No.	Location	PM <sub>2.5</sub> (µg/m <sup>3</sup> )		PM <sub>10</sub> (µg/m <sup>3</sup> )		SPM (µg/m <sup>3</sup> )		SO <sub>x</sub> (µg/m <sup>3</sup> )		NO <sub>x</sub> (µg/m <sup>3</sup> )		CO (mg/ m <sup>3</sup> )		O <sub>3</sub> (ppb)	
		Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*
1	South West corner of the Project boundary (Maidara)	56.83	65	83.46	150	144.48	200	16.28	365	21.64	100	0	10	11	157
2	North-east corner of the project boundary (Sapmari)	44.65	65	71.35	150	118.49	200	14.55	365	20.85	100	1.1	10	41	157
3	North-west corner of the Project boundary (Kaigardaskati)	41.98	65	61.48	150	104.73	200	12.19	365	18.39	100	1.4	10	34	157
4	Barni, Gaurambha union (4km North East from the chimney location)	58.34	65	73.17	150	134.6	200	21.39	365	38.46	100	0	10	28	157
5	Chunkuri-2, Bajua Union (4km South West from the chimney location)	29.61	65	44.28	150	77.88	200	10.59	365	17.21	100	1	10	9	157
6	Pankhali (Chalna), Dacope (4km North West from the Chimney location)	42.59	65	64.71	150	107.31	200	12.8	365	19.33	100	1.1	10	19	157
7	Mongla Port Area	51.83	65	72.4	150	128.3	200	17.44	365	29.16	100	2.4	10	43	157
8	Harbaria, Sundarbans	31.2	65	49.07	150	83.16	200	12.68	365	22.27	100	1	10	11	157
9	Akram point, Sundarbans	23.6	65	51.88	150	79.47	200	15.89	365	21.39	100	1	10	8	157
10	Hiron Point, Sundarbans	38.51	65	49.27	150	89.36	200	14.33	365	16.27	100	0	10	22	157
11	Khulna city near Khan Jahan Ali Bridge	65.66	65	124.55	150	195.17	200	26.18	365	38.58	100	4.9	10	59	157
12	Project site-1 (Township area)	79.64	65	102.33	150	193.43	200	16.92	365	48.41	100	1	10	68	157
13	Access road bridge area	55.31	65	69.4	150	129.45	200	20.76	365	31.69	100	1	10	29	157

Source: CEGIS field survey; STD\*-Standard



**Figure 2.3: Seasonal Variation of the Air Quality Parameters**

Cluster analysis was performed to identify the grouping pattern of the criteria pollutants along with their corresponding locations. Euclidean distances were observed to measure the distances among the objects using as variables (annual average concentrations of the seven studied variables for every station). According to the dendrogram (**Figure 2.4.**) Hiron point (L10), Akram Point (L9) and Harbaria (L8) represents the locations of minimum pollution level situated inside the Sundarbans Forest area and are away from the nuclei of Mongla industrial zone and the project site. On the other hand, Chalna (L6), Mongla Ghat (L7) and Khan Jahan Ali Bridge in Khulna (L11) are subjected to higher in population density and increased industrial activities among all sites whereas moidara (L1), shapmari (L2), Gaurambha (L4) and bajua (L5) represent lower in population density and moderate commercial activities (**Figure 2.4.**).



**Figure 2.4: Dendrogram of the Monitoring Stations using Euclidean Distance**

### 2.1.6 Findings

According to the observed data it can be concluded that the concentration of major air pollutants was found comparatively lower in the Sundarbans area than that of other monitoring locations. But due to the seasonal effect the concentration of the particulate matter was found to be slightly higher at Khan Jahan Ali Bridge area comparable to the standards set by DOE. However, major sources of criteria pollutants in and around the project site as observed were the piling activities, digging, tunnelling and burrowing works, jetty erection activities, major construction works, dust from unpaved roads and vehicle movement, construction materials and goods transportation activities through the roads and river Passur etc. Other sources of pollutants which may contribute to the existing pollution load are the small industries like cement works and refinery industries etc., diffuse sources like wood stoves, fires, and wind generated dust etc.

## 2.2 Noise Quality

From a physics standpoint, noise is indistinguishable from sound as both are vibrations through a medium, like air or water. In general point of view, noise is the chaotic feeling of sound where many sound waves are mixed and difficult to distinguish a single signal. On the other hand, Noise is described by a weighted sound intensity (or level), which represents sound heard by the human ear and is measured in units called decibels (dBA). By extension, in experimental sciences, "noise" refers to any random fluctuations of data that makes more difficult the perception of an expected signal.

### 2.2.1 Methodology

Noise levels were measured thrice in a day (morning, afternoon and evening) at eight locations, twice (morning & noon) at three locations. Each time, noise levels were recorded using sound level meter for five minutes of time span with an interval period of 30 second and the noise meter was properly set up and calibrated following the instruction manual. On the other hand, the monitoring locations were selected considering the sensitivity of the nearest receptors and accordingly, 6 (six) sites were selected in and around the Project area, 3 (three) sites were designated inside the Sundarbans Reserve Forest Area, 1 (one) at Mongla port area and the remaining one was selected at the Khan Jahan Ali Bridge toll plaza area near Khulna City (**Figure 2.5**).





**Figure 2.5: Ambient Noise Acquisition**

### 2.2.2 Sources of Noise in the study area

Among the sources of noise generation engine boats, trawlers, small barges, ships plying over the waterways, birds' chirping, stormy wind, falling of leaves from the trees and the wave breaking sound were the main source of noise generation in and around the Sundarbans. On the other hand, construction activities, the urban and rural vehicles i.e. buses, trucks, local human haulers, auto-rickshaws, motorized vans, motorbikes etc. were much noticeable around the project area.

### 2.2.3 Locations of Noise Level Monitoring

Out of (11) locations, three (03) locations were inside the Sundarbans, six (06) locations were in and around the Project site, one at Khan Jahan Ali Bridge and the remaining one was at Mongla Ghat area (Figure 2.6 and Table 2.3).

**Table 2.3: Noise Monitoring Plan**

SL. No.	Monitoring locations	GPS points	Time of noise monitoring
1	South West corner of the Project boundary	89°33'34.5"E; 22°34'33.8"N	Morning, Noon and evening
2	Proposed township area near Chimney location, Mauza: Sapmari Katakhal	89°32'3.8"E; 22°36'32.5"N	Morning, Noon and evening
3	North West corner of the Project boundary (Kaigar Daskati)	89°33'51.8"E; 22°36'1.06"N	Morning, Noon and evening
4	Barni, Gaurambha union (4km North East from the chimney location)	89°34'37.7"E; 22°38'51.8"N	Morning, Noon and evening
5	Chunkuri-2, Bajua Union (4km South West from the chimney location)	89°34'01.1"E; 22°32'3.3"N	Morning, Noon and evening
6	Pankhali, Dacope, (4km North West from the Chimney location)	89°31'24.2"E; 22°36'6.7"N	Morning, Noon and evening
7	Mongla Port Area	89°35'50.4"E; 22°28'24.8"N	Morning, Noon and evening
8	Harbaria, Sundarbans	89°35'34.2"E; 22°17'43.1"N	Morning and Noon
9	Akram point, Sundarbans	89°30'54.1"E; 22°23.50"N	Morning and Noon
10	Hiron Point, Sundarbans	89°27'53.2"E; 22°14'27.60"N	Not monitored
11	Khulna city near Khan Jahan Ali Bridge	89°35'35.5"E; 22°46'36.8"N	Morning, Noon and evening

### 2.2.4 Status of Noise

In order to provide an overview of the observed data set, the average values for the respective locations have been appended in **Table 2.4** for ready reference; but the detailed Noise Level Data have been attached in **Table C1, C2, C3, C4, C5, C6, C7 and C8** respectively in the **Appendix IV**.

However, the Department of Environment of the People's Republic of Bangladesh, an agency under the Ministry of Environment and Forests has set up the standard of permissible limits of noise level at day time for different classified areas. According to Bangladesh Noise Pollution Control Rules (2006), the eleven monitored locations fall under different classified area like residential, commercial, mixed, silent and industrial class.

Observed noise level at *Chalna*, a commercial area located at a distance of 4 km to the north-west direction of the proposed chimney location was recorded as 58.21 dB whereas it's standard level is 70 dB (**Table: 2.4**). Levels of noise at *Kaigar Daskati* (48.81 dB) situated at the Gucchha Gram, a residential area located at north-west corner of the project area; *Chunkuri-2* (46.58 dB) located at 4km south-west direction from the chimney location; *Maidara Khal* (48.36 dB), south-west corner of the project area and a residential area and; *Shapmari* (44.78 dB), proposed township area didn't cross their corresponding standard limits (55 dB) of noise level (**Table: 2.4**). The level of noise at *Barni (Gaurambha)* was found to be 58.55 dB which was 1.45 dB lower than that of standard limit (60 dB) of noise level for this location (**Table: 2.4**). *Akram Point* (43.78 dB), an ecologically silent zone was also not found to exceed the Bangladesh standard limit (50 dB) of its corresponding standard values (**Table: 2.4**).

On the other hand, observed noise levels at four locations namely *Khan Jahan Ali Bridge* (79.64 dB), a commercial zone; *Mongla Port* (75.37 dB), an industrial zone and; *Harbaria* (55.43 dB) & *Hiron Point* (50.79 dB) of Sundarbans, two more ecologically silent zones were found to exceed the Bangladesh standard limit of noise of their corresponding values (**Table: 2.4**). The standard limits of noise at day time for *Khan Jahan Ali Bridge* and *Mongla Port* are 70 dB and 75 dB respectively whereas the *Harbaria* and *Hiron point*, two ecologically critical areas have the same standard limit of noise (50 dB).



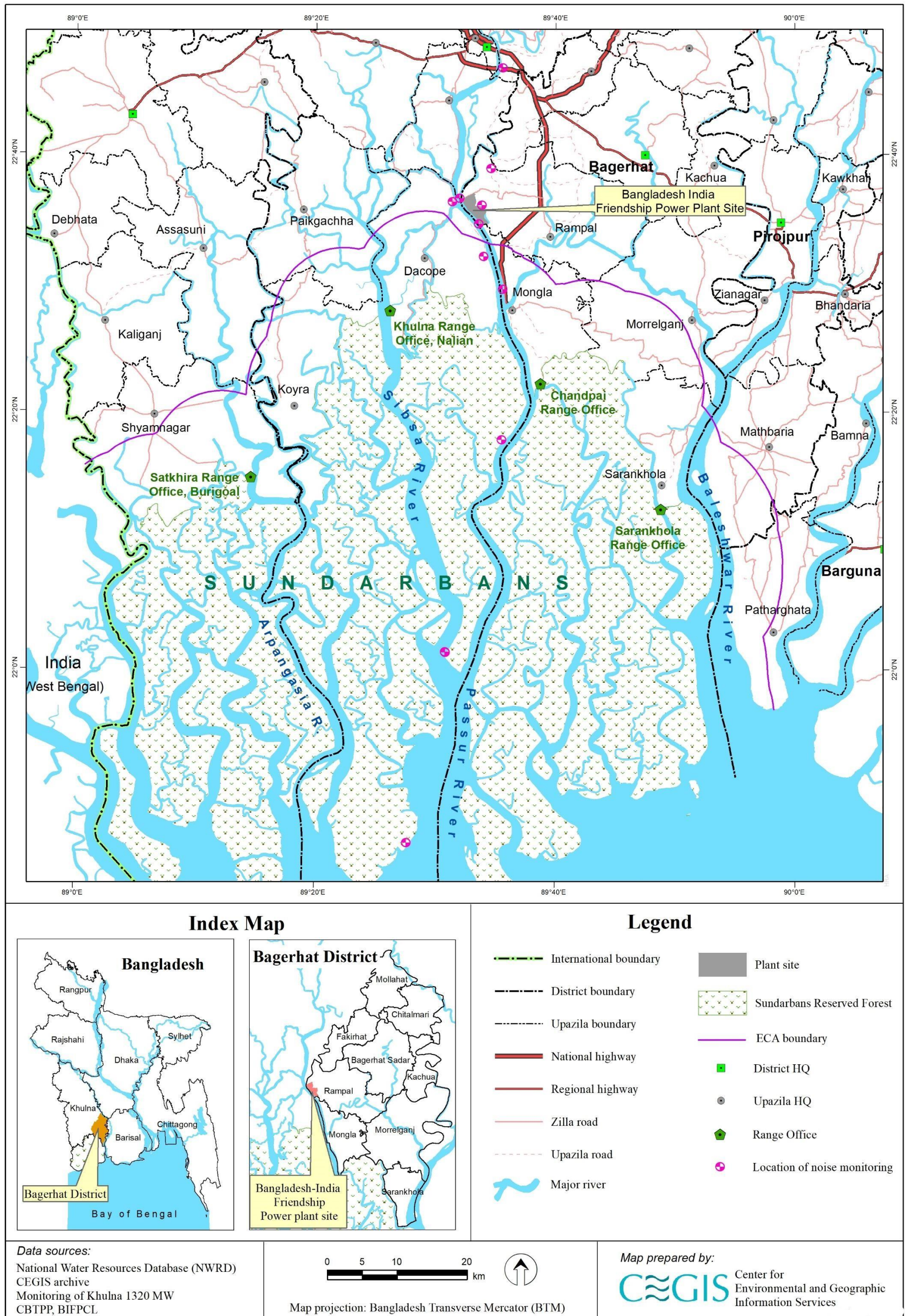


Figure 2.6: Noise Level Monitoring Locations





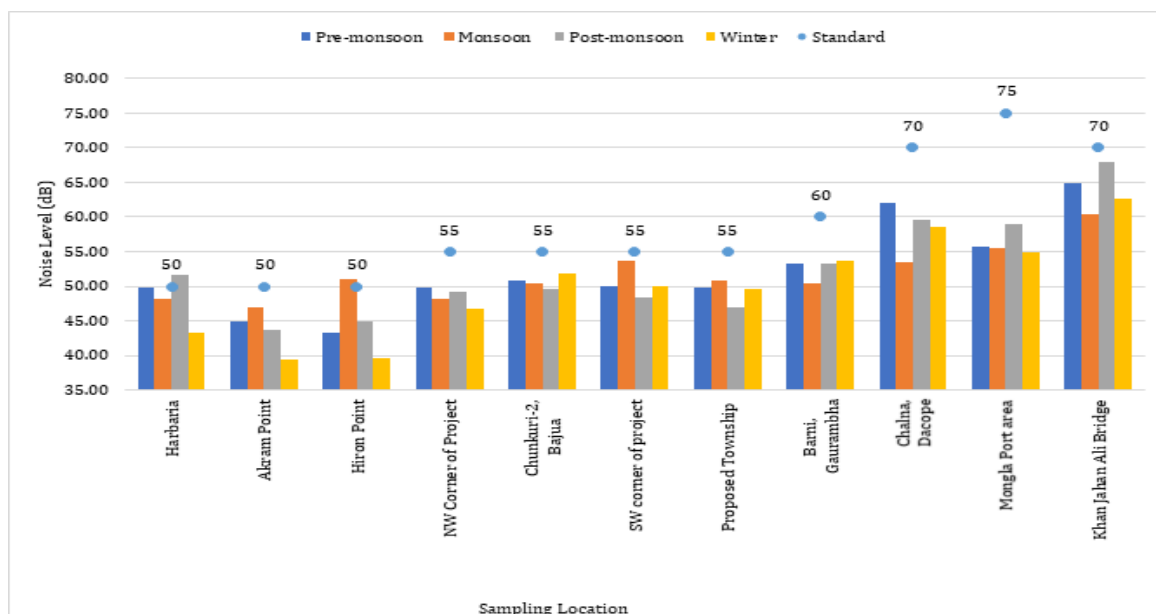


Figure 2.7: Status of average Noise level for all seasons at different locatons

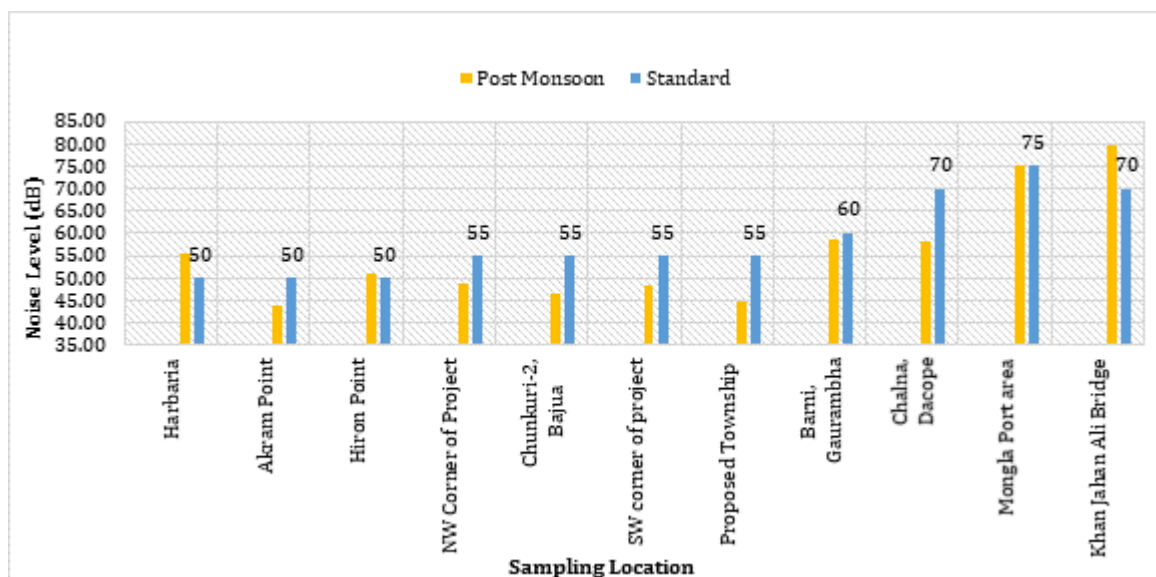


Figure 2.8: Status of average Noise Level at the Monitoring Locations (30<sup>th</sup> quarter)

Table 2.4: Summary of the Ambient Noise Levels Recorded in Consecutive Monitoring Periods

Sl.	Location	Monitoring periods																
		QM-30 (Oct-21)	QM-29 (Aug-21)	QM-28 (Apr-21)	QM-27 (Jan-21)	QM-26 (Nov-20)	QM-25 (Jul-20)	QM-23 (Feb-20)	QM-22 (Nov-19)	QM-21 (Jul-19)	QM-20 (Apr-19)	QM-19 (Feb-19)	QM-18 (Nov-18)	QM-17 (Jul-18)	QM-16 (Apr-18)	QM-15 (Jan-18)	QM-14 (Oct-17)	Std* (dB)
		Value (dB)																
1	Chalna, Dacope	64.57	51.21	61.44	60.50	58.15	51.28	54.59	58.60	59.34	61.67	56.45	58.23	57.54	59.63	60.1	58.64	60
2	NW Corner of the Project area (Kaigar daskati)	49.59	50.11	49.50	51.42	48.48	43.37	45.42	51.11	55.18	56.85	50.75	58.82	45.63	47.90	49.3	46.95	60
3	Chunkuri-2, Bajua	46.87	50.36	51.31	47.05	45.91	48.75	55.44	55.27	59.36	51.68	50.18	48.69	47.54	52.93	51.4	50.44	60
4	SW corner of the project area (Maidara)	49.37	51.90	55.24	52.36	49.18	50.18	55.60	46.57	63.66	56.05	55.79	61.78	52.63	47.55	44.5	43.26	60
5	Proposed Township area (Shapmari)	47.17	53.84	52.05	49.09	44.45	53.72	48.95	54.88	54.53	58.83	58.13	50.68	44.25	50.81	53.3	43.93	60
6	Barni, Gaurambha	63.96	51.00	52.34	53.09	58.33	48.80	61.97	50.53	54.67	53.18	52.57	53.03	45.52	56.14	55.6	45.52	60
7	Khan Jahan Ali Bridge, Khulna	80.18	52.38	54.65	61.94	81.81	66.31	62.20	66.05	63.46	66.95	66.93	62.15	63.36	64.87	61.7	62.47	70
8	Mongla Ghat area	76.86	55.49	53.63	56.52	76.92	64.41	61.06	57.25	62.01	63.99	66.18	55.97	60.97	62.95	59.8	49.66	75
9	Harbaria, Sundarbans	57.02	NM	48.04	44.40	54.54	49.97	43.94	44.10	44.90	48.43	49.67	48.80	50.28	47.93	44.4	46.48	50
10	Akram Point, Sundarbans	43.29	44.62	43.42	37.85	42.23	51.04	36.59	44.86	44.84	42.33	46.45	41.00	45.20	45.39	40.1	42.38	50
11	Hiron Point, Sundarbans	52.27	50.94	NM	38.85	50.70	NM	40.34	40.28	NM	NM	39.21	39.4	NM	NM	38.8	39.79	50

Sl.	Location	Monitoring periods														
		QM-13 (Apr-17)	QM-12 (Jan-17)	QM 11 (Oct-16)	QM 10 (Jul-16)	QM 9 (Apr-16)	QM 8 (Jan-16)	QM 7 (Oct-15)	QM 6 (Jul-15)	QM 5 (Apr-15)	QM 4 (Jan-15)	QM 3 (Oct-14)	QM 2 (Jul-14)	QM 1 (Apr-14)	Std* (dB)	
		Value (dB)														
1	Chalna, Dacope	61.62	59.29	65.51	52.42	65.08	66.07	65.12	49.77	57.08	53.28	54.63	52.87	68.13	60	
2	NW Corner of the Project area (Kaigar Daskati)	47.19	44.52	55.48	52.65	50.79	50.96	41.94	41.56	44.67	35.25	41.92	NM	51.89	60	
3	Chunkuri-2, Bajua	50.44	55.31	51.55	53.4	44.49	53.62	47.43	40.66	47.05	49.29	51.39	52.55	57.76	60	
4	SW corner of the project area (Moidara)	43.25	45.19	48.51	65.37	54.50	60.44	42.7	43.75	43.58	36.03	45.95	47.6	49.2	60	
5	Proposed Township area (Shapmari)	42.65	42.62	43.69	55.79	53.37	53.77	50.52	46.75	41.47	41.47	41.92	46.68	48.75	60	
6	Barni, Gaurambha	44.83	49.05	54.91	56.75	53.97	59.16	55.16	46.18	54.17	43.6	49.78	49.95	58.84	60	
7	Khan Jahan Ali Bridge, Khulna	56.72	55.57	60.95	63.77	65.85	68.45	64.25	52.82	73.45	61.72	66.28	60.8	71.7	70	
8	Mongla Port area	47.61	48.95	49.86	52.86	49.88	52.7	47.01	39.61	48.15	38.69	60.5	53.84	61.24	75	
9	Harbaria, Sundarbans	54.10	41.18	55.33	52.9	44.55	45.2	50.75	35.03	65.37	34.38	55.3	56.13	40.88	50	
10	Akram Point, Sundarbans	44.30	38.08	41.77	47.96	42.95	42.95	49.6	NM	54.86	34.32	43.98	47.9	40.94	50	
11	Hiron Point, Sundarbans	NM	42.29	44.38	NM	43.11	NM	46.06	NM	47.84	37.37	47.98	51.29	38.63	50	

Note: All values are in decibels (dBA), QM- Quarter Monitoring, NM – Not Monitored, \*Std- Standard as defined in National Noise Control Rules, 2006

### 2.2.5 Findings

The noise generation sources in the study area can mainly be divided into two types; one is natural and the other one is anthropogenic. Natural sources of noise generation were birds' chirping, stormy wind, wave breaking on the shoreline, howling of leaves and so on. On the other hand, traffic mobilization, industrial activities, vessels movement within the rivers and local vehicles were the anthropogenic sources of noise. However, the observed noise level was not found to exceed the Bangladesh standard limit of noise level (Table 2.4).

## 2.3 Water Quality

An updated water quality status of the Passur-Sibsa River system and adjacent water bodies have been depicted in this section. The methodologies used for the entire monitoring activities, both the national and international guidelines were followed and adopted. This report includes physical water quality parameters collected during 30<sup>th</sup> quarterly monitoring tier (October, 2021) and the tested results obtained from the laboratory up to August, 2021 (29<sup>th</sup> quarterly monitoring). The surface and groundwater quality were monitored in the respective locations performed during the previous monitoring. A number of identical parameters were selected to understand the quality of the water for community use, aquatic life, and for the Sundarbans Forest ecosystem itself.

### 2.3.1 Methodology

Water quality monitoring covers selection of water quality parameters, identification of sampling locations, determination of sampling frequency and evaluation criteria of the monitoring parameters etc. Standard approaches and methodologies were followed for the above-mentioned events. Both the surface and groundwater quality status in and around the Power Plant and the Sundarbans area were examined. The monitoring results have been presented graphically and been compared with the national standards (ECR, 1997 and all available amendments).

The samples were collected from eighteen (18) pre-selected locations (15 locations for surface water along the Passur River from Chalna to Hiron Point of Sundarbans, Sibsa River near Akram Point, Maidhara River near the project area and 3 locations for groundwater i.e. project area, Kapashdanga and Rajnagar). The selected monitoring locations for the monitoring program are shown in **Figure 2.9**. The details of the monitoring plan covering sampling locations, geographical locations, frequency and analysis techniques of sampling for surface and groundwater are given in **Table 2.5** and **Table 2.6** respectively.

**Table 2.5: Groundwater Quality Monitoring Parameters, Locations and Plan**

Sl. No.	Locations	GPS (Decimal Degree)		Frequency	Methods/Monitoring indicators/ Techniques
		Easting	Northing		
1	Near Proposed Township Area	89.566139°E	22.594167°N	Quarterly	In-situ testing of physical water quality parameters by Horiba U-50 multi-meter. Sample preserving and Laboratory analysis at DPHE Central Laboratory and BCSIR for inorganic non-metallic, aggregate organic and metals quality. However, one of the monitoring locations (Kalekarber) has been found damaged since 2015. Hence, the corresponding data for this location were not collected.
2	Rajnagar	89.576056°E	22.612528°N		
3	Kapasdanga	89.563000°E	22.622528°N		

Table 2.6: Surface Water Quality Monitoring Parameters, Locations and Plan

Sl no	Monitoring Indicators	Locations	GPS (Decimal Degree)		Frequency	Methods/Tools/ Techniques
			Easting	Northing		
1	pH, Temperature, Salinity, DO, BOD <sub>5</sub> , TDS, TH, TSS, COD, Nitrate, Sulphate, Phosphate, Arsenic, Lead, Mercury, Oil & Grease, PAH, TOC, TC	Left Bank of Passur River at 100m u/s of North West corner of the Project boundary	22.604167°N	89.527222°E	Quarterly	In-situ measurement (pH, Temperature, Salinity, DO) and Laboratory analysis (TDS, TH, TSS, COD, Nitrate, Sulphate, Phosphate, Arsenic, Lead, Mercury, Oil & Grease, PAH, TOC, TC).
2		Middle of Passur River at 100m u/s of North West corner of the Project boundary	22.607222°N	89.528889°E		
3		Right Bank of Passur River at 100m u/s of North West corner of the Project boundary	22.609361°N	89.531417°E		
4		Left Bank of Passur River at Project Site-Jetty	22.584833°N	89.543583°E		
5		Middle of Passur River at Project Site-Jetty	22.587667°N	89.546472°E		
6		Right Bank of Passur River at Project Site-Jetty	22.589333°N	89.548222°E		
7		Left Bank of Passur River at South West corner of the Project boundary	22.572889°N	89.552583°E		
8		Middle of Passur River at South West corner of the Project boundary	22.574611°N	89.557500°E		
9		Right Bank of Passur River at South West corner of the Project boundary	22.575667°N	89.559861°E		
10		Maidara river at the South East corner of the project boundary at Ichamoti-Maidara confluence	22.600639°N	89.565611°E		
11		Maidara river near proposed Township area	22.577472°N	89.569250°E		
12		Passur river at Passur – Ghasiakhali confluence	22.473861°N	89.602361°E		
13		Passur river at Harbaria of the Sundarbans Reserve Forest area	22.295250°N	89.593139°E		
14		Passur river at Akram Point of the Sundarbans Reserve Forest Area	22.024120° N	89.514220°E		
15		Passur river at Hiron point of the Sundarbans Reserve Forest Area	21.774183°N	89.464778°E		



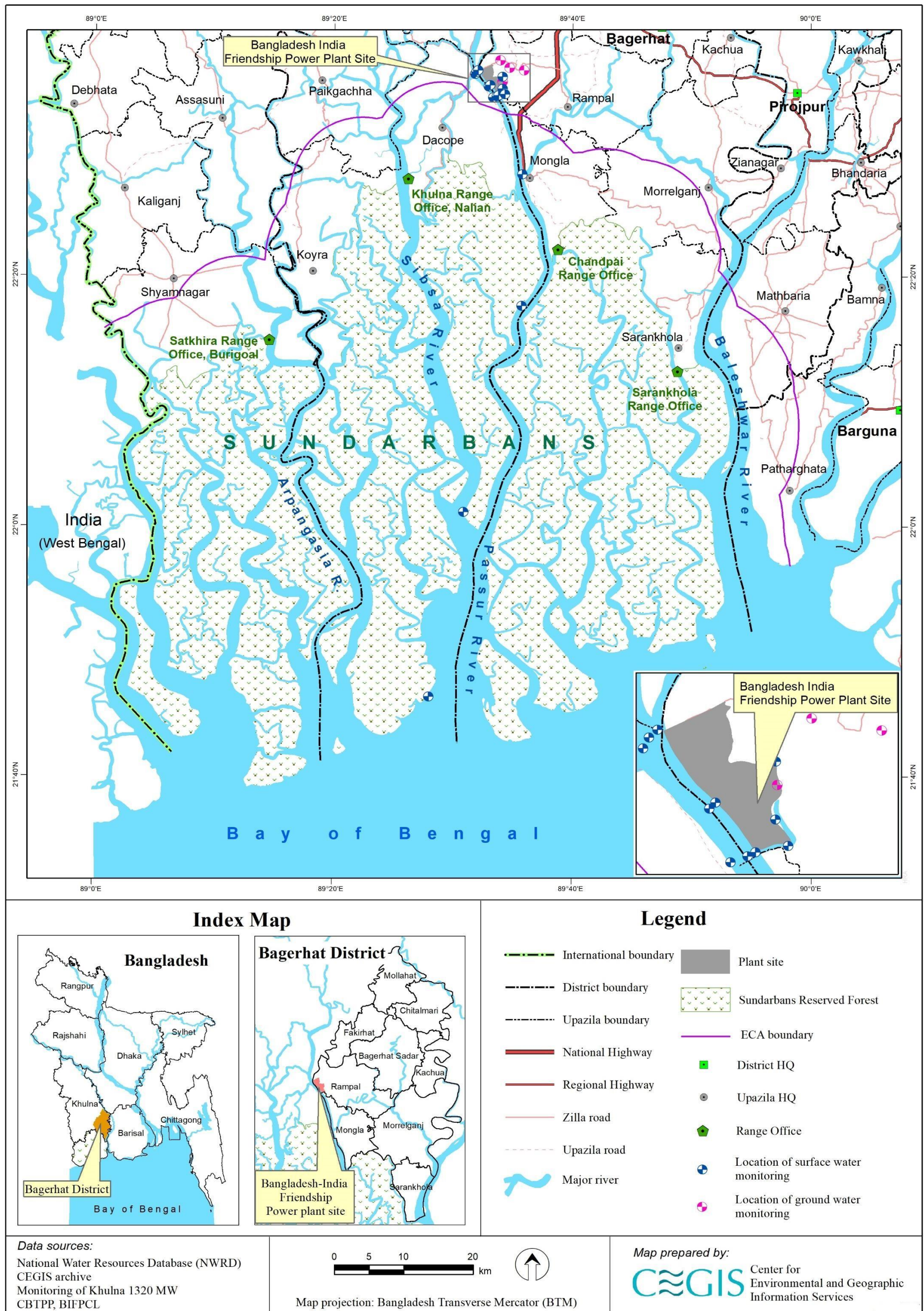


Figure 2.9: Surface Water and Groundwater Quality Monitoring Location





### 2.3.2 Selection of Parameters

Water quality parameters were selected based on tentative potential impacts to be exerted during pre-construction, construction and operation phases of the Power Plant Project.

#### *Surface Water Quality Parameters*

The selected parameters for surface water quality include Temperature, pH, Dissolved Oxygen (DO), Total Dissolve Solids (TDS), Total Suspended Solids (TSS), Total Hardness (TH), Turbidity, Chemical Oxygen Demand (COD), Salinity, Nitrate ( $\text{NO}_3^-$ ), Phosphate ( $\text{PO}_4^{3-}$ ), Sulphate ( $\text{SO}_4^{2-}$ ), Heavy Metals (As, Pb, Hg), and Oil and Grease. The parameters were categorized into 4 groups:

- Physical and aggregate properties i.e. pH, Temperature, Salinity, Hardness, TDS, TSS, Turbidity, Oil & Grease;
- Inorganic non-metallic constituents i.e., DO,  $\text{NO}_3^-$ ,  $\text{PO}_4^{3-}$  and  $\text{SO}_4^{2-}$ ;
- Aggregate organic constituents i.e. COD;
- Heavy metals i.e. As, Pb and Hg;

However, some additional parameters i.e., PAH (Polycyclic Aromatic Hydrocarbons), TOC (Total Organic Carbon) and TC (Total Carbon) were included in the monitoring study as per recommendation of the DoE approved coal transportation study monitoring framework as well as approval condition no. 26 and accordingly the analysed data of the additional parameters are recorded and submitted to the DoE and other concerned authorities.

#### *Groundwater Quality Parameters*

Ground water quality parameters include pH, Temperature, Dissolved Oxygen (DO), Total Dissolve Solids (TDS), Total Hardness (TH), Chemical Oxygen Demand (COD), Salinity, Nitrate ( $\text{NO}_3^-$ ), Phosphate ( $\text{PO}_4^{3-}$ ), Sulphate ( $\text{SO}_4^{2-}$ ), and Heavy Metals (As, Pb, Hg) etc.

### 2.3.3 Sampling Procedure

The standard sampling procedure was followed for both surface and groundwater sampling to reduce the possibility of any error. Each sample was labelled at the time of sampling.

### 2.3.4 Surface Water Sampling Procedure

The study area is highly influenced by tidal variation. Hence, temporal and spatial variations of tides were considered in sampling procedure. Surface water samples were collected at a distance of 30-50m away from the riverbank and at a depth of 6 cm below the water surface during low tides or relative slag period after the low tide for all parameters except oil and grease. The non-acidified sampling bottles were rinsed with respective water samples before sampling. Acidified sampling bottles were used for heavy metal (As, Pb, Hg) sample collection. On the contrary, Analysis of  $\text{BOD}_5$  has been discarded because of constraints to maintain the proper procedure to collect, preserve and lab testing the water samples at ideal condition. All samples were preserved as per standard procedure. The in-situ testing of the water quality parameters are shown in **Figure 2.10**.



**Figure 2.10: Water Sample Collection and insitu Testing of Water Parameters**

### 2.3.5 Groundwater Sampling Procedure

The groundwater samples were collected from hand operated tube wells after 5-7 minutes of water extraction. Each sampling bottle was rinsed with respective water samples before sample collection and storing. Acidified sampling bottles were used for heavy metals (As, Pb, Hg) sample collection and were preserved following standard procedure.

### 2.3.6 Water Quality Parameter Analysis Techniques/Methods

Water quality parameters were analysed as per the procedure of American Public Health Association (APHA) standard. The analysis procedures of different parameters along with the standards are given in **Table 2.7**.

**Table 2.7: Testing Methodology of Water Quality Parameter**

Parameters	Methods/Measuring Tools	Unit	BD Standard (ECR 1997)
Temperature	Horiba U-50 multimeter	°C	20 - 30
pH	Horiba U-50 multimeter	-	6.5-8.5
TDS	Horiba U-50 multimeter	ppm or mg/L	2100 (SW), 1000 (GW)
TSS	Horiba U-50 multimeter	ppm or mg/L	150 (SW), 10 (GW)
Salinity	Horiba U-50 multimeter	ppt	-
DO	Horiba U-50 multimeter	ppm or mg/L	6
BOD <sub>5</sub>	5-Day BOD Test at 20°C	ppm or mg/L	50 (SW)
COD	Closed Reflux Method	ppm or mg/L	200 (SW), 4.0 (GW)
Total Hardness (as CaCO <sub>3</sub> )	Titrimetric	ppm or mg/L	200-500
Ortho-Phosphate (PO <sub>4</sub> <sup>3-</sup> )	UV-VIS Spectrophotometers	ppm or mg/L	6
Nitrate (NO <sub>3</sub> <sup>-</sup> )	UV-VIS Spectrophotometers	ppm or mg/L	10
Sulphate (SO <sub>4</sub> <sup>2-</sup> )	UV-VIS Spectrophotometers	ppm or mg/L	400
Oil and Grease	Liquid-liquid extraction with hexane, treatment with silica gel and gravimetric determination	ppm or mg/L	10 (SW)
Arsenic (As)	Atomic Absorption Spectrophotometers-Hydride Vapor Generating (AAS-HVG)	ppm or mg/L	0.05
Lead (Pb)	Atomic Absorption Spectrophotometers-Graphite Furnace (AAS-GF)	ppm or mg/L	0.05

Parameters	Methods/Measuring Tools	Unit	BD Standard (ECR 1997)
Mercury (Hg)	Mercury Analyzer	ppm or mg/L	0.001
PAH	APHA 5310.B	mg/L	N/A
TOC and TC	APHA 5310.B	mg/L	N/A

### 2.3.7 Water Quality Reporting Arrangement

Water quality status of the adjacent water bodies of power plants and the Sundarbans Reserve Forest (SRF) are being observed since April, 2014. During the 30<sup>th</sup> quarterly period, yearly variations of monsoon (July-August, 2021) for chemical water quality statuses and yearly variations in post-monsoon (Oct-Nov, 2021) for physical water quality statuses are presented and compared with the ECR' 1997 Standards. To do so, all sampling points are clustered in five different sampling sites considering homogenous characteristics of the sampling points as well as the type of ecosystem touching the sample points. The clustered sample monitoring sites and the logical explanation of the clusters are presented in the following **Table 2.8**.

**Table 2.8: Monitoring Sites and Characteristics**

SL	Monitoring sites	Site Characteristics
(a)	<b>Power plant &amp; adjacent areas</b>	In this monitoring site, total 11 sampling points were selected and the values were averaged to represent the water quality status of power plant adjacent surface water bodies. These 11 sampling points are situated in the same river system or network and embedded within 1km radius of power plant. In addition, previous monitoring results indicated same water chemistry. Therefore, this study makes the clusters to represent the water quality status of the areas in a more explainable and understandable way.
(b)	<b>Mongla-Passur confluence</b>	This monitoring site is situated at least 13km downstream of the power plant. This point is a confluence of Passur river and Mongla-Ghasiakhali channel. The terrestrial ecosystem is mostly dominated by agricultural lands followed by rural settlements.
(c)	<b>Harbaria</b>	Harbaria site is situated around 15 km downstream of the Mongla-Passur confluence. This site is dominated by Sundarbans Forest. Heavy activities of mother vessels unloading and small cargo movement for carrying of clinker, coal and LPG gas. Influenced by tidal effects of Bay of Bengal.
(d)	<b>Akram point</b>	Akram point is located around 35 km downstream of the Harbaria point. This site is situated on the bank of Sibsa river before mixing with Passur river at Sibsa point. This site is completely dominated by deep forests ecosystems. Influenced by tidal effects of Bay of Bengal.
(e)	<b>Hiron Point</b>	Hiron point is the furthest point of this surface water-monitoring scheme. This point is at 25 km downstream of the Akram point. Deep forests and marine habitats are the main characteristics of the site. This site is completely exposed to Bay of Bengal. This site is also an individual monitoring point.

### *Status of Surface Water Quality*

#### In-situ tested parameters

The in-situ tested results obtained up to 30<sup>th</sup> monitoring period (Oct-Nov, 2021: Post-monsoon season) are described below:

#### *pH*

Thirtieth (30<sup>th</sup>) quarterly monitoring activities was carried out in the month of October-November, 2021 which is usually considered as post-monsoon season of Bangladesh. During this visit, pH values in the monitoring sites were found to be ranged between 6.5 and 8.5 and altogether the pH value (Values averaged for 11 locations) was almost 7.7 near the power plant areas and reduces up to 6.7 at Hiron point of Sundarbans. However, the pH values of surface water monitoring data have been found within the standard limit of ECR, 1997 Standard (6.5-8.5). However, the values indicated slightly basic in nature during the post-monsoon.

The pH values of monsoon and post-monsoon seasons were found to be comparatively lower than those of the pre-monsoon and winter seasons (**Table B.1: Appendix-IV**) which might be due to the decreased, river flow and water level during pre-monsoon and winter season triggered by inadequate rainfall and insufficient inflow from U/S (upstream) of Passur-Sibsa RS (River System) which has also reported by others (*Rahman et al., 2013*). Fluctuations in pH values during different season of the year can be attributed to factors like; removal of CO<sub>2</sub> by photosynthesis through bicarbonate degradation, dilution of waste with freshwater, reduction in salinity and temperature, and decomposition of organic matter (*Rajasegar, 2003*).

Seasonal variations in pH concentrations among the selected monitoring sites during the quarterly monitoring programs of the previous years of Passur-Sibsa RS are presented in **Figure 2.11** and the observed dataset are attached in **Table B.1 of Appendix- IV**.

#### Temperature

During the monitoring period the temperature varied from 26°C -30°C among the monitored sites. Observed sites outside the Sundarbans and the Deep mangrove forests showed the same average temperature of 27°C -28°C whereas, water temperature of about 30°C was recorded at near the Power Plant jetty site area. According to the ECR, 1997, 30°C water temperature is still be tolerable by the aquatic organisms in tropical environment. However, there were some sites that showed increasing pattern of temperature especially nearby the Power Plant and adjacent area rather than the ECR limit during the pre-monsoon seasons. That changes could be high salinity and hot environment prevailing at that area. However, currently the power plant is not discharging any hot water into its surrounding environment as it is still in construction phase.

The surface water temperature largely depends on daily weather condition (*Bartram. J. et. al., 1996*). According to the seasonal weather pattern of Bangladesh the temperature drops to a minimum level during winter, which is also applicable for the water temperature and thus it differs largely than the other season's temperatures. Recorded temperatures indicated that there was spatial variation among the monitoring sites even in the same seasons.

Seasonal variations in surface water temperature in the selected sites during the quarterly monitoring of previous years are presented in **Figure 2.12** and all the observed dataset are attached in **Table B.2 of Appendix- IV**.

#### Salinity

The observed salinity concentration ranged between 0.1 ppt. and 2.6 ppt. during the last post-monsoon season. The maximum salinity (2.6 ppt.) was observed at Hiron point in the Sundarbans while minimum in Power plant adjacent areas. Sufficient fresh water flow from upstream section of the river system reduced the salinity concentrations in the monsoon and post-monsoon than the pre-monsoon and winter seasons.

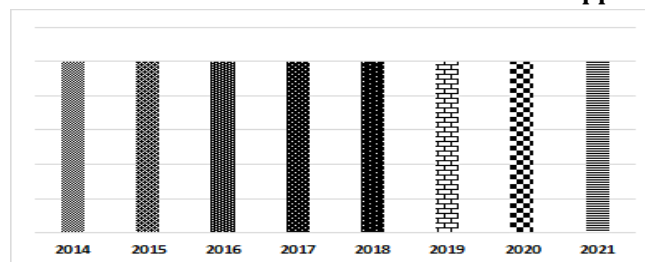
In general, high salinity from sea water increased water salinity in the direction of downstream to upstream. In the monitored river systems, the highest salinity was observed in pre-monsoon season followed by winter season where monsoon reflects the lowest. Freshwater flow from upstream and the dominated towards the sea water are the main reason of low salinity concentration in monsoon. The water salinity data in the selected sampling stations of Passur-Sibsa RS of the previously monitoring periods are presented in **Figure: 2.13** and all the observed dataset are attached in **Table B.3 of Appendix- IV**.

#### Dissolved Oxygen

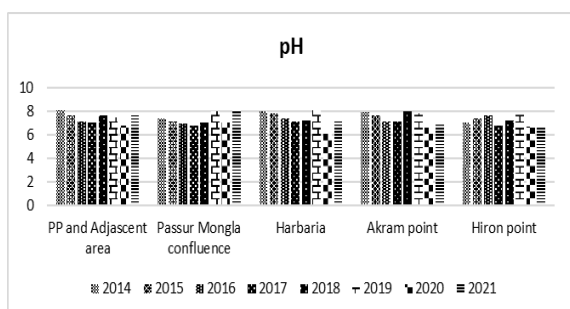
The standard DO level for the fisheries in aquatic environment is more than 5.0 mg/L (ECR'1997). In the last monsoon season, DO ranged from 5.6 mg/L to 7.8 mg/L which was found within the permissible limit recommended by DoE protocols. The average DO value of 6.6 mg/L was found near the power plant sites which was relatively same (6.6 mg/L) inside the Sundarbans. Higher DO level in monsoon and post-monsoon season, basically was for heavy rainfall and freshwater availability. During winter, salinity affects the temperature and then water temperature affects the holding capacity of DO in water. However, still the

DO concentration of Passur-Sibsa RS (near project site and inside the Sundarbans), are complying with the water usable for irrigation, as irrigation usable DO concentration limit is only 5.0 mg/L (ECR, 1997).

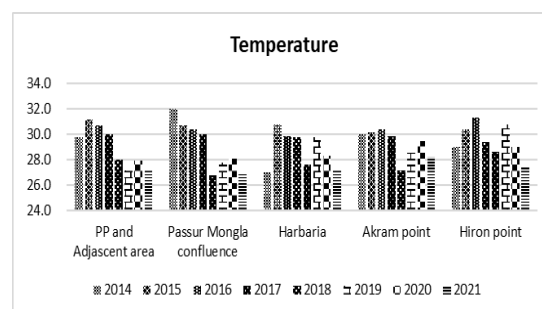
Seasonal variations of DO at the monitoring sites of Passur-Sibsa RS for the monitoring periods are shown in **Figure: 2.14** and all the observed dataset are attached in **Table B.4 of Appendix- IV**.



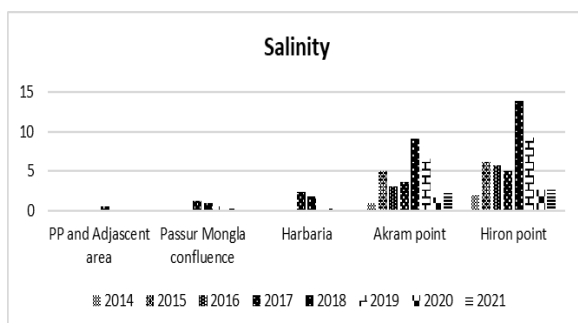
*Legend direction (left to right: 2014-2021)*



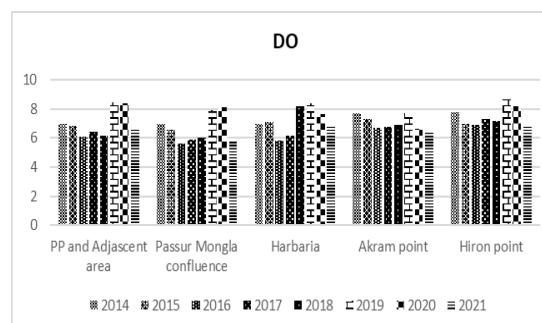
**Figure 2.11: Variations in Post-monsoon pH values in different monitoring sites**



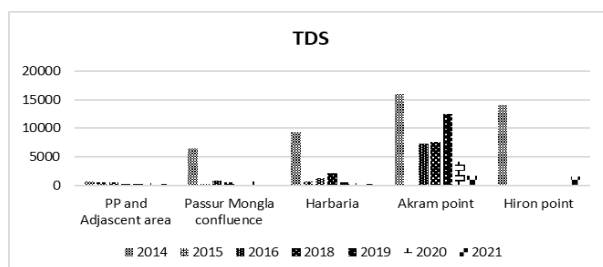
**Figure 2.12: Variations in Post-monsoon Temperature values in different monitoring sites**



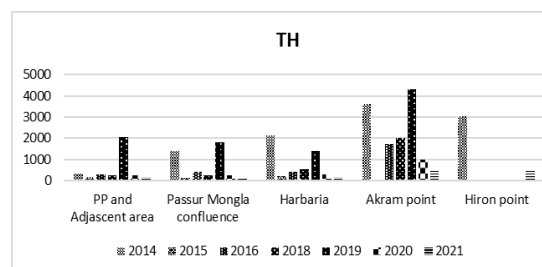
**Figure 2.13: Variations in Post-monsoon Salinity values in different monitoring sites**



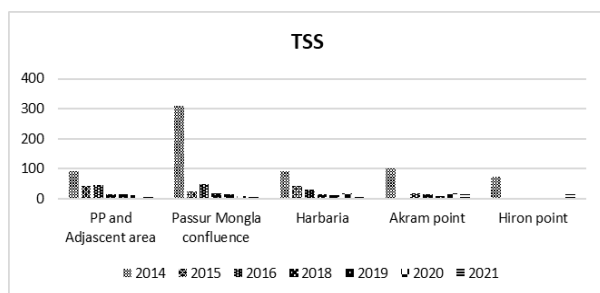
**Figure 2.14: Variations in Post-monsoon DO values in different monitoring sites**



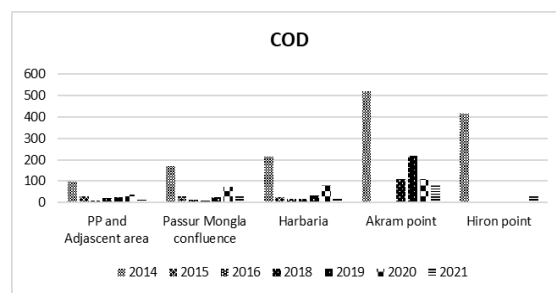
**Figure 2.15: Variations in monsoon TDS values in different monitoring sites**



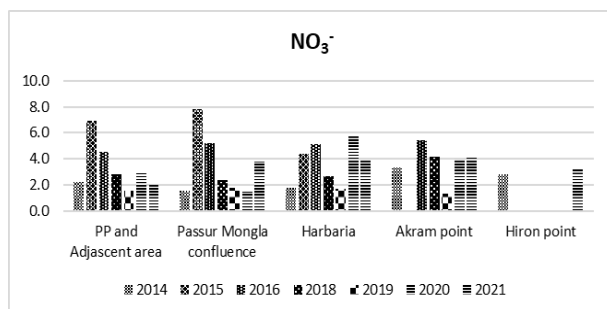
**Figure 2.16: Variations in monsoon TH values in different monitoring sites**



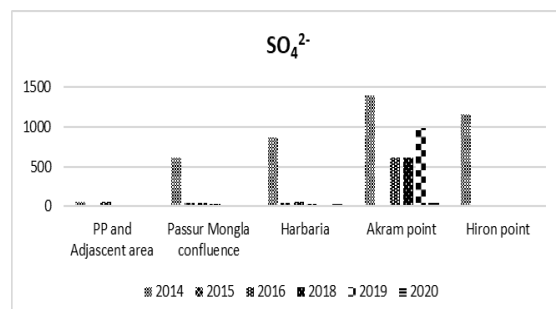
**Figure 2.17: Variations in monsoon TSS values in different monitoring sites**



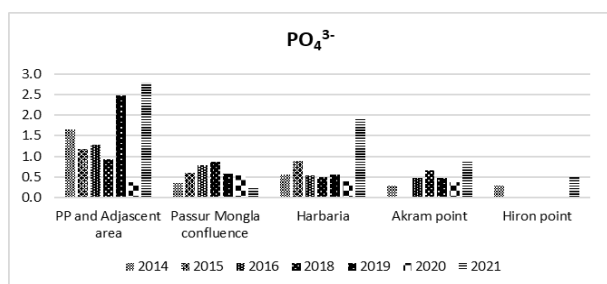
**Figure 2.18: Variations in monsoon COD values in different monitoring sites**



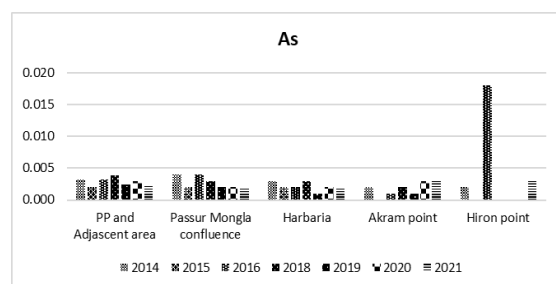
**Figure 2.19: Variations in monsoon Nitrate values in different monitoring sites**



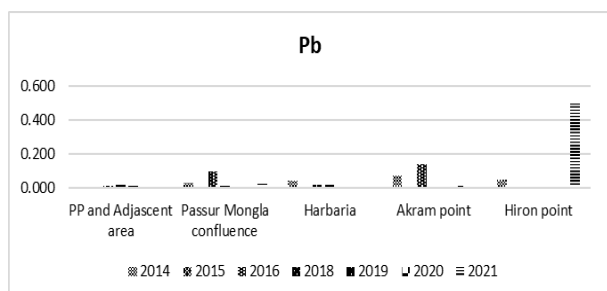
**Figure 2.20: Variations in monsoon Sulphate values in different monitoring sites**



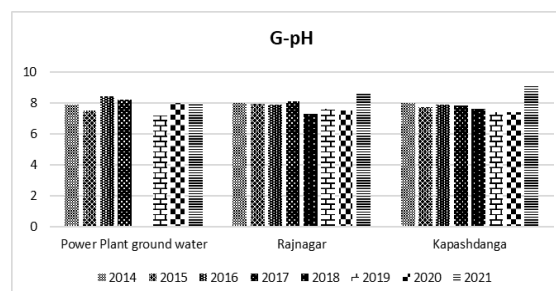
**Figure 2.21: Variations in monsoon Phosphate values in different monitoring sites**



**Figure 2.22: Variations in monsoon Arsenic values in different monitoring sites**

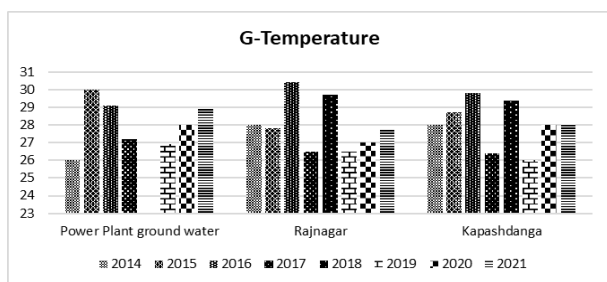


**Figure 2.23: Variations in monsoon Lead values in different monitoring sites**

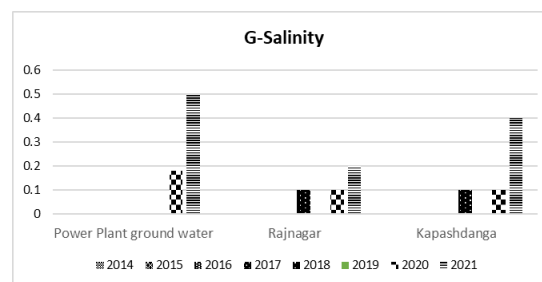


**Figure 2.24: Variations in Post-monsoon G-pH values in different monitoring sites**

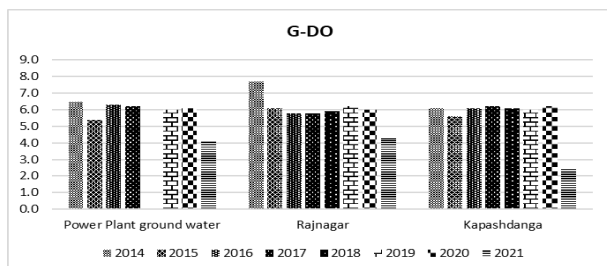




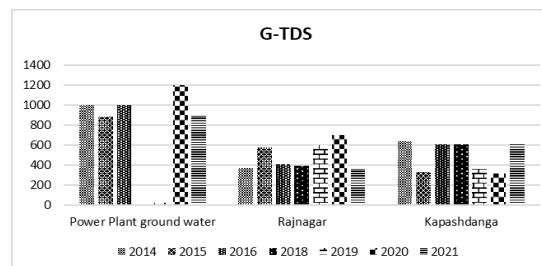
**Figure 2.25: Variations in Post-monsoon G-Temperature values in different monitoring sites**



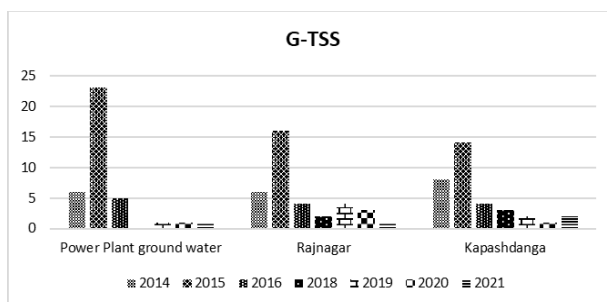
**Figure 2.26: Variations in Post-monsoon G-Salinity values in different monitoring sites**



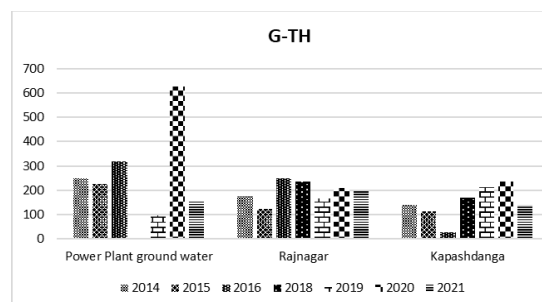
**Figure 2.27: Variations in Post-monsoon G-DO values in different monitoring sites**



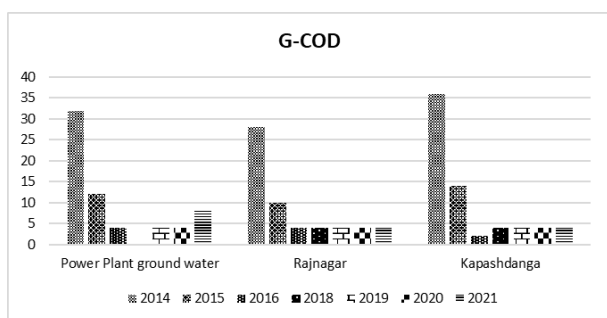
**Figure 2.28: Variations in monsoon G-TDS values in different monitoring sites**



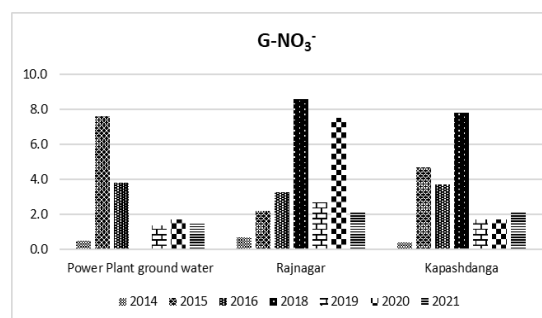
**Figure 2.29: Variations in monsoon G-TSS values in different monitoring sites**



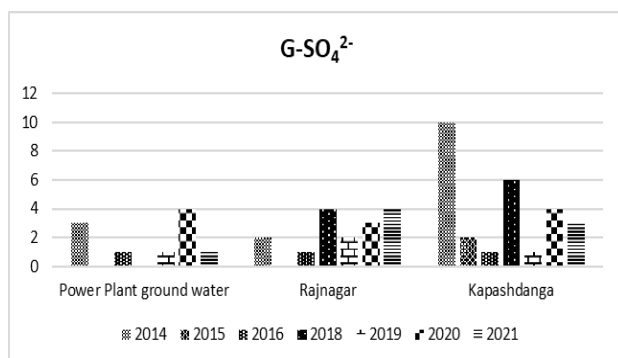
**Figure 2.30: Variations in monsoon G-TH values in different monitoring sites**



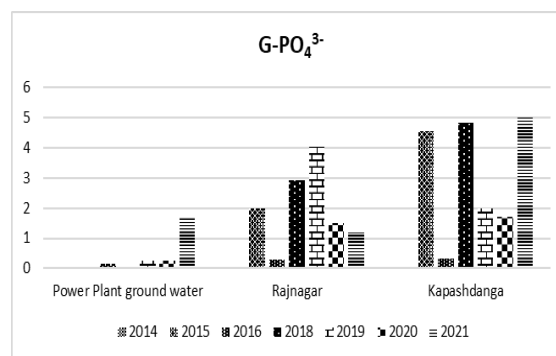
**Figure 2.31: Variations in monsoon G-COD values in different monitoring sites**



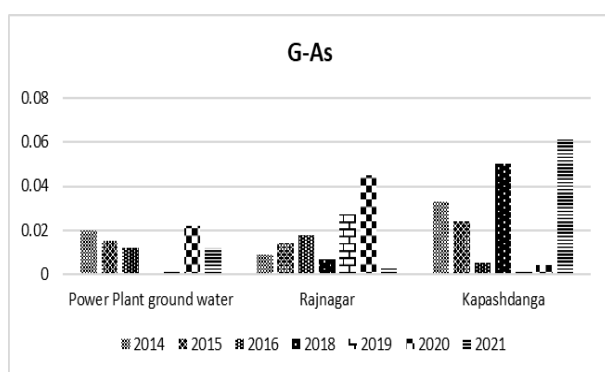
**Figure 2.32: Variations in monsoon G-Nitrate values in different monitoring sites**



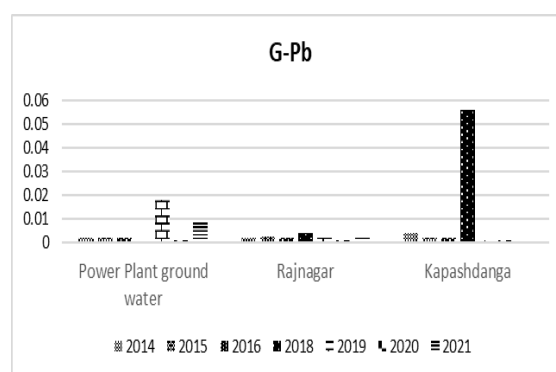
**Figure 2.33: Variations in monsoon G-Sulphate values in different monitoring sites**



**Figure 2.34: Variations in monsoon G-Phosphate values in different monitoring sites**



**Figure 2.35: Variations in monsoon G-Arsenic values in different monitoring sites**



**Figure 2.36: Variations in monsoon G-Lead values in different monitoring sites**

#### Laboratory tested parameters

The laboratory tested results obtained up to 29<sup>th</sup> monitoring period (Jul-Aug, 2021: monsoon) are described below:

#### Total Dissolved Solids (TDS), Total Hardness (TH) and Total Suspended Solids (TSS)

TDS mainly indicates the presence of various kinds of minerals like ammonia, nitrate, phosphate, alkalis, some acids, sulphates and metallic ions etc., in water which comprise both colloidal and dissolved solids in water (Tareq. M. S. *et al.*, 2013). During the last monsoon, the TDS values were found to be ranged between 58-1700 mg/L (**Figure 2.15**). In general, the TDS values increase in Pre-monsoon and winter seasons than in monsoon and post-monsoon periods which could be the contribution of heavy rainfall and upstream flow to its dilution in the rainy season (Izonfuo and Bariweni, 2001)<sup>1</sup>. On the other hand, TDS of water may be influenced by pH concentration as pH affect the solubility of the suspended matters in water<sup>2</sup> (Gadhia. M., *et al.*, 2013). Passur River were increased as it progressed toward the Sea. Therefore, Akram point was showing the highest TDS with respect to remaining sampling point. **Table B.8: Appendix IV**). In Passur-Sibsa RS, TDS has temporal variations as well. The TDS values during pre-monsoon and winter is high because of low rainfall and at the same time the tidal effects. The Bay of Bengal contains many minerals and

<sup>1</sup> Izonfuo W. A. and L Bariweni 2001. The effect of urban runoff water and human activities on some physicochemical parameters of the Epie creek in the Niger Delta. *J. Appl. Sci. & Environ. Mgt*, **5**(1): 4755.

<sup>2</sup> Gadhia. M., Surana. R., and Ansari. E., 2013. Seasonal Variations in Physico-Chemical Characteristics of Tapi Estuary in Hazira Industrial Area. *Our Nature* (2012) 10: 249-257.

turn the dominant composition of the said river system during pre-monsoon and winter. Therefore, in monsoon and post monsoon, the TDS concentration falls down. Regarding spatial variation, towards downstream of the RS, usually high TDS concentrations due to tidal influence of the Bay of Bengal that contains lots of salts and other nutrients.

**Total Hardness (TH)** follows similar pattern as that of TDS e.g., high TH during pre-monsoon and winter season. The higher the TDS, the higher the nutrients and therefore higher occurrence of TH. Insufficient freshwater supply due to low rainfall during winter and pre-monsoon period increase the TDS concentrations in the Passur-Sibsa RS. Seawater contains huge quantity of minerals including calcium and magnesium, which make the water hard. During the last monsoon period the TH values were found to be ranged between 130 mg/L to 480 mg/L. Usually in rainy season, TH is supposed to be lower in concentrations. In the power plant adjacent areas, for the last monsoon (2021) the hardness is in the acceptable limit of the ECR'97. In the deep Sundarbans hardness always found to be comparatively higher than the standard value of surface water (**Figure 2.16**). Generally, water hardness is found to be higher in monsoon season but in Passur River, it is found to be higher in pre-monsoon season due to the saline water intrusion toward upstream (Rahman et al., 2013).

**Total Suspended Solids (TSS)** include solid materials of organic and inorganic in origins, which are normally suspended in water. In the Passur-Sibsa RS, the suspended matters generally contain sand, clay, silt and loam. TSS concentrations among the monitoring sites varied from 3 mg/L to 16 mg/L observed in the last monitoring results. TSS values in every spot recorded during the last monsoon period found to be within the permissible limit of 150 mg/L (ECR, 1997). In 2014, TSS reached more than 150 mg/L at Mongla-Passur Confluence due to the oil spillage incident occurred at 9<sup>th</sup> December, 2014. After that, the issue was not found any more, and the water bodies reinstated its properties naturally. Above all, in the Passur-Sibsa RS, TSS showed consistency in the concentrations of suspended matters (**Figure 2.17**).

Generally, in the Passur-Sibsa RS, TSS was found to be higher in post-monsoon and winter seasons than those of pre-monsoon and monsoon. During post-monsoon and winter season, the TSS value increases, probably due to relatively low precipitation and less upstream freshwater flow, urban runoff, industrial wastes, bank erosion, bottom feeders (such as carp), algae growth or wastewater discharges.

The status of TDS, TH and TSS of Passur River in the observed winter seasons at different monitoring sites are presented in **Figure 2.15**, **2.16** and **2.17** respectively and all the observed dataset are attached in **Table B.8**, **Table B.9** and **Table B.10** of **Appendix- IV**.

#### Chemical Oxygen Demand (COD)

COD is an indicator of organic pollution, which is caused by the inflow of natural organic loads, domestic, livestock and industrial wastes, which contain elevated levels of organic pollutants (Ayati, 2003). In fact, the higher the organic matter, the higher will be the decomposition and hence there will be a higher demand of O<sub>2</sub> in the water body.

COD concentrations varied from 4 mg/L to 80 mg/L during the last pre-monsoon season (**Figure 2.18**). The highest value was found at Akram Point while the lowest value was found in Passur River near the Power Plant area. The high values of COD indicate high level of organic pollution in the river water (Sivasubramaniam, 1999). **Figure 2.18** indicates that, organic loads are higher in the deep forests of Sundarbans than the upstream areas especially the power plant and its adjacent areas. Deep forests supply many organic loads in the river while upstream loads as well increase the organic materials concentrations in huge at the downstream of the RS. COD concentrations of all the monitoring sites found slightly higher than the Draft ECR' 2017 (25 mg/L).

Over the year, COD concentration was found to be higher in pre-monsoon season followed by winter as these seasons had insignificant rainfall comparing to those of other seasons and which actually increased the density of organic matter. The COD concentrations of pre-monsoon and winter seasons (dry) were found higher than those of monsoon and post-monsoon seasons. In monsoon, higher discharge diluted the

COD load of the river water, which in turn reduced COD concentration in post monsoon. All observed values of COD are shown in **Figure 2.18** and the completely monitored dataset are provided in **Table B.6 of Appendix- IV**.

#### Nitrate, Sulphate and Phosphate

During monsoon the highest value was found to be 4.1 mg/L at Akram point and lowest value was found to be 1.3 mg/L at Right Bank of Passur River at 100m u/s of North West corner from the Project boundary. The highest values were found in pre-monsoon season of 1st quarter of 2nd year, which would be due to the higher amount of surface and groundwater runoff, dissolution of nitrogen-rich geological deposits, and biological degradation of organic matter as observed from numerous studies (Spencer, 1975; Kinne, 1984; Gleick, 1993; Wetzel, 2001; Rabalais, 2002) (**Table B.11 of Appendix-IV**). High nitrate concentration was found in monsoon period across the Passur-Sibsa RS, which would be the result of surface run-off, agricultural run-off, atmospheric deposition and domestic wastes dumping together with industrial pollution from upstream.

Naturally, sulphate ( $\text{SO}_4^{2-}$ ) concentration is higher in seawater as well as in coastal river due to tidal interactions. The monitored dataset substantiates this fact i.e.,  $\text{SO}_4^{2-}$  concentration of Passur-Sibsa RS increases in the direction of upstream to downstream. However, this variation is visible clearly in monsoon and pre-monsoon seasons only. Freshwater availability from upstream makes this variation. During the monitoring tier sulphate concentration was found to be higher in Hiron point (598 mg/L) and lowest (13 mg/L) at Middle of Passur River at South West corner from the Project boundary.

On the other hand,  $\text{PO}_4^{3-}$  concentrations were found to be in the range of 0.2 – 5.4 mg/L during the last monitoring period (Monsoon, 2021).  $\text{PO}_4^{3-}$  concentration showed very little spatial variation in last monsoon. Upstream anthropogenic activities probably the reason for this kind of trend along with pattern of rainfalls and bio-geochemical cycles of nitrogen. All the monitoring sites complied with the permissible limit as per Draft ECR' 2017 rules of 0.5 mg/L of  $\text{PO}_4^{3-}$  in the inland surface water except the site of Maidara River. Maximum concentration (5.4 mg/L) was found at left bank of Passur River at South west corner of the project boundary which might be due to the runoff from agricultural field into the small river. On the other hand, the recorded low phosphates value during dry seasons might be attributed to the limited flow of upstream freshwater, high salinity and utilization of phosphate by phytoplankton, stated by Senthilkumar et al., 2002; Rajasegar, 2003 (**Table B.11**).

$\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$  and  $\text{PO}_4^{3-}$  concentrations at different monitoring sites are shown in **Figure 2.19**, **Figure 2.20** and **Figure 2.21** and all the observed dataset are given in **Table B.11**, **Table B.12** and **Table B.13 of Appendix- IV**.

#### Heavy Metals

Arsenic (As) concentrations varied between 0.002 to 0.003 mg/L. During the monitoring, the results again fitted with the said range. Though there were some seasonal variations in As concentration, but still As concentration complies with the drinking water quality standard of WHO (0.01 mg/L). The Bangladesh limit is as high as of 0.05 mg/L (**Figure 2.22**).

Lead (Pb) dissolved in water is very harmful to aquatic organisms; due to bioaccumulation, it increases in body tissue of organisms (Rompas, 2010). It is also evident that organic fertilizer, which comes from lime and compost fertilizers, can contain heavy metal, e.g., NPK fertilizer (phosphate fertilizers containing Pyromorphite-  $\text{Pb}_5(\text{PO}_4)_3$  like the way said by Zhu et. al., 2004), which may result in higher amount of Pb concentration in river water. During 29<sup>th</sup> monitoring period, the concentration of Pb ranges from 0.002 to 0.5 mg/L (**Figure 2.23**). On the other hand, the values of Mercury (Hg) revealed consistency among all the monitoring points in all the seasons in all monitoring quarters. The values never exceeded 0.001 mg/L. In the last monsoon, the concentrations also remain same. All the observed data are found to be within the permissible limit (0.05 mg/L) as per ECR, 1997.

The average value of As and Pb concentrations at different monitoring sites of the consecutive monitoring quarters for winter season are presented in **Figure 2.22 and 2.23** and all the observed dataset are given in **Table B.14, Table B.15 and Table B.16 of Appendix- IV**.

#### Oil and Grease

In order to measure the concentration of oil and grease in Passur-Sibsa River, samples were collected at five locations during low tide from the surface layer and analysed following the standard testing method of APHA. The concentration of oil and grease are presented in **Table-B.7 of Appendix-IV**.

During monsoon and post monsoon periods, the concentration of oil and grease were found lower than that of winter and pre-monsoon season. It appears from the data that Passur and Sibsa river system recorded high concentration of oil and grease in winter period in 2014, which might be due to accidental oil spillage occurred on December 9, 2014. An amount of 350,000 litres (Philips, 2014) of furnace oil had spilled in the river and spread over an area of 350 km<sup>2</sup> (Welle, 2014).

During the monsoon period, oil and grease was found <2.0- mg/L for all the monitoring sites. Plying of motorized boats, launches and other tourist boats, Navy boats and fishing boat at Dublar char could be the reasons of high oil and grease in that areas. Moreover, for the seasonal fishing at sea, the engine boats and other fishing boats contributes huge amount of oil and grease in the river water. Therefore, due to oil spillage and discharges of other organic residual from large number of marine vessels in the location; oil discharge from the fishing boats and other anthropogenic activities might be the reason of having such higher amount of oil and grease concentration sometimes.

#### Total Organic Carbon

Total Carbon (TC) represents all the carbon in the sample, including both inorganic and organic carbon. Total Organic Carbon (TOC) is the amount of carbon found in an organic compound and is often used as a non-specific indicator of water quality or cleanliness of pharmaceutical manufacturing equipment. Total Inorganic Carbon (TIC) often referred to as inorganic carbon (IC), carbonate, bicarbonate, and dissolved carbon dioxide (CO<sub>2</sub>).

This study only considers TOC, which is very important in detecting contaminants in drinking water, cooling water, water used in semiconductor manufacturing, and water for pharmaceutical use. However, three sites of Project Jetty, Harbaria and Hiron Point were monitored for TOC concentrations. During the monitoring tier TOC concentration was found highest across the Majhar point and Harbaria area i.e. 20.0 mg/L. On the other hand, the highest TC was found to be 544 mg/L at Hiron Point. Observed surface water is safe from TOC and TC contaminant so far (**Table B.29: Appendix IV**).

#### PAHs (Polycyclic aromatic hydrocarbons)

During the last monitoring (monsoon), the PAHs was undetectable near the Project jetty site, Harbaria and at the Hiron point. It indicates that there were no PAHs pollution until now in the Passur-Sibsa RS (**Table B.28: Appendix IV**).

### *Findings*

Passur River is highly influenced by tidal effects. Tidal penetration in the Passur River depends on seasonal change, upstream flow and catchment water discharge. However, the physico-chemical properties of Passur River changes with the tidal intrusion in different seasons.

In this 30<sup>th</sup> quarterly monitoring, pH was found slightly basic in nature. Salinity during monsoon has been recorded significantly lower than the pre-monsoon and winter seasons. Temperature and dissolved oxygen level was found in fair and favourable for the aquatic life forms. During the 29<sup>th</sup> quarter (monsoon, 2021), TDS and TH has been relatively lower with respect to the same seasons of last consecutive years. TSS of the rivers was also recorded lower than the previous year of pre-monsoon seasons. Nitrate (NO<sub>3</sub><sup>-</sup>) level

remained relatively lower. Sulphate concentration should be re-investigate after getting the data from future quarterly monitoring season.

The phosphate ( $\text{PO}_4^{3-}$ ) was found within the safe limit of aquatic organisms. In case of metal pollution, no variation was recorded for As, Pb and Hg concentration and even no issues as well. Oil & grease concentration was found less than 2.0 mg/L at all sites which is less than the recommended concentration (10 mg/L) for Inland Surface Water. No TOC and PAH issues were raised so far in the Passur-Sibsa RS.

### 2.3.8 Status of the Groundwater quality

#### *In-situ tested parameters*

The in-situ tested results obtained up to 30<sup>th</sup> monitoring period (October, 2021: Post-monsoon season) are described below:

#### pH and Temperature

The values of pH and temperature of groundwater in the monitored sites complied with the drinking water quality standards as specified in ECR, 1997 (6.5-8.5 and 20-30°C respectively). The pH values during 30<sup>th</sup> monitoring scheme were found to vary from 8.0-9.1. When it comes to increasing drinking water alkalinity, various chemicals and pollutants are known to cause high pH levels. If the soil or bedrock around groundwater sources includes carbonate, bicarbonate, or hydroxide compounds, those materials get dissolved and travel with the water. These mineral deposits also increase the alkalinity of the water. The temperature was recorded between 27.7°C -28.89°C. No significant differences have been observed against the previous monsoon season results. Temperature were found more or less consistent with the previously respective season's data. However, the 30<sup>th</sup> consecutive monitoring results of pH and temperatures (monsoon) of selected sites are presented in **Figure 2.24** and **2.25** the observed dataset of pH and Temperature are attached in **Table B.17** of **Appendix- IV**.

#### Salinity and Dissolved Oxygen (DO)

Groundwater salinity concentration in all the monitoring sites were found to be increasing trend with respect to previous years during post-monsoon period. Over the years the ground water salinity is incrementally increased especially at Rajnagar and Kapashdanga. High ground water extraction, ground water salinity intrusion or surface saline water percolation may be the key reason for increasing the level of salinity into ground water over the years. During the monitoring period the groundwater of all the three sites were found to be saline free (**Table B.18: Appendix- IV**).

DO values ranged between 6.1 – 7.7 mg/L during this monitoring season. DO concentrations were found to be slightly higher than the permissible limit of ECR, 1997 (6.0 mg/L). A slight low DO concentration in drinking water might only reduce the taste of water. Higher DO level makes water tastier but causes corrosion to the supply pipe.

All monitoring results of salinity and DO of the selected monitoring sites are presented in **Figure 2.26** and **2.27** and all the observed dataset of DO and Salinity are attached in **Table B.18** of **Appendix- IV** respectively.

#### *Laboratory tested parameters*

The laboratory tested results obtained up to 29<sup>th</sup> monitoring period (Jul-Aug, 2021: pre-monsoon season) are described as follows:

#### TDS, TSS and TH

The highest TDS value of 890 mg/L was recorded near the Project Township Area, followed by Kapashdanga (610 mg/L) and Rajnagar (360 mg/L). Which complied completely with the ECR' 1997 (1,000

mg/L) (Figure 2.26: TDS). TSS also known as non-filterable residue, are the solids (minerals and organic material) which remain trapped on a 1.2µm filter (U.S.EPA, 1998). During the 29<sup>th</sup> monitoring period, the TSS concentrations was recorded around 1-2 mg/L, which complied within the Standard for Drinking Water, Bangladesh (TSS: 10mg/L, ECR, 1997) (Figure 2.26: TSS). TSS was found much higher than the drinking standard quality particularly at Rajnagar during the pre-monsoon in 2017 and 2018. But the last monitoring in pre-monsoon, the TSS remain 1 mg/L due to sufficient groundwater recharge and filtration.

TH concentrations of the three monitored spots varied from 140mg/L to 195mg/L during the last monsoon period. The maximum value was found near Rajnagar followed by Township area and Kapashdanga. Over the last seven monsoon seasons monitoring, drinking water hardness complied with standard limit (200-500 mg/L) set by the ECR' 1997 most of the time.

Groundwater TDS, TSS and TH values of the consecutive winter periods are presented in **Figure: 2.28, 2.29 and 2.30** and all the observed dataset are attached in **Table B.19 and B.20 of Appendix- IV**.

#### Chemical Oxygen Demand

The Bangladesh standard for COD in drinking water is 4.0 mg/L. Monitoring sites completely breached with the Bangladesh Standard as COD concentrations for every sites in the last monsoon period as like the year 2014 and 2015. However, the highest value of COD was found at Project site drinking water (36.0 mg/L). Increasing organic or inorganic compounds or ion in the ground water was the major cause for increasing COD in the ground water during monsoon in the monitoring areas.

The COD concentrations of all the pre-monsoon period monitoring sites are given in **Figure 2.31** and all the observed dataset are attached in **Table B.21 of Appendix- IV**.

#### Nitrate, Sulphate and Phosphate

Natural nitrate levels in groundwater are generally very low (typically less than 10 mg/l  $\text{NO}_3^-$ ), but nitrate concentrations grow due to human activities, such as agriculture, industry, domestic effluents and emissions from combustion engines. The sources of nitrates pollution in groundwater are cultivation in areas where the soil layer is relatively thin, or has poor nutrient buffering capacity, or where there are changes in land use; over fertilization of crop for intensification of agricultural activity; spread cultivation of crops which require high fertilizes doses and which leave the soil bare over long periods (maize, tobacco and vegetables); drainage systems which lead to drainage of fertilizers; intensive agricultural rotation cycles involving frequent ploughing and extensive areas of bare soils during winters; organic fertilizers form animal husbandry and increased urbanization. Among the monitoring tiers, the  $\text{NO}_3^-$  values were found to be highest during the monsoon of 2018 though it was found to be within the standard limit set by ECR'97. However, during last monsoon period, the nitrate values were found to be highest (2.1 mg/L) in Rajnagar and Kapashdanga and lowest (1.5 mg/L) in Project site.

On the other hand, Sulphate ( $\text{SO}_4^{2-}$ ) level has been monitored since 2015. On that time,  $\text{SO}_4^{2-}$  concentrations were complying with the Bangladesh Standard for Drinking Water Quality (400 mg/L).  $\text{SO}_4^{2-}$  concentration in groundwater showed significantly decreasing trend during concentrations during pre-monsoon monitoring in April, 2021. During the last monsoon, highest (4 mg/L) values was found in Rajnagar and lowest (1 mg/L) in Project area.

In addition, the concentrations of  $\text{PO}_4^{3-}$  were found between 1.7mg/L and 5mg/L, which was within the standard limit of 6.0mg/L (ECR'1997).  $\text{PO}_4^{3-}$  concentrations actually have both spatial and temporal variations but which is minor in the interest of this monitoring objectives as well as drinking purpose by the community resides there. The observed winter seasons  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$  and  $\text{PO}_4^{3-}$  concentrations of groundwater are presented in **Figure 2.32, 2.33 and 2.34** and all the observed dataset are attached in **Table B.22, B.23, and B.24 of Appendix- IV**.

*Arsenic (As), Lead (Pb) and Mercury (Hg)*

According to Bangladesh Standard (ECR, 1997), the maximum acceptable concentration of Arsenic (As) in groundwater is 0.05 mg/L. The As concentrations among all the monitoring locations ranged between 0.003 mg/L and 0.061 mg/L in the last monsoon. The As level of Kapashdanga slightly exceeded the Bangladesh standard for drinking water quality (ECR, 1997) and in the next monitoring the owner of the tube-well will be informed about the As level exceedance (**Figure 2.35: Arsenic**). Earlier, there were two cases was noted as exceedance during the entire monitoring scheme since 2014. The first one was during the winter period of 2019 (0.063 mg/L) and the second one was during the post-monsoon of 2020 (0.053 mg/L) at Rajnagar. Now, it was the third time, where the as concentration exceeds the Bangladesh standard of Drinking water (ECR, 1997) at Kapashdanga monitoring well. Therefore, we have to investigate further for find out the root cause and taking firm decision about the monitoring well. We should aware to the ground water user on as issue.

Lead (Pb) and Mercury (Hg) concentrations were also measured and the values were found within the permissible limit specified in ECR 1997 (0.05 mg/L for Pb and 0.001 mg/L for Hg). The concentration of Pb showed only spatial variation to some extent (**Figure 2.36: Lead**). However, the water of the tube-wells was found suitable for drinking purpose in terms of metal pollution status.

The observed values of as and Pb in all the winter seasons are presented in **Figure: 2.35 and 2.36** and all the observed dataset of As, Pb and Hg are presented in **Table B.25, B.26 and B.27 of Appendix-IV**.

*Remarks*

This concluding remark represent the status of physical (post-monsoon, 2021), chemicals and metals status (Monsoon, 2021) characteristics of drinking water. It has been observed that the physical characteristics of groundwater quality is still in good condition with slight variation in pH and salinity. The reason being saline water intrusion and infiltration due to excessive withdrawn of groundwater by the surrounding communities during the dry season. In addition, evaporation also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes in salinity.

Chemical characteristics of the groundwater quality are also found relatively good but exceeded on the permissible limit for Bangladesh (Drinking water standards, ECR' 1997). The observed groundwater is completely free from the metal pollution particularly Lead and Mercury. Arsenic pollution was recorded at Kapashdanga monitoring station during the April, 2021. Out of 29 monitoring seasons, only three times Arsenic became an issue temporarily with slightly higher concentrations than the drinking standards.

**2.4 Land Resources Monitoring****2.4.1 Methodology**

Monitoring of selected indicators is very crucial for better management of land resources in the study area. Plot/land use, soil fertility/nutrient status, soil contamination with heavy metals and soil salinity have been considered as the major indicators for land resources monitoring. It is also assumed that during the operation phase of the power plant, fly ash and other air borne pollutants may get deposited on the surrounding agriculture land, which ultimately will pollute the study area soil. Before that (during pre-construction and construction stage), only natural phenomena are responsible to alter soil parameters.

*Sampling Frequency*

The frequency of monitoring for land resources data collection has been considered twice in a year. Accordingly, the soil samples are collected during this monitoring (30<sup>th</sup> monitoring) field visit and sent immediately to laboratory for analysis. The analysis data will be incorporated with next monitoring report.



### Monitoring Indicators

The continuous monitoring has given an opportunity to observe seasonal change along with spatial change of selected indicators of sampling plots. The selected indicators are soil reaction (pH), soil salinity (EC), Organic matter (OM), base Cations-Ca, Mg, K and Na, status of macro nutrients (N, P and S), status of micro nutrients (B, Fe, Mn and Zn) and presence of heavy metals (Pb and Cd). Sodium absorption ratio (SAR), exchangeable sodium percentage (ESP) can be calculated from the analysed data. It can also be mentioned that the structural change of soils in the sampling plots may also be identified from these data.

The formula to calculate SAR is given below, with concentration expressed in milli equivalents per liter (meq/L) analysed from a saturated paste soil extract.

$$SAR = \frac{[Na^+]}{\sqrt{\frac{1}{2}([Ca^{2+}] + [Mg^{2+}])}}$$

ESP is the sodium adsorbed on soil particles as a percentage of the Cation Exchange Capacity (CEC). It is calculated as:

$$ESP = \frac{[Na]^+}{CEC} \times 100$$

CEC is often estimated as the major exchangeable cations, including hydrogen. Both cation and CEC are expressed as meq/100g. ESP can also be calculated as:

$$ESP = \frac{[Na]^+}{[Ca^{2+} + Mg^{2+} + Na^+ + K^+]}$$

ESP is used to characterise the sodicity of soils only, whereas SAR is applicable to both soil and soil solution or irrigation water.

### Location

The selected mauzas for monitoring are Baranpara (E-89°30'59.1", N-22°37'57.0") of Batiaghata Upazila, Chunkuri-2 (E-89°32'20.0", N-22°34'51.0") of Dacope Upazila, Kapalirmet (E-89°36'8.8", N-22°32'18.9") of Mongla Upazila, Chakgona (E-89°34'25.3", N-22°34'18.3") of Rampal Upazila and Basherhula (E-89°34'25.0", N-22°36'14.0") of Rampal Upazila under Khulna and Bagerhat Districts. However, a new sampling location (Bidyarbon- E-89°34'40.0", N-22°33'42.0") of Mongla Upazila was included with the previous ones for monitoring as per ToR. The sampling locations with their corresponding coordinates are stated in **Table 2.9**. Locations of collected soil samples are presented in **Figure 2.37**.

**Table 2.9: Land Resources Monitoring Plan**

Site No.	Monitoring indicators	Location	GPS(Decimal Degree)		Sampling Frequency	Methods/Tools/ Techniques
			Northing	Easting		
1	Plot use, Soil fertility and nutrient,	Mouza: Baranpara, Union: Gangarampur Upazila: Batiaghata, District: Khulna	N-22°37'57.0"	E-89°30'59.1"	Bi-yearly (April and October)	In situ field sampling and Laboratory Testing in SRDI
2	Chemical properties of soil (pH, Pb, Cd),	Mauza: Chunkuri-2, Union: Bajua Upazila: Dacope, District: Khulna	N-22°34'51.0"	E-89°32'20.0"		
3	Crop production and damage	Mouza: Kapalirmet/Buridmial Union: Burirdanga, Upazila: Mongla	N-22°32'18.9"	E-89°36'8.8"		

Site No.	Monitoring indicators	Location	GPS(Decimal Degree)		Sampling Frequency	Methods/Tools/ Techniques
			Northing	Easting		
		District: Bagerhat				
4		Mouza: Chakgona, Union: Rajnagar Upazila: Rampal, District: Bagerhat	N-22°34'18.3"	E-89°34'25.3"		
5		Mouza: Basherhula, Union: Rajnagar Upazila: Rampal, District: Bagerhat	N-22°36'14.0"	E-89°34'25.0"		
6		Mouza: Bidyarbon, Union: Burirdanaga Upazila: Mongla, District: Bagerhat	N-22° 33' 42.0"	E-89° 34' 40.0"		

### 2.4.2 Process of Soil Samples Collection

#### Plot Selection

Monitoring plots were selected at the very beginning of this study. Expert's judgement along with plot owner's opinion was taken into consideration for this selection. Upazila Agriculture Officers of Batiaghata and Dacope of Khulna, Rampal and Mongla of Bagerhat District and Senior Scientific Officer of Soil Resource Development Institute (SRDI) of Khulna were contacted for collecting expert's judgement. Wind speed and wind direction were considered as potential local factor for the monitoring purpose. All the selected plots were characterized as medium high land (F<sub>1</sub>), which are normally flooded in the range of 30-90 cm and remain inundated for more than two weeks to few months during the flood period.

#### Soil sample collection

Standard procedure was maintained during the collection of soil samples. In every plot, minimum three pits were dug through augur to collect composite sample. Each plot had three composite samples, top soil (0-15 cm), sub soil (15-30 cm) and sub stratum (30-45 cm). Soil samples were preserved in an air-tight plastic bag for laboratory analysis.

#### Laboratory Analysis

Collected soil samples have been handed over to the SRDI, Dhaka for laboratory analysis. The analysis data and report are incorporated with next monitoring (31st monitoring) report.

### 2.4.3 Agricultural resources monitoring

Monitoring of agriculture resources has been scheduled twice a year as per the monitoring plan of the ToR and accordingly, the survey was conducted in November, 2021. The data on agricultural practice (Production, damage, input use etc.) was collected through informal interview (KII, RRA and FGD) with the local farmers from the monitoring area.

#### Locations

The agricultural monitoring locations remain same as the soil sampling locations which is presented in **Table 2.4**.

### *Monitoring indicators*

For data collection, six sampling plots were selected on random basis within the project influence area during construction phase monitoring. The mauzas which were selected for land resources monitoring were considered for monitoring agricultural resources.

During 30<sup>th</sup> quarterly visit, consultations and group discussions were organized with local people to know the use of agricultural inputs, present cropping patterns by land type, crop damages and other conditions like drainage congestion/water logging, salinity intrusion or other natural calamities induced impacts, diseases and pest infestation as well as management practices and crop production in the selected locations of the monitoring area.

#### **2.4.4 Present cropping pattern of the monitoring plots**

Detailed data on cropping pattern for this year were obtained through discussions with the plot owners. Based on the discussions, the plot-based cropping patterns was identified and the associated data was collected in November 2021 and described in the following sections and presented in **Figure 2.38**.

#### *Monitoring Plot-1 (Baranpara)*

This plot is located at Baranpara mauza and the area is about 0.4 hectare. Previously local Aman (Chapshail) was cultivated in this area due to water logging and other problems. But this year, the farmers cultivate BR10 rice. Due to satisfactory growth, the farmer didn't use any chemical fertilizer and pesticides. The cropping practice and management practice remain same as the previous monitoring. The detailed cropping pattern is shown in **Table E.2 of Appendix IV**.





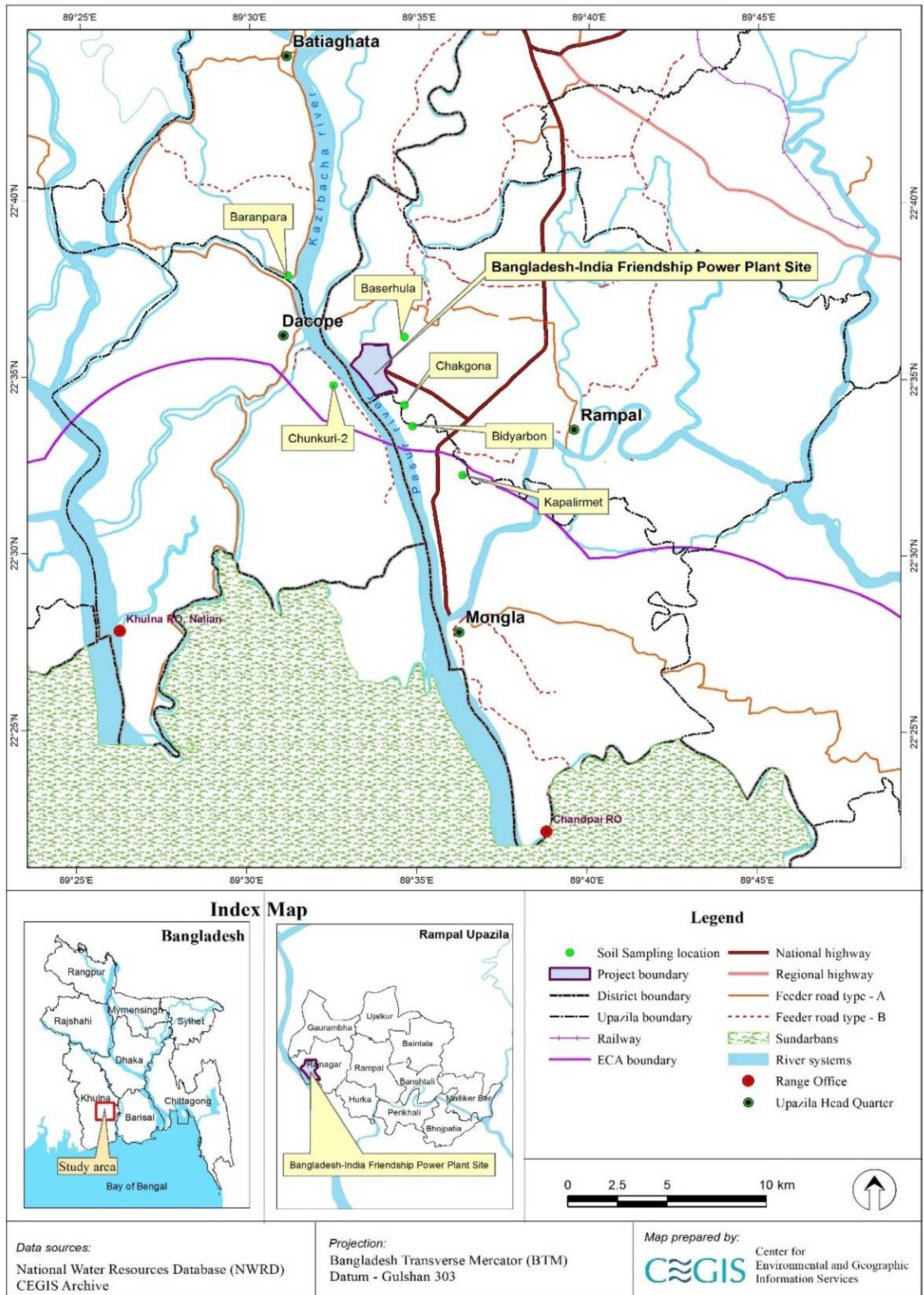


Figure 2.37: Land and Agricultural Resource Monitoring Locations





### *Monitoring Plot-2 (Chunkuri-2)*

This monitoring plot is located at Chunkuri-2 and the size of the plot is about 0.93 hectare. Local Aman (Benapole) was found to be cultivated in this plot in Kharif-II season. No chemical fertilizers were applied in this plot. The cropping practice and management practice remain same as the previous monitoring. Detailed cropping pattern has been shown in **Table E.2 of Appendix IV**.

### *Monitoring Plot-3 (Kapalirmet)*

This monitoring plot is located at Kapalirmet and the size of the plot is 0.14 hectare. During the 1<sup>st</sup> monitoring period of pre-construction phase, it was found to be cultivated, but later on, this plot remained fallow from the 2<sup>nd</sup> and 3<sup>rd</sup> monitoring program due to increase in salinity. According to the opinion of the local people, Bangladesh Water Development Board (BWDB) decided to re-excavate the Ghona River and hence they had to remove all the obstacles to facilitate the re-excavation of the Golbunia khal mouth. Then the saline water was allowed to enter into the settlement areas including their cultivated plots during the year 2014-15 and remained inundated by saline water. As a result, farmers started practicing shrimp culture instead of cultivating traditional crops in these plots. However, a number of farmers tried to cultivate crops in their plot in this adverse condition, but all crops were actually damaged due to the above-mentioned fact.

Owners of Shrimp farms of this area used the saline water in these plots for shrimp culture as there was no scope to drain out saline water from this area. The situation is still not in farmers' favour. Farmer of this land decided that they would not cultivate crops in future due to increase in salinity. Rather they would only practice the shrimp culture in future. It was observed during the recent monitoring period that the plot still remained fallow and used for shrimp cultivation. Detailed for this plot is presented in **Table E.2 of Appendix IV**.





**Figure 2.38: Contemporary view of the monitoring plots**

*Monitoring Plot-4 (Chakgona)*

This monitoring plot is located at Chakgona and the size of the plot is 0.14 hectare. Local Aman (Chapsail) was found in the field during field visit where no chemical fertilizer was used (**Table E.2 of Appendix IV**).

*Monitoring Plot-5 (Basherhula)*

This monitoring plot is located in Basherhula and the size of the plot is 0.47 hectare. Local Aman (Chapshail) was found to be cultivated in this plot in Kharif-II. The cropping practice and management practice remain same as the previous monitoring. However, detailed cropping pattern is shown in **Table E.2 of Appendix IV**.

*Monitoring Plot-6 (Bidyarbon)*

The size of the plot is 0.1 ha. This year the farmer used for cultivate BR10 instead of local Aman (Chapshail). Farmer use urea for the growth of rice but no other fertilizer or pesticides are used here. Detailed cropping pattern is shown in **Table E.2 of Appendix IV**.

#### **2.4.5 Crop Production in Monitoring Plots**

The information on crop production will be collected after harvesting in April 2022. For this reason, crop production details will be incorporated in April, 2022 report (32<sup>nd</sup> monitoring)

#### **2.4.6 Crop Damage in Monitoring Plots**

The information on crop damage will be collected after harvesting in April 2022. For this reason, crop damage details will be incorporated in April, 2022 report (32<sup>nd</sup> monitoring)

#### **2.4.7 Livestock Resources Monitoring**

*Monitoring indicators*

The frequency of monitoring for livestock resources data collection was considered twice in a year. During the 30<sup>th</sup> quarterly visit, consultations and group discussions were organized with local people to know the status of feed/fodder and diseases of livestock in the adjacent of the project area (Baranpara, Chunkuri-2) and study area (Mongla bazar, Bhaga bazar, Rampal). The data on livestock status was collected in November 2021 and described in the following sections. A glimpse of livestock resources of the monitoring area is presented in **Figure 2.39**.





**Figure 2.39: View of Livestock resources in the monitoring plots at November, 2021**

#### *Feed/Fodder condition of Livestock Resources*

Overall feed and fodder situation remain unchanged. The farmers of the sampling points still claim for fodder shortage. Due to commercial use of land, grazing land become squeezed day by day. Under this situation livestock farming become difficult in the sampling areas

#### *Diseases of Livestock Resources*

Diseases of livestock/poultry remain similar to the previous monitoring periods. According to Veterinary Surgeon (VS) of the Rampal upazila, the unhygienic condition of the courtyard is between July to November for spreading diseases to livestock and poultry populations. However, some diseases were also found in year round. The severity of the infestation was reported more or less alike in this concurrent circumstances as for the past situations. The mortality rate of the livestock/poultry becomes negligible, due to immunization and insemination program run by Department of Livestock.

## **2.5 Transportation Monitoring**

### **2.5.1 Location of Traffic Survey**

The traffic survey for this monitoring during the construction phase was conducted from November 2<sup>nd</sup> to November 4<sup>th</sup>, 2021 on three weekdays at three pre-selected locations around the project site. Weather was sunny on all the three days when the survey was conducted. The selected sites were Khudir Bottola and Gonai Bridge at Khulna Mongla Road and Gonabelai Bridge at Power Plant access road presented in the **Figure 2.40**.

### 2.5.2 Methodology

Traffic surveys were carried out at three distinct periods (morning - 7:00 AM to 10:00AM; noon-12:00 PM to 2:00PM and evening- 17:00 PM to 19:00PM) to understand the nature of traffic flow and traffic load on the preselected locations during different phase of the day. Vehicles were categorized based on the available vehicle types around the project area.

### 2.5.3 Traffic Volume Calculation

The survey results were used in computing the traffic volume of these roads in Passenger Car Unit (PCU). PCU is a matrix used in Transportation Engineering, to assess traffic-flow rate on roadways. A PCU is essentially the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single car. While calculating the traffic volume in PCU, vehicle conversion factors suggested by the Roads and Highway department of Bangladesh were used as mentioned in **Table 2.10**.

**Table 2.10: Vehicle Conversion Factors**

Vehicle type	Factor
Bus	2.5
Minibus/Truck	2
Car/Microbus/Zeep	1
CNG	0.5
Rickshaw/Auto Rickshaw	0.8
Tempo/Human hauler	0.6
Motorcycle	0.3
Bicycle	0.2
Push Chart	4

### 2.5.4 Results of Monitoring

The summary results of vehicular movements at three different locations presented in **Table 2.11** shows that, according to the Passenger Car Unit (PCU) per hour, the Khulna-Mongla Highway receives the largest number of vehicles, compared to other surveyed roads.

**Table 2.11: Calculated PCU in Three Locations at Three Different Time Period**

Location	7:00 AM to 10:00AM	12:00 PM to 2:00PM	17:00 PM to 19:00PM
Khulna Mongla Road at Khudir Bottola	693	743	535
Khulna Mongla Road at Gonai Bridge	332	432	511
Power Plant access road at Gonabelai Bridge	122	110	112

Source: Field Survey, August, 2021

Similar to the earlier months monitoring report, vehicular movements were observed during the surveys were mostly for the regular construction activities of the Power Plant as the construction activities of the Power Plant are progressing heavily. Khulna Mongla Road at Khudir Bottola received the highest traffic volume compared to the other two locations namely Khulna Mongla Road at Gonai Bridge and Power plant access road at Gonabelai Bridge. It is to be mentioned here during the morning time traffic volume at Khudir Bottola was found to be lower whereas Khulna Mongla Road at Gonai Bridge and Power Plant access road at Gonabelai Bridge received higher traffic volume compared to the previous monitoring period. The detail survey findings regarding the traffic volume surveys as well as the detail calculations are attached in **Table E1, E2 and E3 of Appendix-IV**.



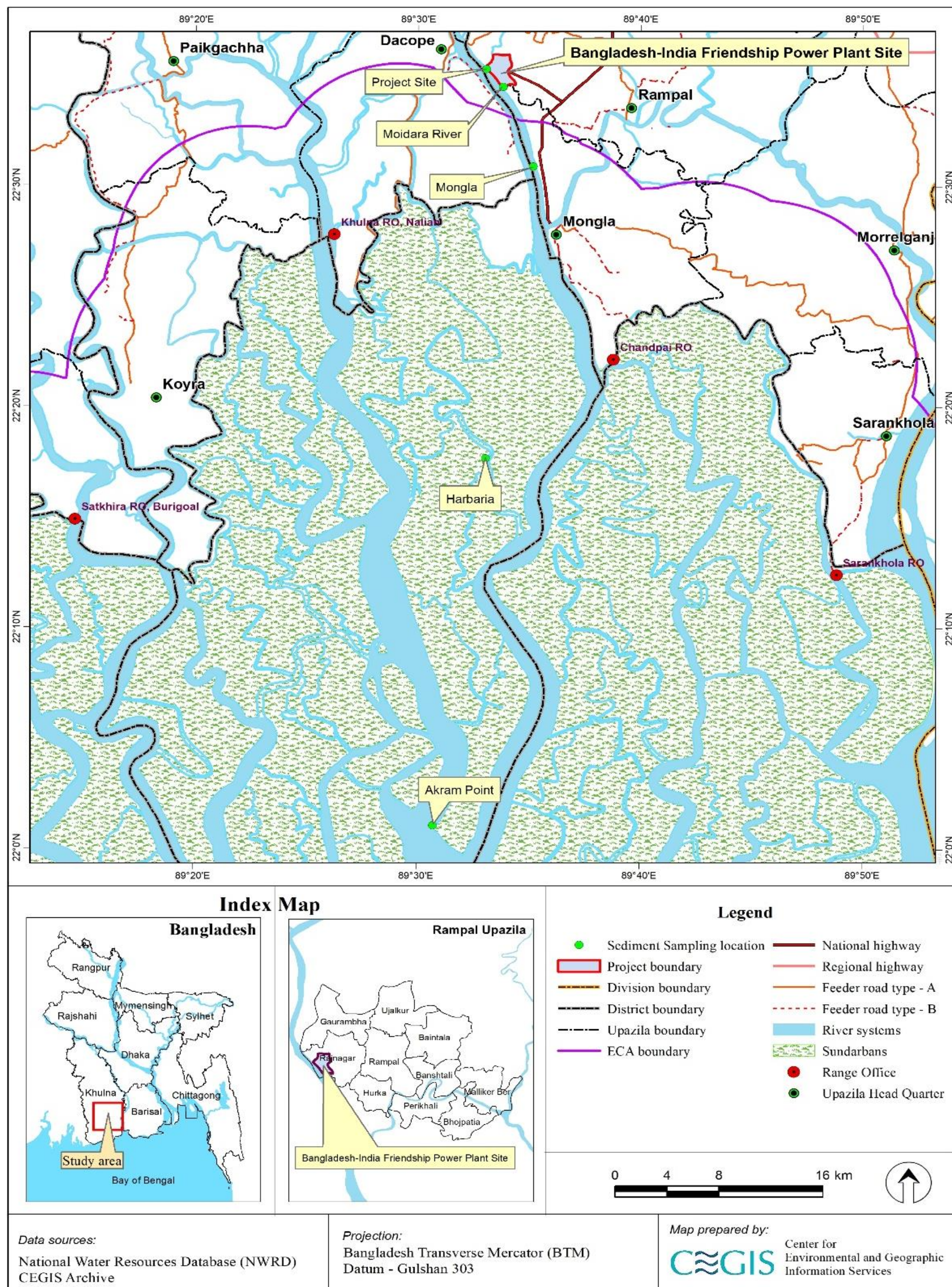


Figure 2.40: Locations of Traffic Survey







## 2.6 Water resources monitoring

### 2.6.1 Introduction

Bangladesh is a riverine country. Rivers in different hydrological regions have different characteristics. Rivers in the northern part have fluvial characteristics while it is tidal in the south. The Passur River is one of the dynamic and major rivers in the southern part of Bangladesh. Rampal power plant is being constructed along the left bank of the Passur River. It is always important to monitor the morphological characteristics of the river at regular interval to assess the dynamics of the river in case of any development works. Monitoring of river dynamics like erosion, accretion and shifting of the bankline of the Passur River with a half-yearly basis may facilitate the proper planning and management of the development work. On the other hand, it becomes very much important to understand the chemical properties of river bed sediment. In this part of the report, analysed chemical properties of river bed sediment has been incorporated in order to comply the scope of works.

### 2.6.2 Monitoring of Chemical properties of riverbed sediment

Sediment have been considered as an important environmental indicator for metal pollution in any natural ecosystem. The investigation of heavy metals in water and sediments could be used to assess the anthropogenic impacts and risks posed by waste discharges to the riverine ecosystems. Therefore, sediment quality assessment is done during environmental issues monitoring of this project.

### 2.6.3 Methodology

#### *Sampling frequency*

The frequency of monitoring for sediment quality is considered twice in a year (January and July). Accordingly, sediment sampling was done in 29th monitoring (July, 2021; considered as wet season, 2021). Data analysis of that sampling is incorporated in this report.

#### *Monitoring indicators*

The main objective of sediment quality monitoring is to find out the heavy metal accumulation in sediments due to anthropogenic activities (e.g. power plant activity and coal transportation). To find out the answers a biannual sediment monitoring is done in different sampling points. The major indicators for monitoring are heavy metals (As, Pb and Hg), pH and Sulfate. The selected heavy metals are mainly found in coal and assumed to pollute the sediment and water system during operation stage of power plant.

#### *Location*

The sampling locations are selected in both near places of project area and inside the Sundarbans. The sampling locations are stated in **Table 2.12**. Locations of collected samples are presented in **Figure 2.41**.

**Table 2.12: Location of Sediment Monitoring Plan**

Site No	Monitoring Indicators	Location	GPS(Decimal Degree)		Sampling Frequency	Methods/Tools/Techniques
			Northing	Easting		
1	Heavy metals (Arsenic-As, Mercury-Hg, Lead-Pb); pH and Sulfate (SO <sub>4</sub> )	Project Site	N-22°35'21.2"	E-89°32'53.4"	Bi-yearly (January and July)	In situ field sampling and Laboratory Testing at BCSIR
2		Moidara River	N-22°34'33.4"	E-89°33'38.8"		
3		Mongla Port	N-22°30'57.1"	E-89°35'0.3"		
4		Harbaria	N-22°17'44.2"	E-89°32'53.4"		
5		Akram Point	N-22°01'07.6"	E-89°30'34.4"		

#### 2.6.4 Process of Sediment Sample Collection

##### Plot Selection

The sampling locations were selected on the basis of potential route of coal transshipment and assumed major polluted area. Project site and Moidara River are beside the power plant, while Harbaria and Akram point are inside the Sundarbans area where the coal transportation will take place. The sampling points were selected on the basis of TOR. Expert's judgement was also taken to validate the sampling points.

##### Sediment Samples Collection

Standard procedure was maintained during the collection of sediment samples. At least three replications were taken to ensure composite samples. Sediment samples were preserved in air-tight plastic bag for laboratory analysis.

##### Laboratory Analysis

Sediment samples are taken twice a year. Dry season samples are taken in January field visit and wet season samples are taken in July monitoring field visit. Accordingly, wet season, 2021 sample was taken in July, 2021 field visit (29<sup>th</sup> monitoring field visit). Data analysis of wet season, 2021 is incorporated in this report.

#### 2.6.5 Status of sediment quality of the Passur River

The data presented in this report represents wet season, 2021 which was collected in July, 2021 (29<sup>th</sup> monitoring). According to the analyzed data, Mercury (Hg) touches average shale value (ASV) (Marowsky and Wedepohl, 1971) in two locations (Moidara river and Harbaria) while Jetty site Mercury (Hg) touches average upper crust value (AUCV) (Rudnick and Gao, 2014) but below the ASV. Both Arsenic (As) and Lead (Pb) concentration found to be lower than ASV and AUCV. As and Pb value found within the stated limits even in published reports (Ali et al., 2018). Compared to previous wet season monitoring report (January, 2020), As and Pb concentration is reduced in all sampling locations except Harbaria while Hg concentration is decreased in all locations. The maximum concentration for As, Pb and Hg is found in Jetty site (project site), Mongla and Moidara & Harbaria respectively. The average concentration for As, Pb and Hg during this monitoring is 2.86 ppm, 6.18 ppm and 0.02 ppm respectively. Only As concentration in project site (jetty point), exceeds this monitoring average. Previous monitoring data is incorporated in **Figure 2.42**.

**Table 2.13: Reference level of the Heavy metals in sediment of the Passur River**

Sl No.	Name of Heavy metal	Average upper crust concentration (ppm)	Average Shale Value (ppm)	Average heavy metal content in the Passur River in ppm (Ali et al., 2018)	
				Summer	Winter
01.	Arsenic (As)	4.8	14	8.87	12.4
02.	Lead (Pb)	17	20	21.9	33.6
03.	Mercury (Hg)	0.05	0.26	-	-



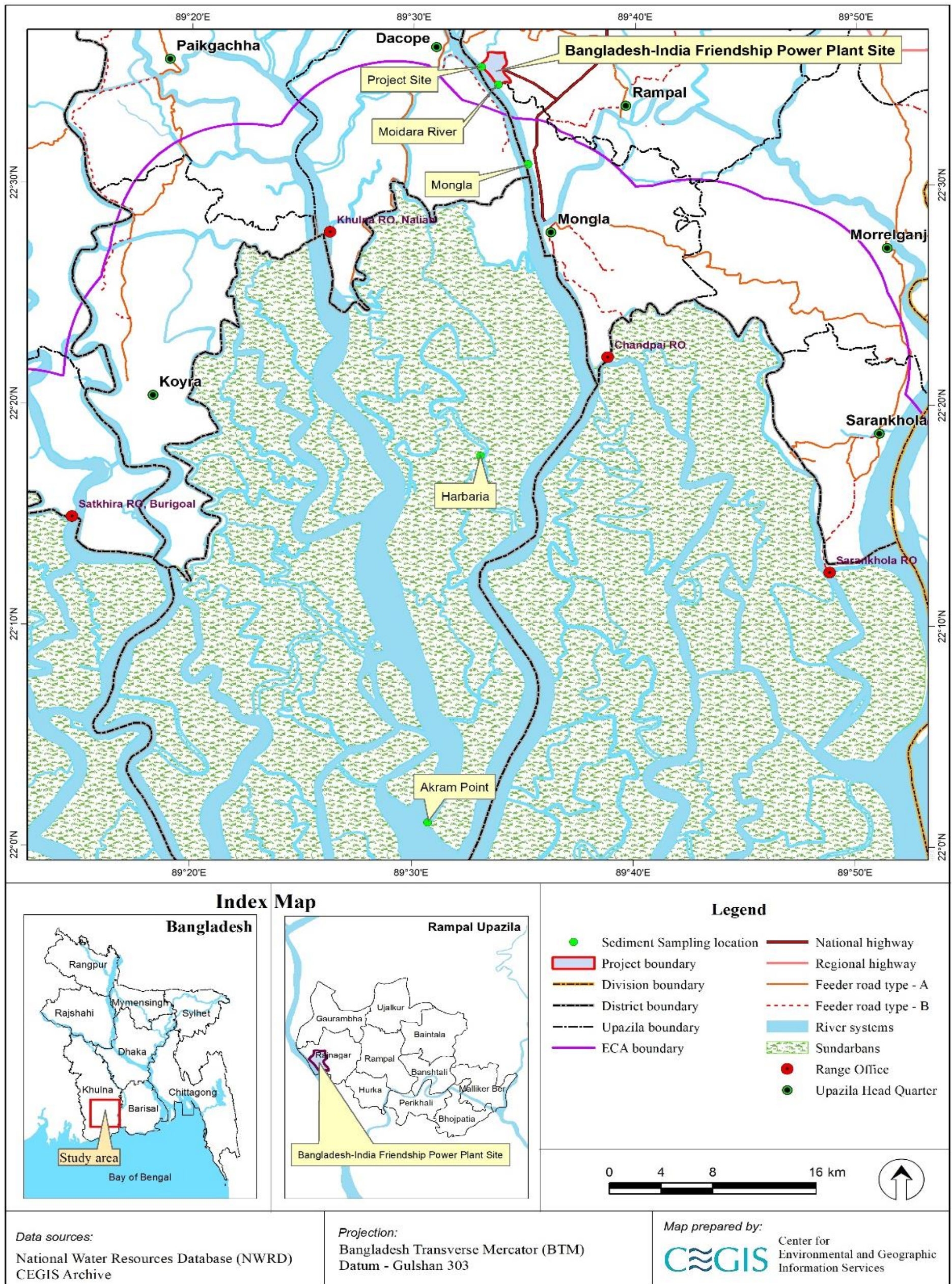


Figure 2.41: Locations of Sediment Sampling





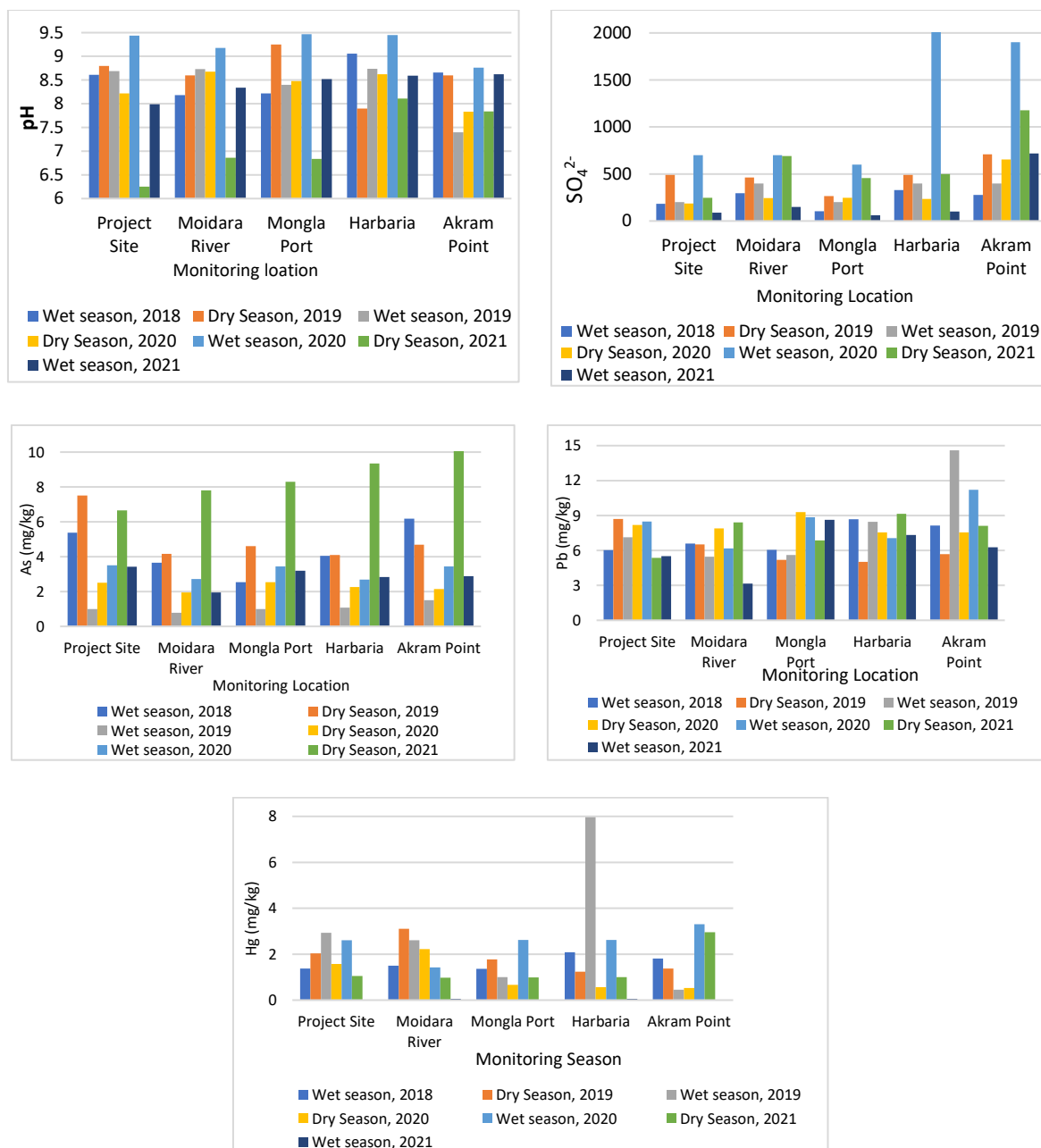


Figure 2.42: Sediment quality monitoring data at different locations of the Passur River





### 3. Biological Environment

Biological resources include all living organisms within an ecosystem which interact with one another as well as with the concerned physical environment. The biological resources around the project site were categorized into three major groups and monitored quarterly with the aim to establish baseline conditions to compare with the probable impact of proposed project in place. These groups include fisheries resources, ecological resources and Sundarbans Reserve Forest (SRF).

#### 3.1 Fisheries Resources

The monitoring of twenty-nine quarters for the session of 2014-15, 2015-16, 2016-17, 2017-18, 2018-2019, 2019-20 as well as of 2020-21 was completed and reported earlier. This chapter contains the findings of 30<sup>th</sup> quarter and comparison with the earlier 29 quarters.

##### 3.1.1 Methodology

###### *Location of Monitoring Sites*

In this phase, the monitoring activities were carried out in 13 pre-selected locations of which 10 locations were for capture fish habitat and three (03) were for shrimp/fish farms (culture fish habitat). Sampling sites for capture fishery were selected based on the available fishing grounds at upstream, midstream and downstream of the Passur River system. Sampling sites for culture fishery (shrimp/fish farms) were selected considering the project influence area. The fisheries resources monitoring locations are provided in **Table 3.1** and also shown in **Figure 3.1**.

**Table 3.1: The Sampling Locations for Monitoring of Fisheries Resources**

Site	Capture Habitat Location	Site	Capture Habitat Location
A	Akram Point	F	Chandpai
B	Haldikhali	G	Jongra
C	Charaputia	H	Mongla Port
D	Bhodra	I	Maidara
E	Harbaria	J	Chalna Point, Batiaghata
Site	Culture Habitat Location	Site	Culture Habitat Location
1	Bhekatkhali Khal, Rajnagar	3	Chunkuri-2
2	Kapasdanga-Muralia		

###### *Selection of Parameters*

According to ToR, five major components were selected for fisheries monitoring, such as fish habitat status, fish migration, fish diversity, shrimp/fish farm practices and fish production. Fish habitat status was monitored through investigating habitat suitability index in view of habitat classification based on length frequencies of different fish species, sensitivity of fish diversity and survival success of different life stages of fish to abiotic factors (water quality, bed material, morphological aspects and biotic factors (food cover). Fish migration status was monitored through assessing migratory fish species diversity, migration pattern, migration purpose, period and extent of migration etc. Species evenness, species richness and community structure were investigated for monitoring fish diversity. Shrimp/fish farm practice was monitored by viewing stocking pattern, growth rate and mortality rate. Fish production monitoring was divided into capture and shrimp/fish farm production.

#### *Fish Habitat Status*

Fish habitat status was monitored through determination of Habitat Suitability Index (HSI) by applying numerical habitat model based on the habitat classification and sensitivity of fish diversity and survival success of different life stages of fish to abiotic and biotic factors. Fish habitat classification was analyzed by calculating Euclidean Distance among sampling sties. Moreover, the similarities in species composition among the sites were analyzed using the Jaccard Index (JI) for estimating the extent of similarity between pairs of data sets.

#### *Fish Migration*

Migratory species were identified from the sampling sites by analyzing the common species found in the catch assessment survey and based on IUCN list.

#### *Fish Diversity*

Fish diversity was surveyed by Catch Per Unit Effort (CPUE) method. The fish individuals were counted according to the length of each species from the samples. Diversity was estimated by analyzing Shannon-Weiner Index ranges from 0 to 1. Fish species richness (FSR) was analyzed using the Simpson's Index that generates two types of values. The first one includes values from 0 to 1 expressing normalization scores for species richness status and the second one includes values from one (01) to values equal to the total number of species found in the sample which suggests that how many species are dominant in this fish community. Fish community structure has also been analyzed through counting the length-wise fish individuals.

#### *Fish-Shrimp Culture Practice*

For monitoring shrimp/fish farm, three farms within the direct impact zone of the proposed Power Plant were surveyed. Stocking pattern of the shrimp/fish farm is the major issue for successful production, because of having natural genetic resources from the wild source of the Passur River System. Moreover, mortality rate should be minimized for getting more economical output from the farms. So, stocking pattern and mortality rate and its causes were surveyed intensively.

#### *Fish Production*

Fish production for riverine fish was surveyed through CPUE. The information on the species-wise production of shrimp/fish farm was collected from the selected farms for the last catch.

### **3.1.2 Status of Monitoring**

Followed by the quarter monitoring of the 2014-15, 2015-16, 2016-17, 2017-18, 2018-19, 2019-20 and 2020-21 (up to 29<sup>th</sup> quarter monitoring), 30<sup>th</sup> quarter monitoring of session 2021-22 was conducted during the period from 31 October-12 November, 2021. No fishing activities were observed at Bhodra Khal (D) and Jongra (G) during field visit in this quarter monitoring.

#### *Fish Habitat Status*

Fish habitat status has also varied in the view of habitat classification and habitat use pattern of different life stages of different fish species.





Figure 3.1: Fisheries Resources Monitoring Locations





Habitat Classification

Habitat classification was analyzed by using the length-wise distribution of different fish species in the sampling sites. The length of different life stages of fish species was identified and evaluated from literature review. Linkage distance was calculated with the similarity in distribution. The entire stretch of the Passur River System consists of three major behavioral habitats. The sampling sites were classified on the basis of abundance of different life stages of fish species in those habitats. The following tables show the classification of seven (07) sampling site for 1 to 15<sup>th</sup> quarter monitoring and ten (10) sampling sites from 16<sup>th</sup> to 30<sup>th</sup> quarter monitoring according to the ToR in respect of habitat uses for previous quarters of fisheries monitoring (**Table 3.2**).

**Table 3.2: Classification of habitat use of 10 sampling sites**

Monitoring Quarter	Type of Habitat Use
1 <sup>st</sup> (April, 2014)	<ul style="list-style-type: none"> <li>Grazing Ground</li> <li>Grazing and Breeding Ground</li> </ul>
2 <sup>nd</sup> (July, 2014)	<ul style="list-style-type: none"> <li>Grazing Ground</li> <li>Spawning and Nursery Ground</li> </ul>
3 <sup>rd</sup> (October, 2014)	<ul style="list-style-type: none"> <li>Grazing Ground</li> <li>Grazing and Breeding Ground</li> <li>Spawning, Nursery and Grazing Ground</li> </ul>
4 <sup>th</sup> (January, 2015)	<ul style="list-style-type: none"> <li>Grazing Ground</li> <li>Grazing and Breeding Ground</li> <li>Spawning, Nursery and Grazing Ground</li> </ul>
5 <sup>th</sup> (April, 2015)	<ul style="list-style-type: none"> <li>Grazing Ground</li> <li>Nursery Ground</li> <li>Spawning and Nursery</li> </ul>
6 <sup>th</sup> (August, 2015)	<ul style="list-style-type: none"> <li>Grazing, Breeding Ground</li> <li>Spawning, and Nursery Ground</li> </ul>
7 <sup>th</sup> (October, 2015)	<ul style="list-style-type: none"> <li>Grazing Ground,</li> <li>Nursery Ground and</li> <li>Growing and Feeding</li> </ul>
8 <sup>th</sup> (January, 2016)	<ul style="list-style-type: none"> <li>Nursery and Feeding Ground</li> <li>Growing and Feeding</li> </ul>
9 <sup>th</sup> (April, 2016)	<ul style="list-style-type: none"> <li>Spawning and Nursery Ground</li> <li>Feeding and Growing Ground</li> </ul>
10 <sup>th</sup> (July, 2016)	<ul style="list-style-type: none"> <li>Nursery Ground</li> <li>Feeding and Breeding Ground</li> </ul>
11 <sup>th</sup> (October, 2016)	<ul style="list-style-type: none"> <li>Breeding and Spawning Ground</li> <li>Feeding and Grazing Ground</li> </ul>
12 <sup>th</sup> (January, 2017)	<ul style="list-style-type: none"> <li>Grazing and Spawning Ground</li> <li>Nursing Ground</li> </ul>
13 <sup>th</sup> (April, 2017)	<ul style="list-style-type: none"> <li>Grazing and Feeding Ground</li> <li>Nursing Ground</li> </ul>
14 <sup>th</sup> (October, 2017)	<ul style="list-style-type: none"> <li>Grazing and Feeding Ground</li> <li>Nursing Ground</li> </ul>
15 <sup>th</sup> (January, 2018)	<ul style="list-style-type: none"> <li>Grazing and Feeding Ground</li> </ul>

Monitoring Quarter	Type of Habitat Use
	<ul style="list-style-type: none"> <li>Nursing Ground</li> </ul>
16 <sup>th</sup> (April, 2018)	<ul style="list-style-type: none"> <li>Feeding ground</li> <li>Growing ground</li> <li>Nursing ground</li> </ul>
17 <sup>th</sup> (July, 2018)	<ul style="list-style-type: none"> <li>Spawning and Nursery Ground</li> <li>Nursery Ground with Feeding and Growing Capacity</li> <li>Growing and Feeding Ground</li> <li>Omni-ground</li> </ul>
18 <sup>th</sup> (November, 2018)	<ul style="list-style-type: none"> <li>Ground for Maturation</li> <li>Omni-Ground: Nursery and Feeding Ground/Migratory Route; Ground for Maturation; Growing and Maturation Ground; Maturation Ground for Juveniles</li> </ul>
19 <sup>th</sup> (February, 2019)	<ul style="list-style-type: none"> <li>Ground for Feeding</li> <li>Omni-Ground including Nursery Ground and Ground for Maturation</li> </ul>
20 <sup>th</sup> (April, 2019)	<ul style="list-style-type: none"> <li>Ground for Feeding and Maturation</li> <li>Omni-Ground including Nursery Ground and Ground for Maturation</li> </ul>
21 <sup>st</sup> (July, 2019)	<ul style="list-style-type: none"> <li>Ground for Feeding and Maturation</li> <li>Omni-Ground including Nursery Ground and Ground for Maturation</li> </ul>
22 <sup>nd</sup> (November, 2019)	<ul style="list-style-type: none"> <li>Spawning and Nursery Ground</li> <li>Omni-Ground including Feeding and Maturation Ground</li> </ul>
23 <sup>rd</sup> (February, 2020)	<ul style="list-style-type: none"> <li>Nursery Ground</li> <li>Spawning ground</li> <li>Ground for maturation and feeding</li> </ul>
25 <sup>th</sup> (July, 2020)	<ul style="list-style-type: none"> <li>Nursery Ground</li> <li>Ground for maturation and feeding</li> </ul>
26 <sup>th</sup> (November, 2020)	<ul style="list-style-type: none"> <li>Nursery Ground</li> <li>Omni-Ground including Spawning and Nursery Ground, and Maturation Ground</li> </ul>
27 <sup>th</sup> (January, 2021)	<ul style="list-style-type: none"> <li>Nursery Ground</li> <li>Omni-Ground including Spawning and Nursery Ground, and Maturation Ground</li> </ul>
28 <sup>th</sup> (April, 2021)	<ul style="list-style-type: none"> <li>Spawning and Nursery Ground</li> <li>Ground for Maturation and Feeding</li> </ul>
29 <sup>th</sup> (September, 2021)	<ul style="list-style-type: none"> <li>Nursery Ground</li> <li>Ground for Maturation and feeding</li> </ul>

During the 30<sup>th</sup> quarterly monitoring conducted in November of 2021-22 Session, the sampling sites were divided into two major classes and shown in the **Figure-3.2 (Figure D.1 of Appendix IV)**.

**1. Feeding Ground:** The Mongla (H) and Maidara Point (I) were found to support mostly length groups of >25cm of available fish species. Field findings revealed that the mentioned sampling sites were found to be used as feeding ground of observed fish species

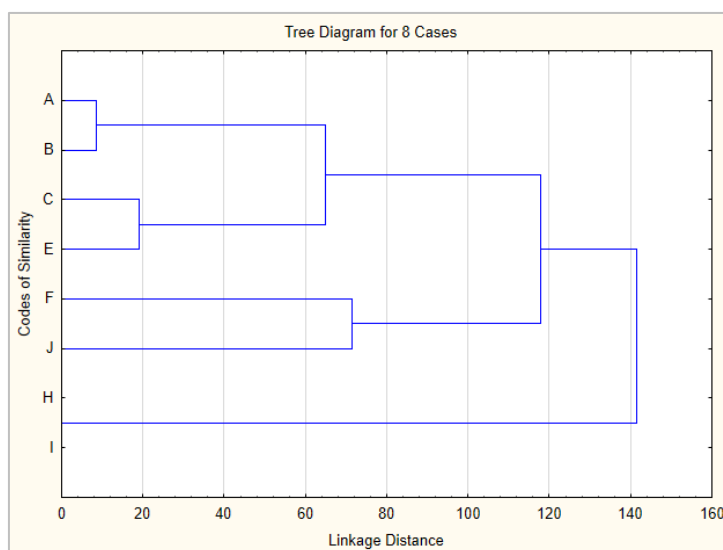
**2. Omni-Ground:** Another class, which is found to support multi-length groups (<2cm, 2-3cm, 5-10cm, 10-20cm and >25cm) of observed fish species, was considered as omni-ground for fishes. Fishes of this class mainly belong to two major habitats- i) Nursery Ground and ii) Maturation Ground

**Nursery Ground:** Among the sampling sites, the Chandpai (F) and Chalna Point (J) of the Passur River system was identified as the nursery ground for very high abundance of fry fishes.

**Ground for Maturation and feeding:** The sampling site, Akram Point (A) and Haldikhali (B) observed of dominant length group of 5-10cm indicates that the sites function as the maturation of different fish



species. The sampling sites, Charaputia (C) and Harbaria Point (E) were found to be rich in all length-groups except brood fish. Presence of dominant length groups of 5-10cm and 10-20cm indicate that the sites function as the maturation and feeding ground of different fish species (following the considerations of Rahman, 1989 and 2005; Huda et al., 2003).

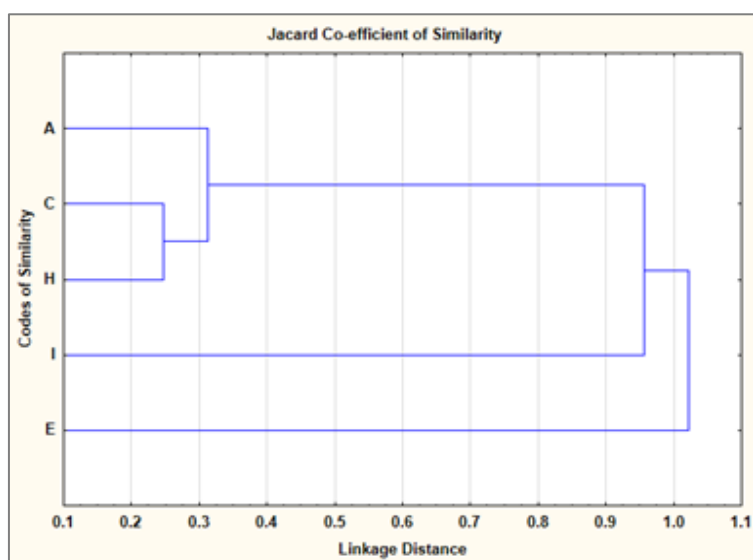


### 30<sup>th</sup> Monitoring (November, 2021)

(Note: Life stages are identified through length measurement of the fish individuals)

**Figure 3.2: Habitat classification on the basis of different life stages of fish species**

The dendrogram indicated the distances among the JI (Jaccard Coefficient Index) indices which are opposite to the JI values. It was found that the length-wise distribution relationship varied not only with the seasons but also with the year to year. In this quarterly monitoring in 2021-22 (30<sup>th</sup>), the JI value between the Mongla Point (H) and Maidara (I) sampling sites were the highest (**Figure 3.3**) which indicates the maximum similarity in species occurrence between the two sites out of 8 sampling sites of available fishing.



### 30<sup>th</sup> Monitoring (November, 2021)

**Figure 3.3: Dendrogram showing similarity in binary species composition in three sampling sites**

## Fish Diversity

Fish Species Richness (FSR)

Fish species richness was identified through Simpson's Index<sup>3</sup>. Considerable difference is noticed in the fish species richness (FSR) in different habitat classes (**Table 3.3** and **-3.4** and **Figure-3.5**).

In this monitoring phase, species richness varies with the sampling sites. Maximum FSR was obtained at Charaputia (n=34), while very low FSR was recorded at Maidara and Mongla Point (n=1). Different scenarios of richness were found in this quarter in comparison to the previous monitoring years. Among habitats in the downstream of the Passur River system, Akram Poin was home to rich assemblage of *Motka*, *Chaka* and *Goda Chingri*, Haldakhali was of *Gulsha*, *Goda* and *Mokta Chingri*, Charaputia was of *Goda Chingri*, *Motka Chingri*, *Gangania*, *Golda*, *Paissa* and *Harina Chingri* and Harbaria Point was of *Goda*, *Motka*, *Paissa* and *Golda*. In the midstream portion, Chandpai was rich of *Chewa*, *Motka* and *Harina Chingri*, and Mongla was rich in *Ilish*.

**Table 3.3: Site wise Rich Species Number (1<sup>st</sup> to 12<sup>th</sup> QM)**

Site	Location	No. of Rich Species											
		2014-2015				2015-2016				2016-2017			
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>	9 <sup>th</sup>	10 <sup>th</sup>	11 <sup>th</sup>	12 <sup>th</sup>
A	Akram Point	4	0	4	3	3	-	3	2	0	0	1	2
B	Haldikhali	7	0	4	2	0	-	3	2	0	0	1	0
C	Harbaria	1	5	2	0	4	4	3	6	4	0	4	2
D	Chandpai	2	2	5	4	5	8	3	7	4	6	3	7
E	Mongla Point	1	10	4	5	3	6	4	2	4	7	3	2
F	Maidara	3	6	2	2	4	2	4	2	3	2	3	3
G	Chalna Point	3	3	2	3	1	3	3	4	2	4	1	2

**Table 3.4: Site wise Rich Species Number (13<sup>th</sup> to 30<sup>th</sup> QM)**

Site	Location	No. of Rich Species																
		2017-18			2018-19				2019-20				2020-21				2021-2022	
		13 <sup>th</sup>	14 <sup>th</sup>	15 <sup>th</sup>	16 <sup>th</sup>	17 <sup>th</sup>	18 <sup>th</sup>	19 <sup>th</sup>	20 <sup>th</sup>	21 <sup>st</sup>	22 <sup>nd</sup>	23 <sup>rd</sup>	25 <sup>th</sup>	26 <sup>th</sup>	27 <sup>th</sup>	28 <sup>th</sup>	29 <sup>th</sup>	30 <sup>th</sup>
A	Akram Point	2	0	0	4	0	1	0	2	0	0	0	0	2	4	0	1	3
B	Haldikhali	1	0	0	0	0	3	0	-	0	0	0	0	0	0	0	0	4
C	Charaputia	0	0	0	4	0	0	4	7	0	0	5	0	3	3	2	2	6
D	Bhodra	0	0	0	0	0	0	0	-	0	0	1	0	0	0	0	0	-
E	Harbaria	7	6	6	0	2	4	0	2	0	0	2	0	1	0	2	4	4
F	Chandpai	6	5	7	11	9	2	3	7	4	6	2	0	4	1	2	0	3
G	Jongra	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	-
H	Mongla Point	2	2	1	2	3	0	3	-	1	5	2	3	0	1	0	3	-
I	Maidara	1	3	2	1	3	9	3	1	1	6	3	2	3	0	3	1	1
J	Chalna Point	4	2	1	2	3	2	2	2	3	2	3	2	3	1	2	0	2

Source: CEGIS Field Survey, April 2014-January 2021

<sup>3</sup>Simpson's index is a method to calculate the community characteristics of fish in a particular habitat. It is mainly used to know about the species richness of a particular habitat to tell how many species are rich in their abundance. The value of this index ranges from 0 to 1. There is other kind of value which is described in the methodology section. The second value is mainly used to measure the species richness in the sampling sites.

### Shannon-Weiner Index

In this monitoring year of 2021-22, species evenness also varies among the sampling sites. Highest Shannon-Weiner index was found at Chandpai Point (0.64) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at Akram point (0.26) (shown in **Table 3.5**). It has also been found that both the number of fish species found in in-situ catch and the evenness of their distribution within the sampling sites show high variation with the changing seasonal and yearly bio-physical conditions.

Table 3.5: Site Wise Species Diversity using Shannon-Weiner Index (1<sup>st</sup> to 13<sup>th</sup> QM)

Site	Species No													Shannon-Weiner Index*												
	1 <sup>st</sup> QM	2 <sup>nd</sup> QM	3 <sup>rd</sup> QM	4 <sup>th</sup> QM	5 <sup>th</sup> QM	6 <sup>th</sup> QM	7 <sup>th</sup> QM	8 <sup>th</sup> QM	9 <sup>th</sup> QM	10 <sup>th</sup> QM	11 <sup>th</sup> QM	12 <sup>th</sup> QM	13 <sup>th</sup> QM	1 <sup>st</sup> QM	2 <sup>nd</sup> QM	3 <sup>rd</sup> QM	4 <sup>th</sup> QM	5 <sup>th</sup> QM	6 <sup>th</sup> QM	7 <sup>th</sup> QM	8 <sup>th</sup> QM	9 <sup>th</sup> QM	10 <sup>th</sup> QM	11 <sup>th</sup> QM	12 <sup>th</sup> QM	13 <sup>th</sup> QM
A	33	0	13	7	3	0	10	15	0	0	1	2	2	0.5	0	0.7	0.6	1	-	0.6	0.4	0	0	0	0.9	0.74
B	12	0	24	14	0	0	11	3	0	0	1	0	5	0.9	0	0.6	0.4	0	-	0.6	0.6	0	0	0	0	0.37
C	2	12	9	0	11	26	18	24	17	0	23	10	18	0.3	0.77	0.4	0	0.8	0.6	0.5	0.7	0.6	0	0.6	0.6	0.79
D	12	22	15	26	27	24	20	25	8	19	32	27	15	0.3	0.78	0.7	0.5	0.7	0.7	0.5	0.7	0.6	0.6	0.6	0.8	0.76
E	7	13	10	11	6	16	9	9	15	12	5	4	4	0.4	0.6	0.8	0.8	0.2	0.7	0.9	0.4	0.7	0.5	0.7	0.7	0.51
F	3	13	6	4	10	8	14	6	7	5	7	12	9	0.8	0.77	0.5	0.6	0.7	0.4	0.8	0.7	0.8	0.7	0.9	0.9	0.53
G	6	3	5	7	18	3	8	6	6	4	12	3	15	0.7	0.82	0.7	0.7	0.2	1	0.7	0.8	0.6	0.9	0.2	0.7	0.67

Site Wise Species Diversity using Shannon-Weiner Index (14<sup>th</sup> to 30<sup>th</sup> QM)

Site	Species Number														Shannon-Weiner Index															
	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
A	0	0	3	0	8	0	2	0	0	0	0	7	18	0	0	0	0.92	0	0.16	0	0.65	0	0	0	0	0.64	0.59	0	0.49	0.61
B	0	0	0	0	2	0	-	0	0	0	0	0	0	0	0	0	0	0	0.92	0	-	0	0	0	0	0	0	0	0	0.73
C	0	0	12	0	0	24	11	0	0	10	0	4	28	4	0	0	0.69	0	0	1.69	0.86	0	0	0.78	0	0.82	0.53	0.88	0.82	0.83
D	0	0	0	0	0	0	-	0	0	1	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
E	0	0	0	17	12	0	2	0	0	2	0	9	0	3	0	0	0	0.31	0.73	0	0.99	0	0	0.72	0	0.29	0	0.74	0.79	0.73
F	6	17	0	0	0	13	22	19	11	11	0	12	7	20	0.85	0.81	0	0	0	1.44	0.74	0.5	0.81	0.56	0	0.70	0.18	0.37	0	0.68
G	81	29	21	16	19	0	26	0	0	0	0	0	0	0	0.62	0.74	0.78	0.85	0.34	0	0.58	0	0	0	0	0	0	0	0	0
H	112	13	3	18	2	13	-	5	11	10	11	0	3	0	0.54	0.21	0.55	0.49	0	1.44	-	0.14	0.76	0.40	0.55	0	0.12	0	0.85	0
I	3	13	12	10	17	11	8	9	11	12	6	16	0	18	0.88	0.33	0.21	0.65	0.85	1.46	0.14	0.52	0.80	0.54	0.45	0.41	0	0.52	0	0
J	4	5	10	14	11	21	12	14	9	8	15	11	12	4	0.78	0.32	0.54	0.52	0.52	0.98	0.50	0.71	0.50	0.64	0.46	0.53	0.19	0.96	0	0.58

\*According to Shannon-Weiner Index, 0-0.30: Low diversity/equally distribution (VH); 0.31-0.50: Moderate Diversity (M); 0.51-0.80: High Diversity (HD) and 0.80-1.0: Very High Diversity (VHD)



Datina (*Acanthopagrus latus*)



Kain Magur (*Plotosus canius*)



Poikka (*Datnioides quadrifasciatus*)



Tirel (*Eleutheronema tetradactylum*)



Bala (*Butis butis*)



Gangania (*Chaka chaka*)



Poma (*Otolithoides pama*)



Paissa (*Liza Persia*)





Golda (*Macrobrachium rosenbergii*)



Chitra (*Scatophagus argus*)

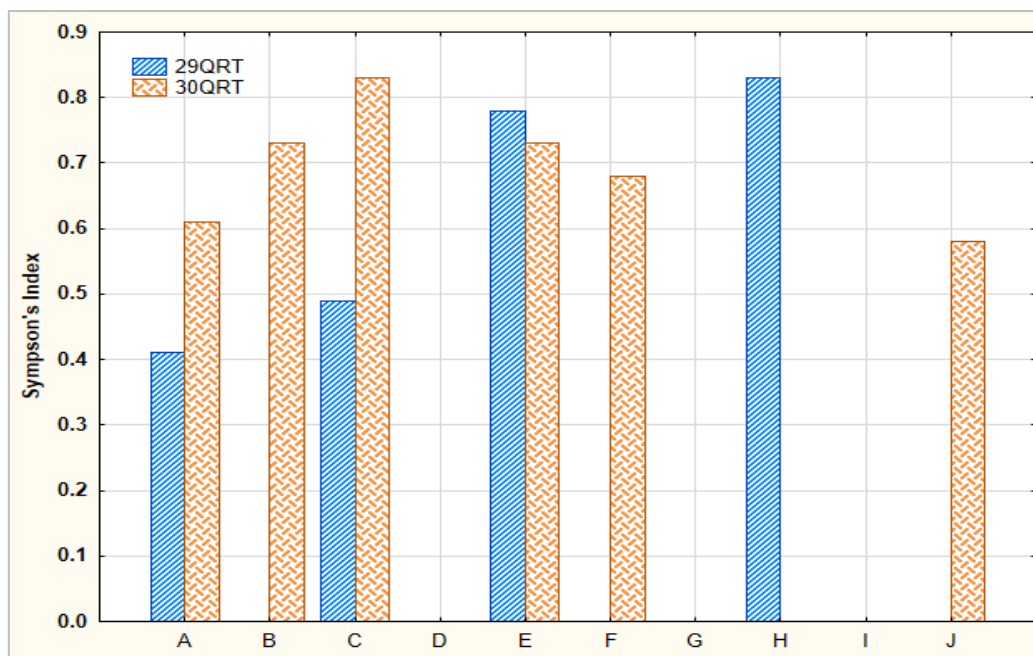


Ramchos (*Polynemus paradiseus*)



Potka (*Teradon cutcutia*)

**Figure 3.4: Different available observed fish species in 30<sup>th</sup> quarter monitoring**



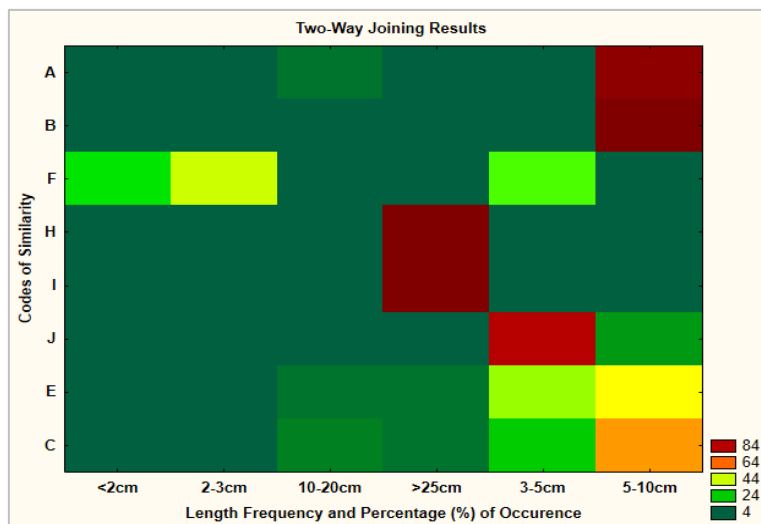
(FSR is identified through Simpson's Index)

**Figure 3.5: Site-wise fish species richness (FSR) in the Passur River System**



### Fish Community Structure

Fish community structure was analyzed through counting the length-wise fish individuals (**Figure 3.6**). The following Table D.3 of **Appendix IV** and **Figure 3.6** for 30<sup>th</sup> quarter of monitoring shows that Fry were dominant at Chandpai, Harbaria and Charaputia, Juvenile were dominant at Charaputia and Harbaria Point but adult age group were dominant at Akram point, Harbaria, Charaputia and Maidara Point.



30<sup>th</sup> Monitoring, November, 2021

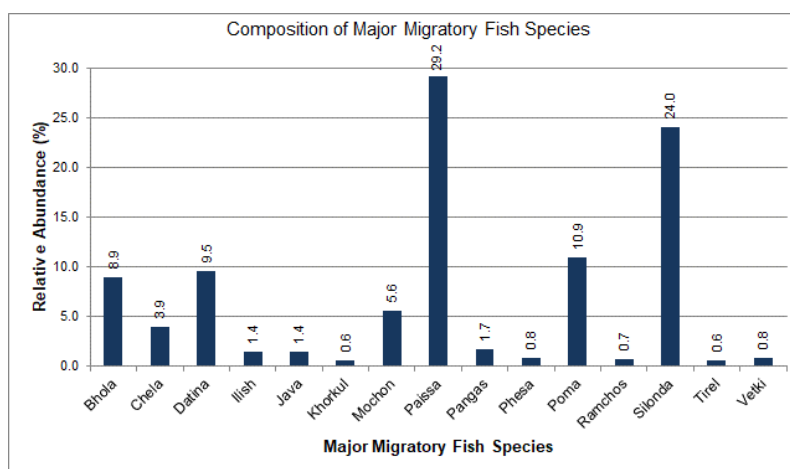
**Figure 3.6: Habitat Distribution of Different Life Stages of Fish Species**

Note: N.B.: Colour ranges from deepest green to deepest red. 0-4.99% Occurrence signifies Deepest Green; 5-9.99%-Shaded Green; 11-14.99%-Normal Green; 15-19.99%-Light Green; 20-24.99%; 25-29.99%-Lightest Green; 30-34.99%; 35-39.99%; 40-44.99; 45-49.99; 50-54.99-Light Magenta; 55-59.99-Deep Magenta; 60-64.99%; 65-69.99%; 70-74.99%; 75-79.99%-Light Red; 80-84.99%-Deep Red; 85-89.99%; 90-94.99%; 95-100%-Deepest Red

### *Fish Migration*

#### Migratory Species Diversity

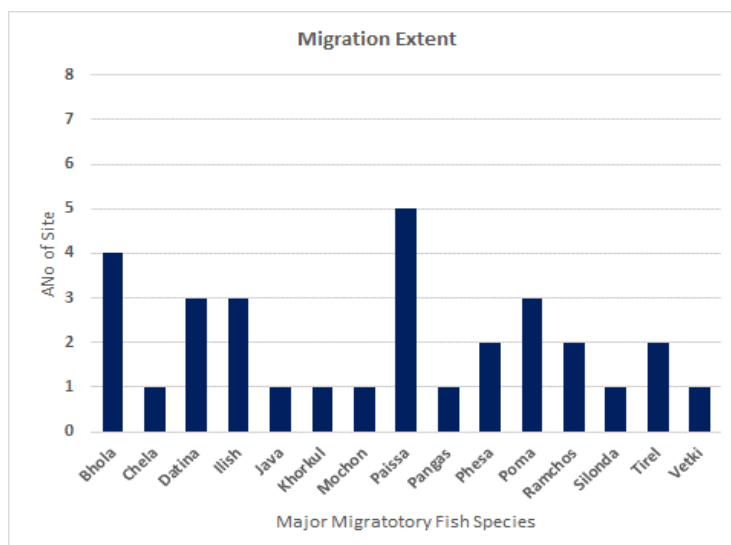
Migratory species were identified by analyzing the common species available in the regular catch from the sampling sites. Fish species like Paissa, Silonda and Poma attain the maximum abundance among the migratory fish species observed in the 30<sup>th</sup> quarter of monitoring. The relative abundance of the migratory species is given below in the **Figure 3.7**.



**Figure 3.7: Relative abundance of major migratory fish species in sampling sites**

### Migration Extent, Time and Purpose

Major fish species showed interesting pattern in distribution for exploiting different purposes mentioned in the following table all along the sampling sites. Among migratory species, Paissa and Bhola were observed to migrate long distance (**Figure 3.8 and Table D.4 of Appendix-1**).



**Figure 3.8: Migration extent of major migratory fish species in sampling sites**

### *Shrimp/Fish Farm*

Three farms situated in the direct impact zone of Power Plant were surveyed for monitoring shrimp/fish. Stocking pattern of the shrimp/fish farm is one of the major issues for successful production because of having natural genetic resources from the wild source of the Passur River System. Moreover, maximization of growth rate and minimization of mortality rate should be ensured for getting more economical output from the farms. So, stocking pattern, growth rate and mortality rate and its causes were surveyed intensively.

### *Stocking Pattern*

It is reported by the farmers of the shrimp farms that no fish stock was done in the shrimp farm during this monitoring phase.

### *Shrimp/Fish Growth Rate and Mortality*

During the 30<sup>th</sup> quarter of monitoring, the highest growth rate was observed in the Kapashdanga Gher followed by Rajnagar and Chunkuri (**Table 3.6 and Table 3.7**).

Table 3.6: Growth Rate and Mortality of Fish/Shrimp (1<sup>st</sup> to 13<sup>th</sup> QM)

Gher No.	1 <sup>st</sup> QM		2 <sup>nd</sup> QM		3 <sup>rd</sup> QM		4 <sup>th</sup> QM		5 <sup>th</sup> QM		6 <sup>th</sup> QM		7 <sup>th</sup> QM		8 <sup>th</sup> QM		9 <sup>th</sup> QM		10 <sup>th</sup> QM		11 <sup>th</sup> QM		12 <sup>th</sup> QM		13 <sup>th</sup> QM	
	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)
1	0.3	15-20	0.2	40	0.25	50	-	-	-	30	0.18	25	0.20	60	-	-	-	-	0.2	20	0.20	60	-	-	-	30
2	0.3	30-35	0.3	94	0.25	10	-	-	-	-	0.14	20	0.15	100	-	-	0.21	15	0.3	40	0.25	50	-	-	-	10
3	0.2	25-30	0.2	25	0.20	65	-	-	-	10	0.15	50	0.25	20	-	-	0.17	30	0.15	30	0.20	30	-	-	-	25

Table 3.7: Growth Rate and Mortality of Fish/Shrimp (14<sup>th</sup> to 30<sup>th</sup> QM)

Gher No.	14 <sup>th</sup> QM		15 <sup>th</sup> QM		16 <sup>th</sup> QM		17 <sup>th</sup> QM		18 <sup>th</sup> QM		19 <sup>th</sup> QM		20 <sup>th</sup> QM		21 <sup>st</sup> QM		22 <sup>nd</sup> QM		23 <sup>rd</sup> QM		25 <sup>th</sup> QM		26 <sup>th</sup> QM		27 <sup>th</sup> QM		28 <sup>th</sup> QM		29 <sup>th</sup> QM		30 <sup>th</sup> QM	
	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)
1	0.03	50	-	-	0.28	0.28	0.38	80	-	-	-	-	0.35	50	0.38	-	0.35	-	-	-	0.38	-	0.42	35	-	-	0.41	20	0.38	-	0.36	-
2	0.38	35	-	-	0.42	0.42	0.30	70	0.30	80	-	-	0.45	80	0.44	-	0.45	-	-	-	0.48	-	0.45	30	-	-	0.35	90	0.42	-	0.44	-
3	0.02	25	-	-	0.4	0.4	0.20	50	-	-	-	-	0.34	40	0.36	-	0.37	-	-	-	0.32	-	0.38	90	-	-	0.39	30	0.4	-	0.37	-

Source: CEGIS Field Survey, 2014, 2015, 2016, 2017, 2018, 2019, 2020 &amp; 2021

## Fish Production

Capture Fish Production

The present study revealed that the highest catch susceptibility was also found in case of Charpata Jal (20.6 kg/haul) shown in **Table 3.8**. In 30<sup>th</sup> quarter monitoring, the highest productivity was found at Harbaria followed by Akram Point and Charaputia (**Table 3.9**). It is to be noted that fries found in catch were not considered in the productivity assessment (**Figure 3.9**).

**Table 3.8: Total Catch in Different Gears in the Sampling Sites**

Site	Habitat	Gear Name/Type	Haul Duration (hr)	No of Haul	kg/haul
A	Passur River	Charpata Jal	12.0	1	20.0
		Khepla Jal	0.1	250	0.04
B	Haldikhali Khal	Khepla Jal	0.1	150	0.05
C	Passur River	Charpata Jal	12	4	7.50
E	Passur River	Charpata Jal	12	4	20.5
F	Passur River	Net Jal	0.5	1	-
H	Passur River	Chandi Jal	0.75	3	0.08
I	Passur River	Chandi Jal	0.75	3	1.20
J	Maidara-Passur Confluence	Chandi Jal	0.75	9	0.6
		Ber Jal	0.75	4	0.38

Source: Catch assessment survey, CEGIS, November 2021; Weight of Fry is not considered for catch assessment

**Table 3.9: Total Catch in the Sampling Sites**

Sampling Site	Total Catch (kg)												
	1 <sup>st</sup> QM	2 <sup>nd</sup> QM	3 <sup>rd</sup> QM	4 <sup>th</sup> QM	5 <sup>th</sup> QM	6 <sup>th</sup> QM	7 <sup>th</sup> QM	8 <sup>th</sup> QM	9 <sup>th</sup> QM	10 <sup>th</sup> QM	11 <sup>th</sup> QM	12 <sup>th</sup> QM	13 <sup>th</sup> QM
A	28	0	3	28.7	6	0	20	276.2	0	0	10	2	2
B	65	0	1	3.3	0	0	10	12.8	0	0	4	0	0.25
C	1,559	0.5	8	8.7	1.05	0.33	19.5	173.6	2.8	0	2.6	10	8.13
D	0	12	3	30	10.5	5.08	10.75	189	0	12	18	56	77.5
E	0	0.6	5	0	0.5	0.4	0.6	7.8	5	7.5	2.6	0	0
F	0	1.2	13	3.7	1.5	0.7	0.8	0	1.5	0.8	0.5	0	0.3
G	0	1.6	4	0.7	2.9	0.83	0.825	70	1	0.8	0.1	0	0.12

Sampling Site	Total Catch (kg)																
	13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
A	2	0	0	17	0	16	0	0.40	0	0	0	0	30.5	3.5	-	1.1	27
B	0.25	0	0	0	0	1	0	0.00	0	0	0	0	-	-	-	0	13
C	0	0	0	1.50	0	0	93	17.50	0	0	4.6	0	18.95	33	12.7	5.85	23
D	0	0	0	0	0	0	0	0.00	0	0	1.35	0	-	-	-	0	-
E	8.13	1.5	2.56	0	0.1	2	0	0.50	0	0	1.17	0	2.07	-	47.5	11.34	52
F	0	0	0	0	0	0	0	0.00	0	0	0	0	0.6	-	2.3	0	-
G	77.5	10.5	37.67	3	4	27	0	0.00	0	0	0	0	-	-	-	0	-
H	0	0	0	0.33	22	0	5	0.00	11.5	0.2	20	10.5	-	4	-	6.1	0.25
I	0.3	0.4	0.67	0.13	3	5	1.2	0.00	0.5	1.7	0.4	3.0	5	-	3.5	7.75	2.5
J	0.12	0.3	0	1	0.25	1.2	0.6	0.17	1.6	0.8	0	6.3	7.5	-	0.3	0	3.25

\*Average Weight 0.15kg/mud crab and average weight 0.6 kg/mud eel; \*\* Weight of Fry is not considered for catch assessment



**Figure 3.9: Fishing gears and crafts observed during 30<sup>th</sup> quarter monitoring**

### Culture Fish Production

The present study on shrimp/fish farm in the 30<sup>th</sup> quarter monitoring phase shows that the highest production was observed in the Kapashdanda Gher (**Table D-7, Appendix-IV**).

## **3.2 Monitoring of Ecosystem and Bio-diversity**

### **3.2.1 Indicators Selection**

Indicators for terrestrial and aquatic ecosystems have been selected by prior anticipation of probable impacts on ecological resources in different phases of the proposed project. Composition and diversity of flora is important for vegetation study which indicates vegetation structure of an area. Plant health is directly related with biomass productivity. Plant health of an area may change for changing of different environmental parameters like temperature, composition of gaseous components, soil salinity, humidity and nutrients, air particulate dust etc. Plant diseases and proportion of healthy/ unhealthy plant is needed to observe for ensuring plant health condition.



Canopy status of terrestrial vegetation indicates plant health and biomass properties of an area. Vegetation canopy structure may be change for change of plant growth rate due to soil properties change, plant physiological disorders due to change of climatic parameters or even for different human interventions. To monitor vegetation canopy status of the study area, canopy cover has been followed in different time intervals.

Among the terrestrial faunal community, Bird is an important class that is sensitive to their habitat condition. Changes of environmental parameters, landuse and vegetation composition directly impact on bird's habitat of a locality. Broadly, two types of bird are found in an area; local and migratory. To observe local bird habitat suitability, number of bird nest and nesting bird species can be a good indicator. Numbers of wetlands where migratory birds come in each migration season have also been considered to observing migratory bird habitat suitability of the area.

In the respects of aquatic ecosystems, dolphin is an ecological indicator which indicates water quality as well as aquatic habitat suitability. This aquatic mammal is still present all the river systems of the study area. Any changes of water quality and river bed siltation may change dolphin occurrence in a river system. So, dolphin occurrence is needed to monitor for this study.

### **3.2.2 Rationales for Selection of Locations**

Four (4) homesteads have been selected for monitoring terrestrial ecosystem's indicators of the study area. Locations of the homesteads have been selected considering wind direction and spatial distribution from the project boundary. All the selected locations for terrestrial ecosystem monitoring is at northern sites as maximum time of the wind rose south to north direction and anticipated impacts will be take part according to this area. Beside this, Sundarban Reserve Forest is located sum of 14 km south from the project and various indicators of different locations of this forest is also observing for forest health monitoring. So, no site has been selected at south site of the proposed project.

### **3.2.3 Terrestrial Ecosystem**

Terrestrial ecosystem supports most of the floral and faunal communities which are directly related to the environmental parameters like temperatures, air quality, sunlight, soil nutrients etc. In the study area, homesteads occupy maximum portions of terrestrial ecosystems. As such, observation on different indicators of selected homestead vegetation and dweller wildlife will be helpful to know the ecological impacts for the proposed project.

#### *Description of the selected homestead*

The homestead in Rajnagar is located at 2.5 km. east from upper North-east boundary of the project site. This is situated inside the damp area as numerous small swamps exist inside and surround the homesteads. Water retention capacity of surface soil of this homestead is very low and for this reason very little number of grasses and other herbs are present. Land elevation of selected homestead at Kalekarber village is comparatively flood free. This is located at about 1.8 km. east from Middle-east boundary of the project. Chalkghona village is located about 0.5 km south from south-east boundary of the project. The selected homestead of this village is close to Maidara River to it's north side and saline water shrimp farms to its south periphery. Presence of shallow ditches and peripheral waterbodies support to grow staple coverage of saline tolerant plant species. Borni village is located at about 3.0 km north from north-east boundary. Sampled homestead at Borni is situated at the middle part of the village. This homestead is also dominated by planted tree species and soil condition is similar to Rajnagar site. Vegetation of this homestead have been severely been damaged by past Cyclone Aila.

### *Species Composition of selected homestead vegetation*

#### *Homestead at Rajnagar*

Once, this homestead was dominated with Gewa (*Excoecaria agallocha*) among all the trees due to its height population which get favor from soil's salinity for luxurious succession. But at ending of the year 2020, the homestead owner re-developed the homestead platform by filling sand extracted from nearer canal beds. Due to this activities, a staple portion of the Gewa coverage has been damaged along with other tree species. As a result, it is difficult to indicate the dominated tree species of this site. However, monocots fruits including Narikel (*Cocos nucifera*) and Khejur (*Phoenix sylvestris*) occupied the top canopy of the vegetation. Beside this, Safeda (*Manilkara zapota*) and Boroi (*Zizyphus sp*) are the two species of fruit yielding trees. In addition, a number of Bola (*Hibiscus tiliaceus*), Kewra (*Sonneratia apetala*) and one Sundari (*Heritiera fomes*) also found to exist. The homestead was cover very few grasses or undergrowth vegetation which also have been scarce after the land re-development.

#### *Homestead at Kalekarber dighi*

Two species like Narikel (*Cocos nucifera*) and Khejur (*Phoenix sylvestris*) occupies the top canopy. The homestead has many Mahagoni (*Swietenia mahagoni*) saplings which population is also high. Aam (*Mangifera indica*), Safeda (*Manilkara zapota*), Peyara (*Psidium guajava*) and Boroi (*Zizyphus sp*) are common trees height not more than 7 m. Mahagoni (*Swietenia mahagoni*), Rendi Koroï (*Albizia saman*) and Raj Koroï (*A. richardiana*) are timber trees those are occupied top canopy height more than 10m. Beside this, Neem (*Azadirachta indica*), Bakul (*Mimusops elengii*) and few numbers of Kola (*Musa sp*) are found on these homestead platforms.

#### *Homestead at Chalkghona*

Vegetation of this homestead also have rich population of mangrove plant species like Gewa (*Excoecaria agallocha*), Gol (*Nipa fruticans*), Kewra (*Sonneratia apetala*), and Ora (*Sonneratia caseolaris*). Narikel is the dominating tree species as well as occupying the top canopy. As the homestead is near the peripheries of river and shrimp gher, soil salinity supports luxurious growth of mangrove plant. This homestead has two shallow ditches which contain brackish water throughout the year. A number of ornamental plants also observed on this homestead platform.

#### *Homestead at Barni*

A total of 30 tree species have been recorded through quadrat sample survey of this homestead. Of which, Rendi Koroï (*Albizia saman*), Mahagoni (*Swietenia mahagoni*), Taal (*Borassus flabellifer*), Narikel (*Cocos nucifera*), Khejur (*Phoenix sylvestris*) are referable. The home owner has planted many fruit yielding trees which is now in sapling form. Among this, Kotbel (*Limonia acidissima*), Aam (*Mangifera indica*) and Safeda (*Manilkara zapota*) are common. Gewa (*Excoecaria agallocha*) was dominated at western part of this homestead now being less populated due to fell by the house owner. Tiger Fern (*Acrostichum aureum*) is a mangrove herb which presence at here also referable.

Random quadrat vegetation survey has been conducted at selected homesteads during recent monitoring tier. A total of 28 plant species (excluding undergrowths) has been recorded from 16 number of surveyed sample quadrates. Details of the survey result is presented in **Table 3.10** below. Plant species diversity followed more or less same than the previous monitoring.

### *Plant health*

Structure of vegetation community of this area is tree dominant. Random saline water shrimp farming is a big threat to plant health of this area. Hence, Plant health of this area is not satisfactory. Expansion of shrimp farming in this area triggered increment of salinity of soils. For this reason, overall plant succession, growth and productivity have changed day by day.

### Plant Diseases and symptoms in homestead vegetation

Plant diseases observation of an area is needed to evaluate plant health and productivity. During initial field survey, some tree species were selected for regular observation of plant disease. In this regards, a number of common tree species have been observed in each homestead.

Leaf blast, Leaf spot, lethal yellowing, nut fall, Mite damage on nut fruit are common diseases of the plants in the study area. A brief discussion was held with home owners about diseases of selected economic plants which exist in their homesteads. Most symptoms for plant diseases are descriptive. Although, all plant diseases symptoms are not visible in a same time of the year, but it was tried to observe the existing disease symptoms. Leaf spot and mite damage on fruits is the common symptoms of *Cocos nucifera*. In addition, bud/trunk rot (Heart Rot), lethal yellowing and diameter loss at top portion of this monocot is also common symptom of this plant in all location. Infection of fungal/bacterial is not remarkable all the homesteads. But Leaf Anthracnose on *Mangifera indica* and Bacteriosis on *Psidium guajava* is commonly found most of the trees. *Phoenix sylvestris* also found unhealthy due to leaf yellowing from manganese deficiency.

### Number of diseases affected trees

Plant health has been slightly improved or unchanged all the sites. Of which, *Excoecharia* has significant improvement at Rajnagar site due to stable of sandy soils at land developed portions of the homestead. Comparing to same season monitoring in previous tier (Nov, 2020), no significant improvement has observed. Following table (**Table 3.11**) represents the time series data on unhealthy plants in studied homesteads.

### *Vegetation Canopy Status*

#### Species representation in different canopy layers of homestead vegetation

Coconut (*Cocos nucifera*) occupied top canopy of all the studied homestead vegetation. Date Palm (*Phoenix sylvestris*) is prevalent as second top layer followed by Gewa (*Excoecharia agallocha*). Most of the fruit yielding trees like Sofeda (*Manilkara zapota*), Mango (*Mangifera indica*) possess upper bole of canopy layer. Lower bole are occupied by small fruit yielding trees like Guava (*Psidium guajava*), Musa sp. Very few grass species and undergrowth vegetation were followed at studied homesteads.

#### Estimated Canopy cover in homestead vegetation of sampling sites

Out of 4 sites. Status of vegetation canopy has improved at Rajnagar site. The causes behind the reduction of stress from land development activities within this homestead. Overall canopy coverage in all the sites are revealed improve status comparing the same seasonal monitoring in Nov 2020. This may be foliage expansion of newly planted sampling at Borni, Kalekarber and Chalkghona sites (**Table 3.12**).

Table 3.10: Plant species composition of the sampled homesteads

Sl. No.	Species Name	Local Name	Rajnagar				Borni				Kalekarber				Chalkghona				Total Number of individuals	Biodiversity Index	Abundance
			Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16			
1	<i>Albizia richardiana</i>	Chambol					1			4	2	1	1	1	2	1			13	1.22	81
2	<i>Albizia saman</i>	Rendi Koro	1				3	1	2	1	1				1				10		63
3	<i>Areca catechu</i>	Supari						6	14			2							22		138
4	<i>Azadirachta indica</i>	Neem					3		1				2						6		38
5	<i>Borassus flabelifer</i>	Taal						1	2	2				3					8		50
6	<i>Cocos nucifera</i>	Narikel	5	3	4	3	3			2	2	3	4	4					33		206
7	<i>Diospyrus pregrina</i>	Gab									2				1	2			5		31
8	<i>Eucalyptus sp</i>	Eucalyptus					1												1		6
9	<i>Excoecaria agallocha</i>	Gewa	6	8	9	7											8	4	42		263
10	<i>Ficus hispida</i>	Dumur											2						2		13
11	<i>Heritiera fomes</i>	Sundari	1																1		6
12	<i>Hibiscus tiliaceus</i>	Bola														1			1		6
13	<i>Limonia acidissima</i>	Kotbel				1				1									2		13
14	<i>Mangifera indica</i>	Aam					3			1					3				7		44
15	<i>Manilkara zapota</i>	Safeda								1	1								2		13
16	<i>Mimusops elengi</i>	Bokul										1							1		6
17	<i>Moringa oleifera</i>	Sazna											1						1		6
18	<i>Musa sp</i>	Kola		6	1						7	3							17		106
19	<i>Phoenix sylvestris</i>	Khejur		2	4	4	1						1	1			3	2	18		113
20	<i>Phyllanthus acidus</i>	Orboroi									1								1		6
21	<i>Sonneratia apetalla</i>	Kewra				1													1		6
22	<i>Swietenia mahagoni</i>	Mahagoni					5		2	2	7	8		4	1				29		181
23	<i>Syzygium cumini</i>	Jaam							1										1		6
24	<i>Tamarindus indica</i>	Tentul													1				1		6
25	<i>Terminalia arjuna</i>	Arjun													1				1		6
26	<i>Nypa fruticans</i>	Golpata																2	2		13
27	<i>Vachellia nilotica</i>	Babla															1		1		6
28	<i>Zizyphus sp</i>	Kul boroi						1	1						2				4		25

Note: Q-Quadra

Table 3.11: Proportion of healthy and unhealthy plants in studied homesteads

Location	Plant Name	Total No. of Plant	No. of Unhealthy Plant																							
			Apr, 2014	Jun, 2014	Oct 2014	Jan 2015	Apr 2015	Aug, 2015	Oct, 2015	Jan, 2015	Oct, 2016	Jan, 2017	Jan, 2018	Apr, 2018	Jul, 2018	Nov, 2018	Feb-19	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020	Nov, 2020	Jan, 2021	Apr, 2021	July, 2021
Rainagar	<i>Cocos nucifera</i>	17*	NS	10	5	5	15	4	5	NS	3	4	6	6	9	4	4	3	2	3	10	3	7	11	10	10
	<i>Phoenix sylvestris</i>	25	NS	15	4	4	22	9	13	NS	10	2	5	4	7	6	8	9	5	3	4	4	5	2	12	2
	<i>Manilkara zapota</i>	1	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
	<i>Albizia saman</i>	2	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2
	<i>Excoecaria agallocha</i>	55*	NS	-	1	1	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	10
	<i>Mangifera indica</i>	3	NS	1	-	-	2	-	-	NS	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	2
	<i>Psidium guajava</i>	2	NS	2	-	-	2	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Borni	<i>Cocos nucifera</i>	10	7	3	-	-	3	1	2	NS	1	2	3	1	2	-	1	1	1	2	1	-	-	-	-	-
	<i>Phoenix sylvestris</i>	12	-	5	4	4	3	1	4	NS	4	3	4	2	1	-	-	1	1	-	-	-	-	-	-	-
	<i>Borassus flabellifer</i>	6	3	1	-	-	-	-	-	NS	-	-	-	-	-	1	1	-	-	-	-	1	-	-	-	-
	<i>Mangifera indica</i>	6	3	3	1	1	4	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Excoecaria agallocha</i>	18	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	3
	<i>Swietenia mehogani</i>	11	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Areca catechu</i>	10	-	6	2	2	8	2	2	NS	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Manilkara zapota</i>	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Psidium guajava</i>	2	2	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kalekarber Dighi	<i>Cocos nucifera</i>	56	35	5	1	1	2	2	3	NS	1	1	-	6	3	-	1	3	1	7	4	2	-	-	-	2
	<i>Phoenix sylvestris</i>	10	-	3	-	-	1	-	1	NS	3	-	3	-	-	-	-	-	-	-	-	3	-	-	-	-
	<i>Mangifera indica</i>	5	1	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Manilkara zapota</i>	2	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Borassus flabellifer</i>	8	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Zizyphus sp</i>	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
	<i>Psidium guajava</i>	8	-	-	-	-	-	-	-	NS	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Tamarindus indica</i>	2	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chalkghona	<i>Cocos nucifera</i>	39	25	19	5	5	34	20	-	NS	2	2	4	5	3	-	3	4	2	4	3	5	-	-	-	-
	<i>Phoenix sylvestris</i>	24	-	10	1	1	6	5	1	NS	1	-	5	2	3	-	-	1	2	2	1	3	-	1	3	2
	<i>Albizia saman</i>	3	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
	<i>Excoecaria agallocha</i>	36	-	-	1	1	-	-	-	NS	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2	-
	<i>Manilkara zapota</i>	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Psidium guajava</i>	17	1	7	-	-	-	-	-	NS	-	-	-	-	-	1	3	-	-	1	-	-	-	-	-	-
	<i>Mangifera indica</i>	7	2	1	-	-	-	-	-	NS	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Borassus flabellifer</i>	2	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: NS = Not Surveyed; \*=1 Cocos and 45 Excoecaria have been cut; Source: CEGIS field survey



**Table 3.12: Vegetation Canopy Cover in different Studied Homesteads**

Location	% of canopy Coverage																			
	Apr 2014	Jun 2014	Oct 2014	Jan 2015	Apr 2015	Aug 2015	Oct 2015	Jan 2016	Jul 2016	Oct 2016	Jan 2017	Jan 2018	Apr 2018	Jul 2018	Nov, 2018	Feb, 2019	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020
Rajnagar	NS	19	19	17	20	20	20	20	21	23	19	15	18	14	11	22	19	18	16	14
Borni	NS	26	18	18	12	14	20	20	25	25	23	21	21	23	20	21	21	20	18	20
Kalekarber	NS	20	24	25	23	24	24	22	24	26	25	23	24	24	25	24	25	25	24	24
Chalkghona	NS	13	24	22	17	21	21	20	21	27	26	25	16	18	21	22	22	22	20	23

Note: NS = Not Surveyed

### Bird Habitat

#### Local birds and their nesting behaviour

Numerous local bird species are occurred in the study area. Homestead vegetation are the prime habitat for local birds. Existence of vast shrimp farms as well as canals and rivers also favor good number of water dependent bird species in this area. Most of the birds are nesting on tall trees of homesteads. Small bird like Tailor bird, prefer small bushy shrubs. Although, birds do not follow any local boundaries, a clear conception on available bird species have been gathered through discussions with studied homestead owners as well as physical observation.

#### Bird species and number of Bird nests in sampling sites

None of the bird nest have been recorded from any monitoring homestead site. However, **Table 3.13** represent the bird nest monitoring datasheet over the monitoring periods.

**Table 3.13: Bird nest observation datasheet**

Monitoring Tier	Location	Name of nesting Bird					
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove
Apr 2014	R	NS	NS	NS	NS	NS	-
	B	-	-	1	-	-	-
	K	NS	NS	NS	NS	NS	-
	C	-	1	-	1	-	-
Jun 2014	R	12	4	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	11	-	-	-
Sep 2014	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Dec 2014	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Apr 2014	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-

Monitoring Tier	Location	Name of nesting Bird					
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove
Aug 2015	R	1	5	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Jan 2016	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Jun 2016	R	10	5	-	-	3	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	1	1	-	-	-	-
Oct 2016	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Jan 2017	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Jan 2018	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	1	-	-	-	-
Nov 2018	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Feb 2019	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	1	-	-
Apr 2019	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Jul 2019	R	-	-	-	1	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Nov 2019	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Feb 2020	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Jul 2020	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-

Monitoring Tier	Location	Name of nesting Bird					
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove
Nov 2020	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Jan 2021	R	-	-	1	1	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Apr 2021	R	-	-	1	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	1
Jul 2021	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-
Nov 2021	R	-	-	-	-	-	-
	B	-	-	-	-	-	-
	K	-	-	-	-	-	-
	C	-	-	-	-	-	-

Note: Location R=Rajnagar, B=Borni, K=Kalekarber, C=Chalkghona

#### Migratory birds and their habitats

Migratory and local migratory winter birds follow at large shrimp gher along the study area. According to local people and physical observation, Common Coot, Common Snipe, Black Winged Stilt, Ruddy Shelduck, Little Grebe etc are common winter visitor of this area. In addition, local Ruddy Breasted Crake, Common Sandpiper, Great Egret, Pond Heron, Little Cormorant are also found at most of the monitoring wetlands of the study area.

All the monitoring wetlands recorded the presence of local migratory birds except Sukhriar Gher. Occurrence of local migratory birds was high at Koigar Daskati Gher and Badyamari Gher. Overseas migratory birds have informed only at Boro Charar Gher and Koigar Daskati Gher. But the population is very low as previous years. According to local knowledgeable presence of migratory birds are scatter in some beels with low population due to re-starting shrimp culture within short intervals from shrimp harvesting in past year and indiscriminate use of pesticides in agriculture field and shrimp farms. In addition to this, noise from construction vehicle movement through the Power Plan approach road, noise from the construction sites during night, vehicle and construction lightings are disturbing the migratory birds which are roaming at the nearby wetland (shrimp farms) like Boro Charargher. Following **Table 3.14** show the presence of migratory birds at the important wetlands inside the study area.

**Table 3.14: Presence of migratory birds at different wetland inside the study area**

Wetland Name	Wetland type	Approximate distance from project Boundary (Km.)	Presence of Birds	
			November 2021	
			LM	M
Choto Charargher	Saline Water Shrimp Farm	0.10	Yes	No
Boro Charargher	"	0.10	Yes	Yes
Putimari Gher	"	1.10	Yes	No
Golbunia Gher	"	0.1	Yes	No
Shukariar Gher	"	1.25	No	No

Wetland Name	Wetland type	Approximate distance from project Boundary (Km.)	Presence of Birds	
			November 2021	
			LM	M
Koigar Daskati Gher	"	0.25	Yes	Yes
Badyamari Gher	"	1.00	Yes	No
Chalkghonar Beel	"	1.50	Yes	No

### 3.2.4 Aquatic Ecosystem Monitoring

Rivers, canals, ponds and saline water shrimp farms are main wetland forms in the study area. Of which, river bear the flowing/ lotic and ponds bear the stagnant/lentic water systems. Canals of this area have merged with shrimp farms. Shrimp farms extend a large proportion of total watershed of the study area those are intervene by human. Therefore, canals are not an actual flowing or stagnant water system.

#### *Monitoring Locations*

Passur is the only external river beside the project area which maintains connectivity with all flowing water systems of the study area. On the other hand, Maidara River including two branches (Sailtakali and Ichamoti) exists as an internal river system. Both of the river systems are support River Dolphin whole of the year. Hence, status of aquatic mammals (Dolphin) in these river systems has been monitored.

#### *Dolphin Occurrences*

##### *Dolphin migration route in the study area*

Two dolphin species (Ganges River Dolphin and Irrawaddi Dolphin) travel throughout the Passur River for whole of the year. The Ganges river dolphin migrates from estuary regions to upstream connected rivers like Rupsha and Madhumoti. Though Irrawardi Dolphin is mostly habituated in estuary regions of Bangladesh, but this aquatic mammal is also occasionally sighted in Passur River. Ganges Dolphins also roam through Maidara River mainly during high tide. Siltation and narrowing of upstream branches are limiting the length of migration area of this river day by day.

##### *Dolphin occurrence in Passur and Maidara River*

Dolphin occurrence have been surveyed within about 16 km length of Passur and Maidara river surround the project area (From Digraz Kheyaghat to Chalna including Maidara River) through boat transact during full tide. A total of 5 dolphins have been recorded in Passur or Maidara River during the survey. Of which 1 were at Passur Channel and another 6 was sighted within the Maidara River. The encounter rate is 0.24 individual/km/hr and was insignificant lower than previous monitoring tier. **Figure 3.10** represents the survey transact and location of dolphin occurrence within these river areas.

##### *Dolphin occurrence in Dhangmari Khal, Shella Gang and Bhadra khal*

Dolphin occurrences also surveyed at the Dhangmari Khal, Chandpai Shella Gang Wildlife Sanctuary and Bhadra Khal. In the case of Dhangmari Khal, total transect length was 12.56 km from Dhangmari-Passur confluence to Gagramari Forest Patrol Post up and down (**Figure 3.11**). A total of 13 dolphins with different sizes were recorded in Dhangmari Khal with an encounter rate 0.80/km/hour. The occurrence rate is higher than previous monitoring period in July 2021 and this may be due to abundance of fishes as their feed and existence of freshwater within the canal.

In the case of Chandpai Shella Gang, the survey transact was bounded from Chandpai to Joymonirgol Thota to Food Silo to Joymonirgol Thota which length was about 6.58 km (**Figure 3.12**). 7 individuals were sighted and the occurrence rate was 0.85 individual/km/hour.

16 dolphins have been recorded at Bhadra Khal during 42 min survey time and the 5.2 km inner reach from Bhadra Patrol Post. The encounter rate was 4.40 individuals/km/hr. The encounter rate was higher than the previous monitoring and this may be due to strictness of anthropogenic activities within the Bhadra Khal by BFD (Bangladesh Forest Department). The distribution of dolphin occurrence at Bhadra Khal is presented in **Figure 3.13**.

Another short survey was conducted Karomjal, Harbaria and Akram Point while passing the river. Dolphin has been notified at Karamjal and Harbaria while travelling on boat. However, the survey result is included in **Table 3.15**.



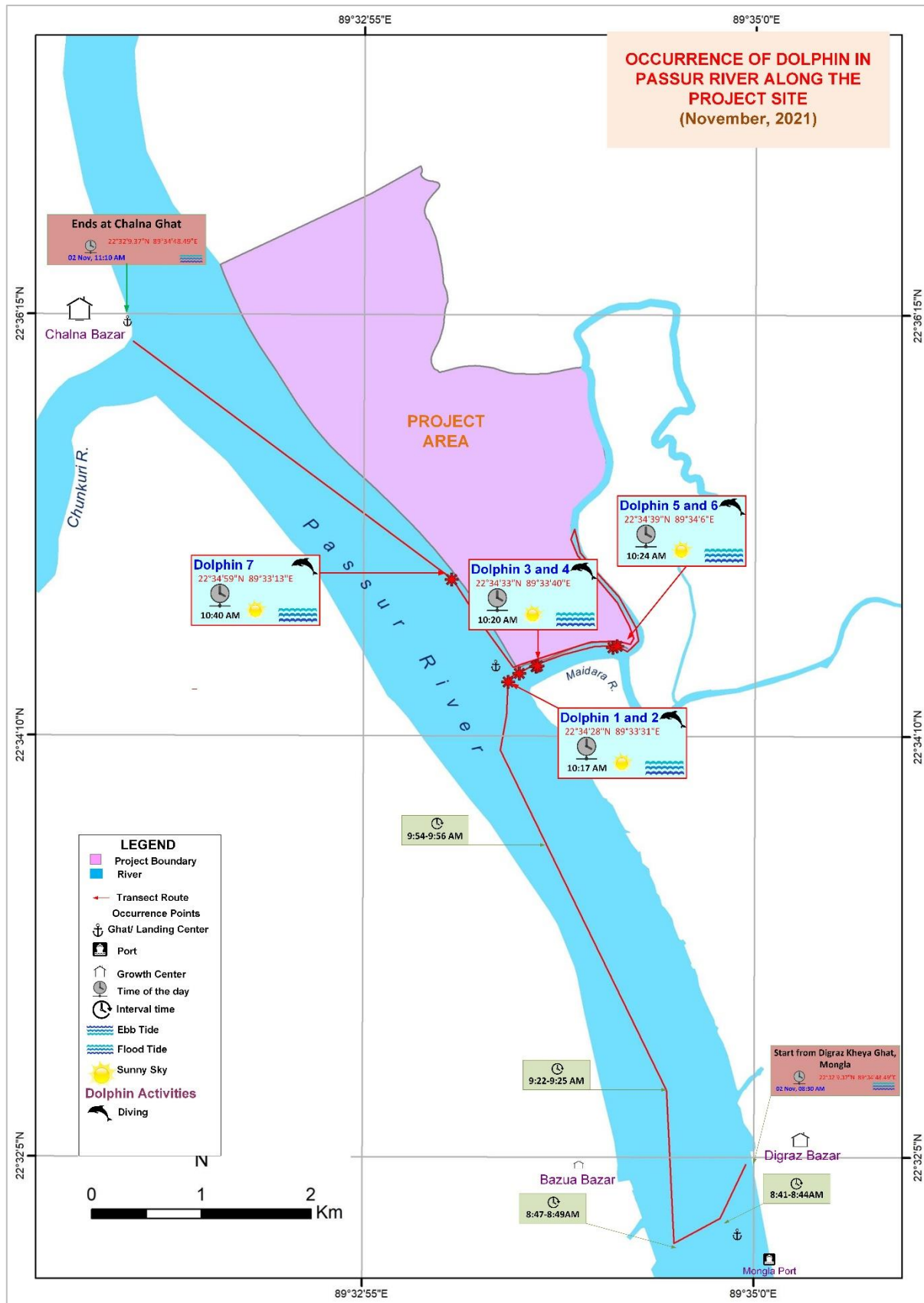


Figure 3.10: Occurrence of dolphin at Passur and Maidara River along the project site

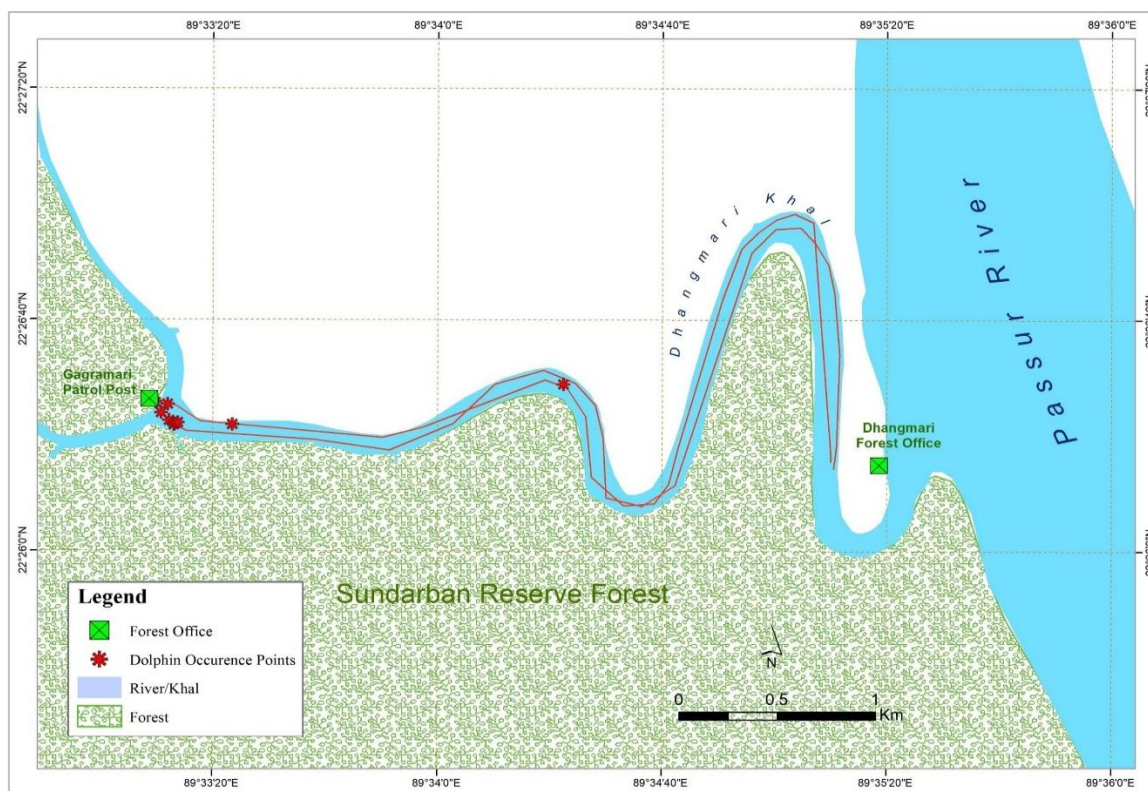


Figure 3.11: Location of dolphin Occurrence at Dhangmari Khal

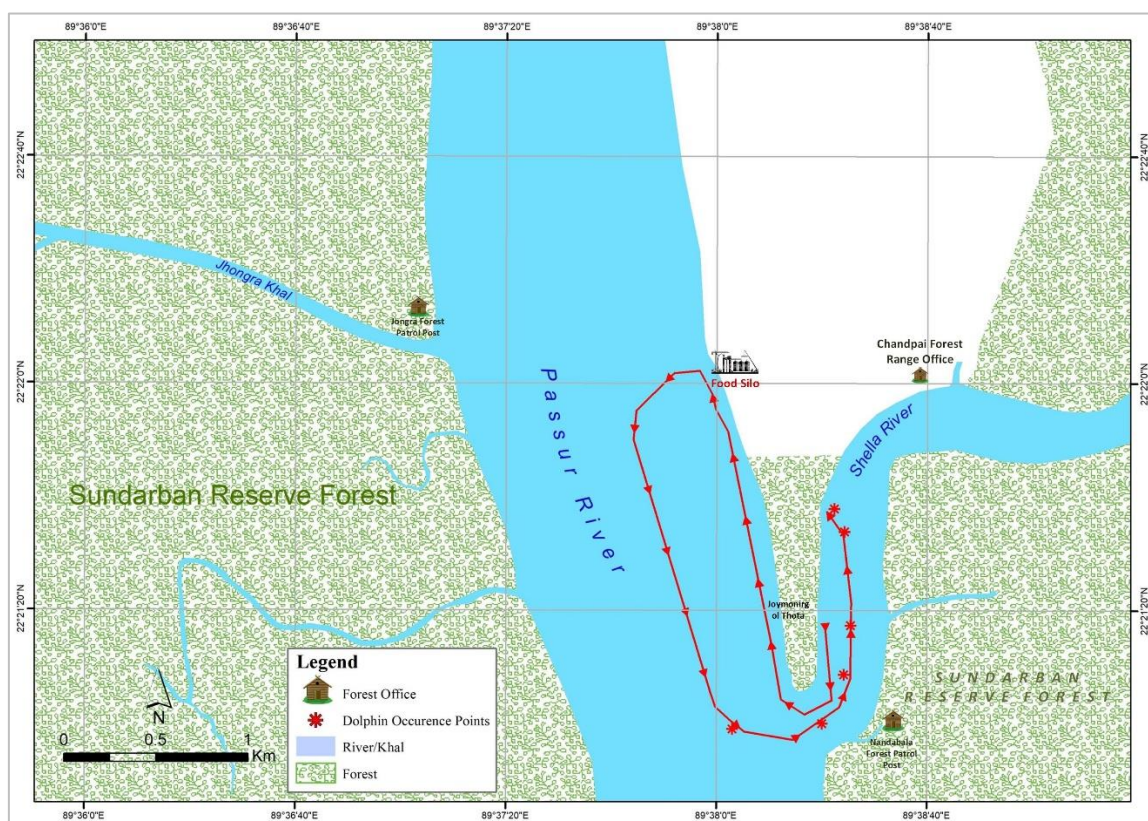
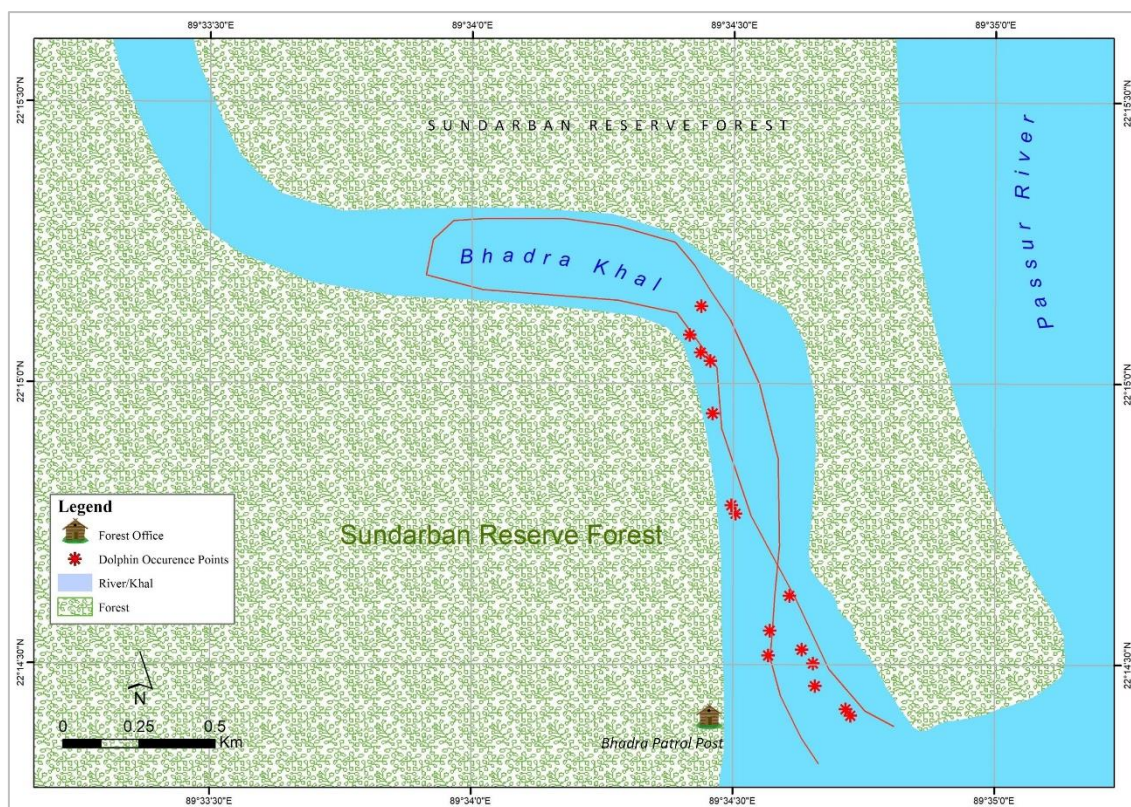


Figure 3.12: Location of dolphin Occurrence at Chandpai





**Figure 3.13: Location of dolphin Occurrence within Bhadra Khal**

**Table 3.15: Dolphin Observation Datasheet**

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Moidara River	Shella River at Chandpai
Apr-14	FT	Y	NS	NS	NS	Y	NS
	NT	Y	NS	NS	NS	N	NS
Jun-14	FT	Y	NS	NS	NS	N	NS
	NT	Y	N	N	N	N	NS
Oct-14	FT	Y	NS	NS	NS	Y	NS
	NT	Y	Y	Y	N	Y	NS
Jan-15	FT	Y	Y	Y	NS	Y	NS
	NT	Y	Y	N	Y	N	NS
Apr-15	FT	Y	N	N	Y	Y	NS
	NT	Y	N	N	Y	N	NS
Aug-15	FT	Y	NS	N	NS	Y	NS
	NT	Y	Y	N	NS	N	NS
Oct-15	FT	NS	NS	Y	N	NS	NS
	NT	Y	Y	NS	Y	Y	NS
Oct-15	FT	Y	Y	Y	Y	N	NS
	NT	Y	N	N	NS	Y	NS
Jul-16	FT	Y	Y	Y	NS	Y	NS
	NT	Y	NS	Y	NS	NS	NS
Oct-16	FT	N	Y	Y	N	NS	NS
	NT	Y	Y	NS	N	Y	NS
Jan-17	FT	Y	Y	N	NS	N	NS
	NT	Y	Y	N	NS	Y	NS
Jan-18	FT	Y	NS	Y	N	NS	NS
	NT	Y	Y	N	N	Y	N
Jun-18	FT	Y	N	N	N	Y	Y

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Moidara River	Shella River at Chandpai
	NT	Y	NS	N	Y	Y	NS
Nov-18	FT	NS	N	N	N	NS	NS
	NT	Y	N	N	N	Y	Y
Feb-19	FT	NS	Y	Y	N	NS	Y
	NT	Y	N	N	Y	N	NS
Apr-19	FT	NS	Y	N	N	NS	NS
	NT	N	N	Y	N	N	Y
Jul-19	FT	Y	Y	N	N	Y	Y
	NT	Y	NS	N	N	N	NS
Nov-19	FT	NS	Y	Y	N	NS	Y
	NT	Y	Y	N	Y	Y	Y
Feb-20	FT	Y	Y	Y	Y	Y	Y
	NT	Y	N	NS	NS	Y	Y
Jul-20	FT	Y	N	N	N	Y	Y
	NT	NS	Y	N	N	NS	Y
Nov-20	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
Jan-21	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
Apr-21	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
Jul-21	FT	y	NS	Y	Y	Y	Y
	NT	NS	Y	N	N	NS	NS
Nov-21	FT	Y	NS	N	N	Y	NS
	NT	Y	Y	Y	N	Y	Y

Note: FT=Flood Tide, NT=Neap Tide, NS=Not Surveyed; Occurrence Status: Y = Occurred, N = Not occurred

### 3.3 Sundarbans Forest Health monitoring

#### 3.3.1 Background

Healthy forests are a critical part of our nation's landscape. Healthy forests are vital to our future (Edmonds et al., 2011), and consistent, large-scale, and long-term monitoring of key indicators of forest health status, change, and trends are necessary to identify forest resources deteriorating across large regions (Riitters et al., 2004). Forest Health Monitoring program designed to determine the status, changes, and trends in indicators of forest condition on a certain time interval basis. The Forest Health Monitoring program uses data from various sources such as ground plots (i.e. long-term monitoring plot) surveys, aerial surveys, and other biotic and abiotic data sources and develops analytical approaches to address forest health issues that affect the sustainability of forest ecosystems. One of the widely used forest healthy monitoring Bio-indicators is the growth trend over time and its relation with leaf area index (Beets et al., 1996). Stands with a high leaf area index will accumulate more biomass and total volume per ha than stands with a low leaf area, other things being equal (Beets et al. 2008). Lichen abundance is another good indicator of forest health. Lichens often grow on trees and shrubs, absorbing nutrients from the atmosphere. Because lichens are very sensitive to air pollution—particularly to sulfur dioxide, fluoride, and ammonia—their presence or absence is an indicator of forest health. The acidity of a tree's bark can also affect lichen abundance (Smith et al. 2003). If air is very badly polluted with sulfur dioxide then there may be no lichens present, just green algae may be found. If the air is clean, shrubby, hairy, and leafy lichens become abundant (Bates et al., 1996). The quality of the soil in a forest is another important indicator of forest health (USDA Forest Service, 2007). An evaluation of soil quality usually involves measuring the soil's physical, chemical, and biological makeup at different depths. Plant species diversity is another Bio-indicator of a healthy forest. One way to assess this diversity is to determine whether there is a mix of plant species of different sizes and ages, thus creating forest "layers" that provide habitat for many species (Greenleaf Forestry and Wood Products Inc. 2010). A healthy forest has a good regeneration capacity, which is also a bio-indicator of forest

health monitoring. These bio-indicators will be investigated in Sundarbans Reserve Forest (SRF) in light of the Rampal Power Plant Installation.

The state of the forest to monitor the potential impacts of the Rampal Thermal Coal Power Plant Project, bio-indicators will be used in the Sundarbans Reserve Forest (SRF). It is necessary to establish a baseline state in order to determine the genuine scenario of power plant impact on forest health. In light of this, CEGIS is implementing a forest health monitoring study at five Sundarbans Reserve Forest (SRF) locations along the Passur River: Sutarkhali, Karamjal, Harbaria, Akram Point, and Hiron Point. Tree growth, regeneration capacity, crab activity, plant diversity, biomass, and carbon stock were among the indicators monitored in this program

### 3.3.2 Methodology

#### *Permanent Sample Plot (PSP) Establishment and Layout*

To set up permanent sample plots, five plots were established. Among those, five sites are along the Passur River at Karamjal, Harbaria, Akram point and in Hiron point respectively and the fifth plot is near Sutarkhali forest office (**Table 3.14**). The sites were selected considering the distance from the proposed project site, wind directions, coal transportation route, river systems and vegetation types. In this present census, *Hiron* point was not considered.

#### *Bio-Indicators for Forest Health Monitoring*

There are many Bio-indicators for forest health monitoring. As the study forest is a mangrove forest, some of the mangrove traits were also selected as Bio-indicator. The Bio-indicators observed in this forest health monitoring program were seedling regeneration, pneumatophores, species diversity, crab hole density, canopy cover, leaf phenology, Leaf Area Index, Tree growth, phenological behaviour, pest and disease.

#### *Sampling Design of Permanent Sample Plots (PSPs)*

In each site, a transect line was laid out perpendicular to river or canal bank. Along the transect line, three circular nested subplots of 12.62m radius have been laid out at 100m intervals in order to capture the maximum tree species (**Figure 3.15**). Because of the variation in species composition in SRF, observation plots were laid out from the coast, river or canal side to upper slope zone where forest area is denser. The location of the first subplot was 40m away from ecotone zone in order to save the subplot from river bank erosion. Each subplot was again subdivided into four quadrates (**Figure 3.16**) during this monitoring period 50% of the sub plot 1 at Hironpoint is eroded and 10 m of the subplot 1 at Akram point is eroded due to high tidal inundation and erosion.

**Table 3.16: General Description of Permanent Sampling Plots (PSPs)**

Transect	Plot	Range	Compartment No.	GPS $\pm$ (m)		Soil Description	Plot Location Notes
				Latitude (N)	Longitude (E)		
Sutar khali	1	Khulna	32	22.4981	89.4875	Hard Clay	Just opposite from Sutar Khali Forest Station and 40m SW from Sutar Khali Canal
	2	Khulna	32	22.4973	89.4871	Hard Clay	Just opposite from Sutar Khali Forest Station and 140m SW from Sutar Khali Canal
	3	Khulna	32	22.4965	89.4866	Hard Clay	Just opposite from Sutar Khali Forest Station and 240m SW from Sutar Khali Canal
Karamjal	1	Chandpai	31	22.4253	89.5943	Hard Clay	Plot center 40m west from Passur River
	2	Chandpai	31	22.4252	89.5934	Hard Clay	Plot center 140m west from Passur River



Transect	Plot	Range	Compartment No.	GPS $\pm$ (m)		Soil Description	Plot Location Notes
				Latitude (N)	Longitude (E)		
	3	Chandpai	31	22.4226	89.5925	Hard Clay	Plot center 240m west from Passur River
Harbaria	1	Chandpai	29	22.2061	89.5924	Hard Clay	40m west from Passur River
	2	Chandpai	29	22.2962	89.5917	Hard Clay	140m west from Passur River
	3	Chandpai	29	22.2962	89.5908	Muddy	240m west from Passur River
Akram Point	1	Khulna	17	22.0195	89.5129	Hard Clay	40m east from Shibsha River
	2	Khulna	17	22.0187	89.5134	Clay	140m east from Shibsha River
	3	Khulna	17	22.0180	89.5140	Hard Clay	240m east from Shibsha River
Hiron Point	1	Khulna	44	22.7753	89.4610	Sandy	350m east from Gogari Canal
	2	Khulna	44	21.9166	89.2333	Sandy	40m north from Bay of Bengal
	3	Khulna	44	22.1833	89.5000	Hard Clay	648m south east from Shibsha River



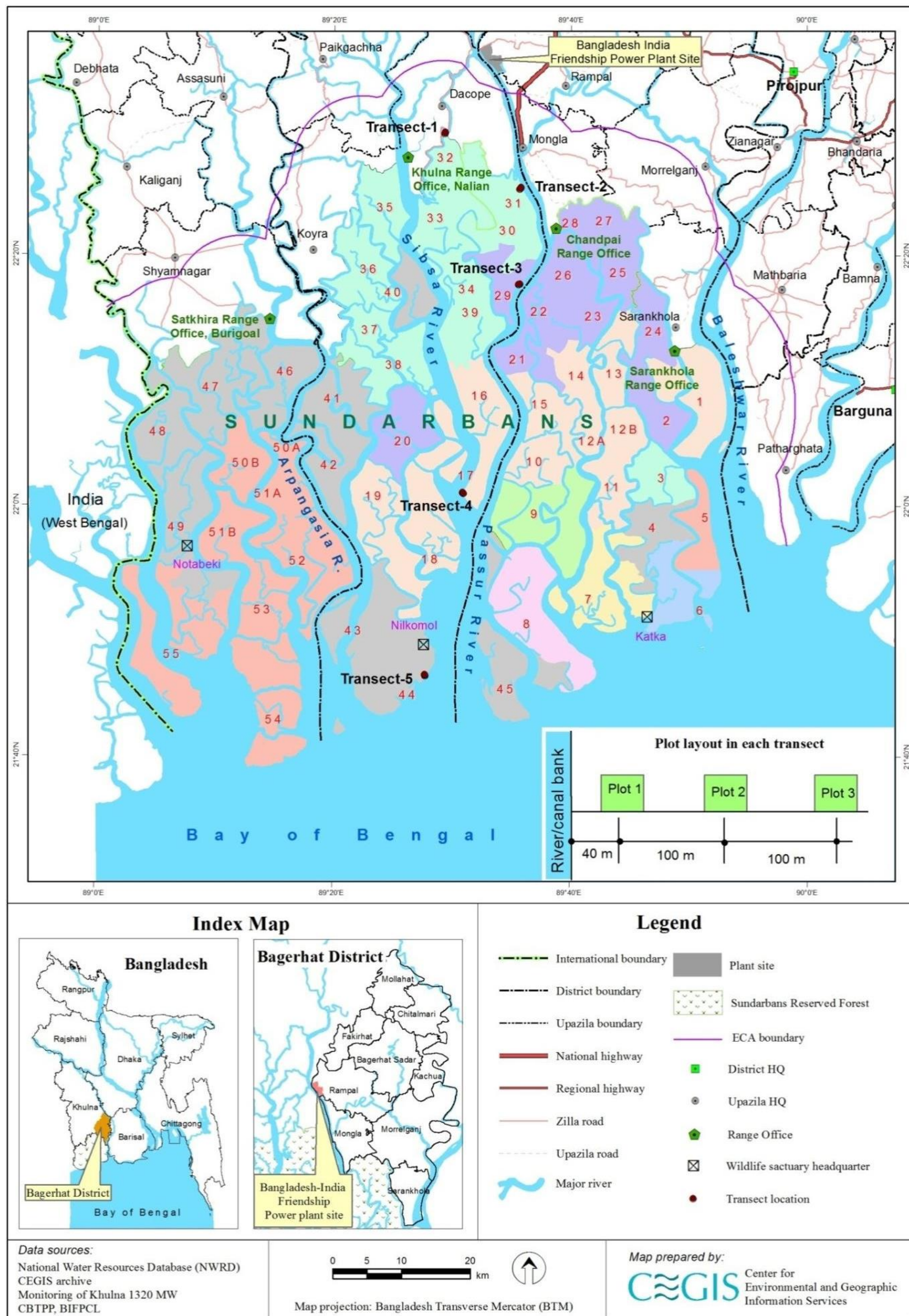
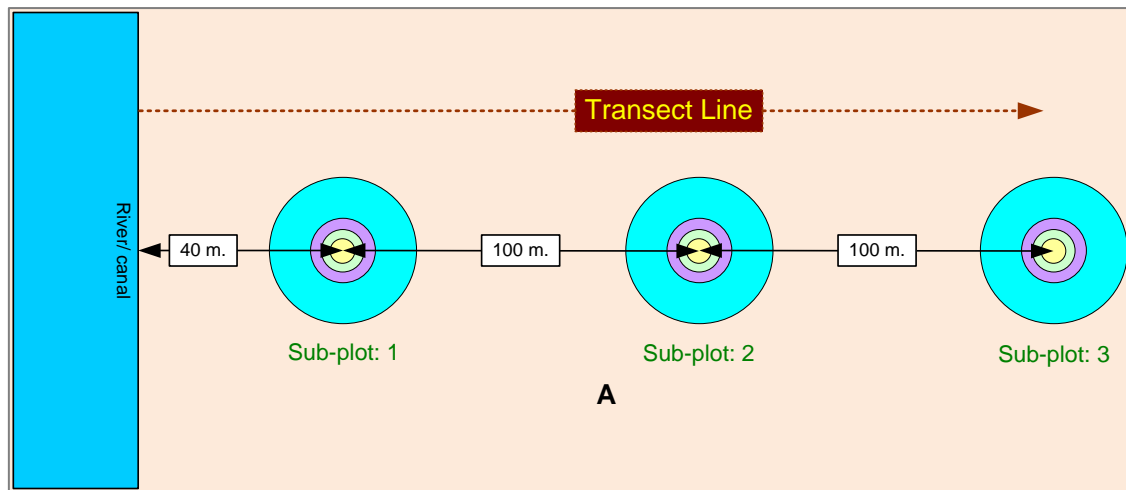


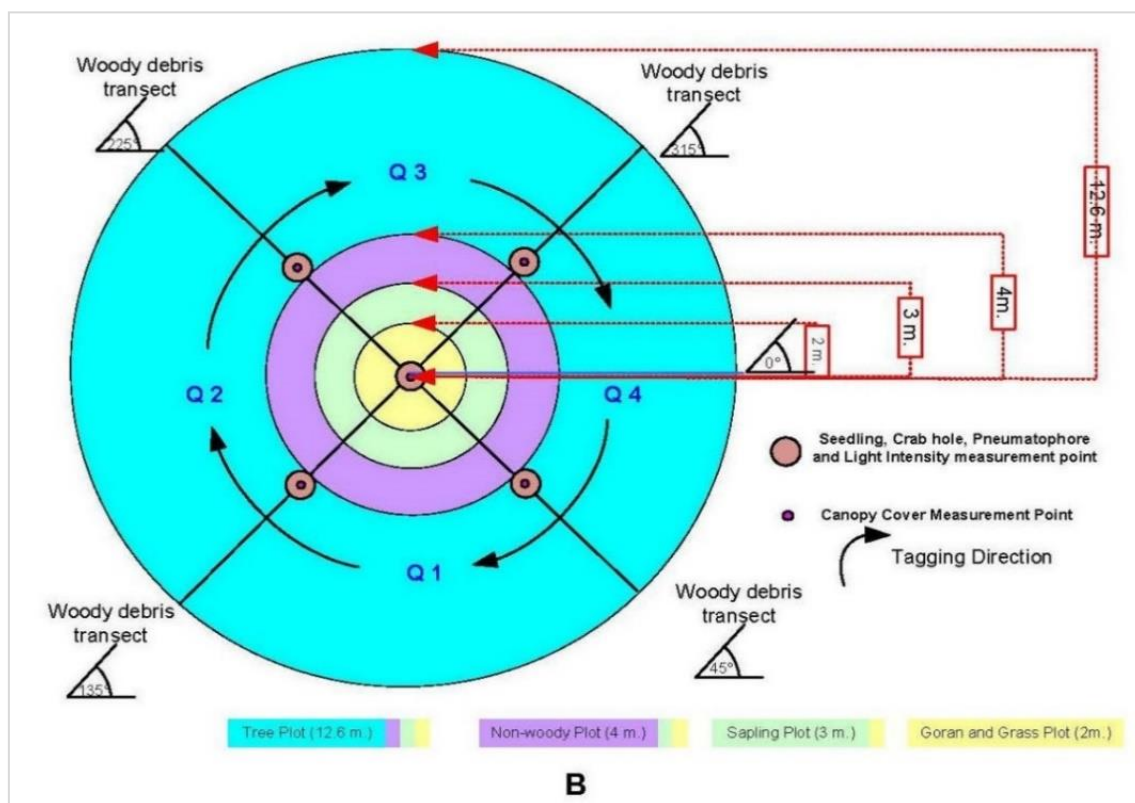
Figure 3.14: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)







**Figure 3.15: Layout of the Subplots and Transect Line Perpendicular from Ecotone (river or canal bank)**



**Figure 3.16: Layout of the Survey Activities in each Subplot**

#### *Tree growth*

Tree species growth data were obtained from measured tree DBH. Individual tree DBH  $\geq 5\text{cm}$  was considered for growth trend observation.

#### *Vegetation Diversity*

Tree species data were collected from the PSPs. Individual tree DBH  $\geq 5\text{cm}$  was considered. Saplings (DBH  $< 5\text{cm}$  and height  $< 1.37\text{m}$ ) and seedlings (height  $< 1.37\text{m}$ ) were assessed within a 3m and 2m radius circle respectively in each PSP. Seedlings were counted species wise and their status of living was also recorded. For saplings, species name and DBH were recorded along with the living status.



### *Biomass and carbon stock estimation in tree*

From each plot tree species were identified and each individual was recorded. Diameter at breast height (1.37m) and height was measured in the field. Total biomass of trees was estimated after adding above and below ground biomass. As the study was conducted in a reserved forest area, it was not possible to cut all the trees and brought them to laboratory for estimating biomass. After reviewing models developed by several authors from across the world (e.g., FAO 1997, Brown et al. 1989), the generic allometric model developed by Chave et al. (2014) was used for measuring biomass as this widely used for tropical region tree standing biomass. Below ground biomass was calculated considering 15% of above ground biomass (Mac-Dicken 1997). After calculating biomass, carbon content was calculated based on the assumption that carbon content is 50 percent of the dry woody biomass (Brown 1997). Aboveground biomass and carbon was calculated on a per-hectare (ha) basis. The model for above ground biomass estimation is as follows:

$$AGB = 0.0673 \times (\rho D^2 H)^{0.976}$$

Where, Y = above ground biomass in Kg; H = Height of the trees in meter; D = Diameter at breast height (1.3m) in cm;  $\rho$  = Wood density in units of g/cm<sup>3</sup>

### *Pneumatophores*

The total numbers of living pneumatophores were recorded within a circular area of 1m radius centring each of the four points of all the subplots.

### *Crab hole*

Crab plays an important role in mangrove ecosystems such as decomposing litter fall which play an important role in increasing soil fertility. In order to record the crab density, crab hole abundance was monitored. For this purpose, the crab holes were counted within an area of 1m radius circle in each subplot's centre and in the midpoint of four transect.

### *Canopy Cover*

Canopy cover percentage was estimated by a spherical densitometer (i.e. Densitometers a gridded convex mirror that provides a simple and inexpensive approach of measuring canopy cover). The densitometer was held at a distance of 30–40 cm from the body and at an elbow height so that head not become visible in the mirror. After levelling the instrument using the level bubble, the dots which had not been occupied by canopy were systematically counted. In each subplot, the meter readings have been taken at four points facing north, south, east, and west direction including the centre point of the subplot. The canopy cover was calculated by taking the average of these readings.

### *Leaf Area Index*

Leaf Area Index (LAI) is a key structural characteristic of forest ecosystems because of the role of green leaves in controlling many biological and physical processes in plant canopies. LAI influences net canopy photosynthesis. Light absorption by the forest canopy can be used to estimate Leaf Area Index (LAI). In this monitoring report, LAI was calculated as follows:

Leaf Area Index (LAI) =  $\log_e (I/I_0) / -K$  leaf area / area of ground (Where, I = Under Canopy Light Intensity,  $I_0$  = Open Canopy Light Intensity and K is Canopy light extension coefficient i.e., 0.5).

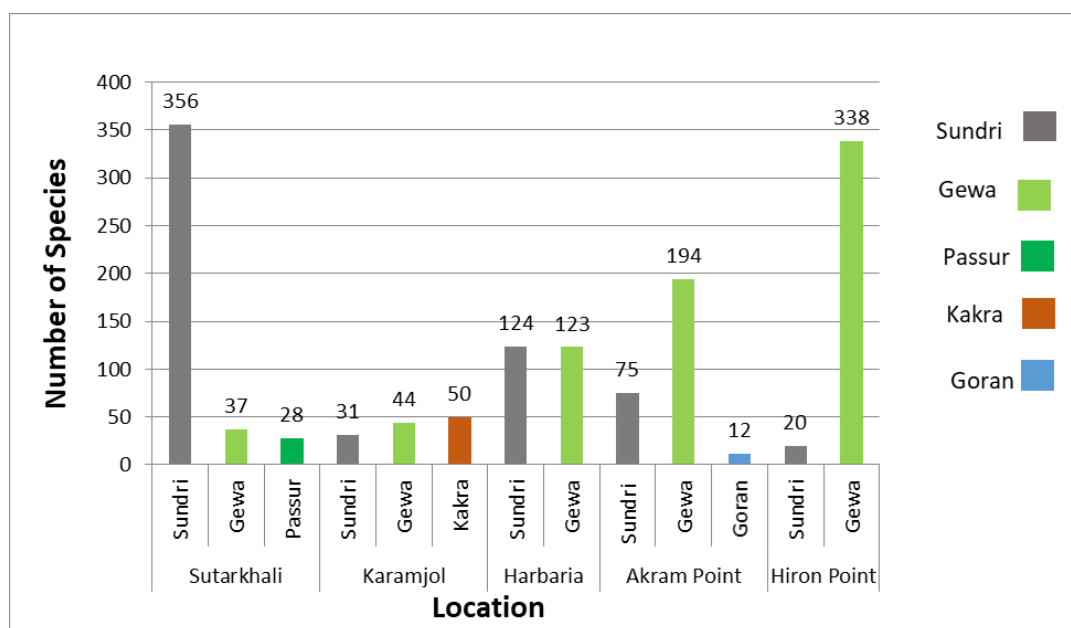
### *Leaf Phenology*

Leaf phenological trait of major mangrove species such as leaf emergence, leaf shedding, flowering and fruiting and fruit/ propagule dropping time was investigated through secondary information. Leaf phenology has been first introduced in this study for the first time. From next field inventory, leaf phenological behavioral change will be monitored.

### 3.3.3 Results and Discussion

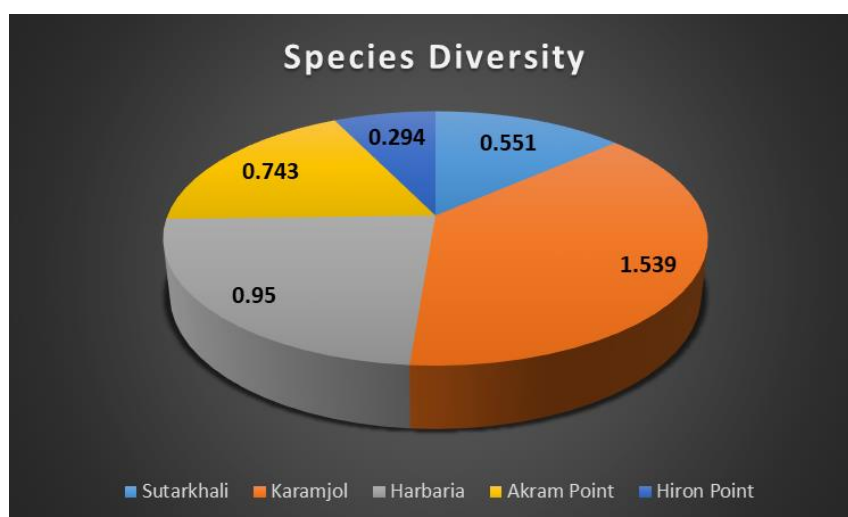
#### Vegetation Diversity, Richness and Compositional Variation

In the context of Bangladesh's other forest types, the Sundarban mangrove forest is a unique plant habitat and diverse location. The distribution of plant species in Sundarban is influenced by saline water. Halophytic tree species dominate the Sundarbans' natural vegetation. Figure (4) depicts the patterns of plant distribution in various places. Healthy *Heritiera fomes* trees dominate and are randomly spread throughout the Sutarkhali area, followed by *Excoecaria agallocha* and *Xylocarpus* species. *Heritiera fomes*, *Excoecaria agallocha*, and *Bruguiera* spp. dominate the Karamjol area, which is less dense than other places. In Karamjal, however, the species composition is higher. *Excoecaria agallocha* and *Heritiera formes* dominate and disseminate the Harbaria zone, although despite growing well in this zone, they show top dying symptoms. *Excoecaria agallocha*, *Heritiera fomes*, and *Ceriops decandra* coexist in the Akram point area. *Excoecaria agallocha* is the dominant plant on Hiron Point. In addition association of *Heritiera fomes* and *Ceriops decandra* is also found.



**Figure 3.17: Location-wise species occurrence**

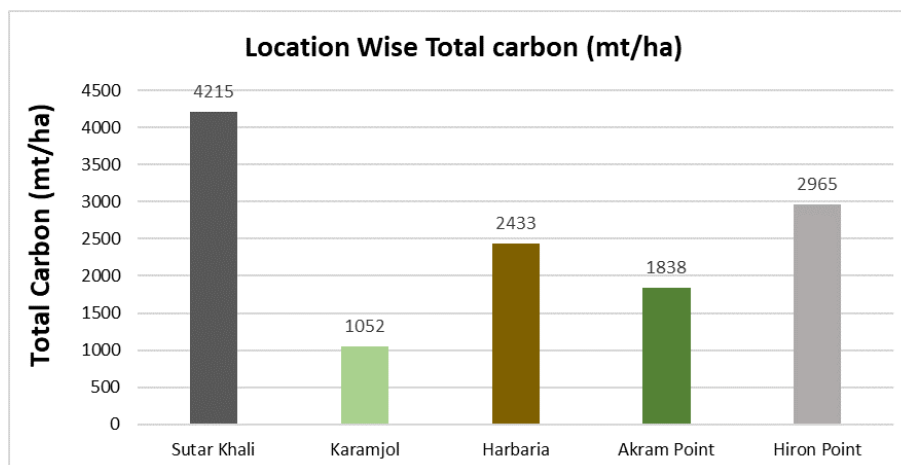
According to Shannon's diversity index, species diversity is comparatively higher in Karamjol than other four sites and lower in Hiron point. While Simpson's dominance index of trees increased from Karomjol to Hiron point. Thus, an inverse relationship between tree dominance and diversity was observed with the distribution. Species diversity order in five locations are: Karamjol (1.539)>Herbaria (0.95)>Akram point (0.743)>Sutarkhali (0.551)>Hiron point (0.294) (**Figure 3.18**).



**Figure 3.18: Location-wise species diversity**

#### *Carbon stock in trees*

When the carbon stock (mt/ha) of mangrove stands in different Sundarban regions was compared, it was shown that the Sutarkhali range had the highest carbon stock, with 4215 mt/ha and a recruit density of 106 trees/ha. With a recruit density of 38 trees/ha, Karamjol has the lowest carbon stock (1052 mt/ha). With a carbon stock of 2965 mt/ha, Hiron point was discovered to have the second-highest carbon stock. With a density of 66 and 70 trees per hectare, carbon stocks in Harbaria and Akram Point were determined to be 2433 mt/ha and 1838 mt/ha, respectively. Carbon stock, on the other hand, showed a substantial (ANOVA, P0.05) variance across five sites. Sutar Khali> Hiron Point> Harbaria> Akram Point> Karamjol> Sutar Khali> Hiron Point> Harbaria> Akram Point> Karamjol> Sutar Khali> Hiron Point> Harbaria> Akram Point> Karam (Figure 3.19). The difference in the carbon stocks in the vegetation biomass of mangrove systems in different zones may be attributed to the structural peculiarities of the stands in each region (Kasawani et al. 2007).



**Figure 3.19: Carbon stock in five (5) plots**

#### *Status of Forest Health Indicator*

Trees of swamp habitats or those subject to tidal flooding, such as mangroves, often have specialized root systems, called pneumatophores, which often are involved in gas exchange. The number of pneumatophores decrease in all sample plots from the previous year monitoring period but there is no significant variation ( $p>0.05$ ) in pneumatophores density over the monitoring period for each PSPs (Figure 3.21). This indicates that forest health condition is not deteriorating in terms of steady state condition of pneumatophores density over time.



Measuring Canopy cover and (Diameter at Breast Height ) DBH at Karamjal



Crab hole counting



Measuring sapling diameter



Data entry at Harbaria Point

**Figure 3.20: Surveying the forest health indicators**

Crab hole number increased in all plots except Harbaria over the previous year observation period but no significant variation found ( $p > 0.05$ ) in each plots from previous monitoring period (**Figure 3.21**). This suggests that crab activity rises at the forest floor, causing the soil to become more aerobic, allowing for faster decomposition of organic matter. Crab density is influenced by the weather. Crabs may be unable to migrate to their breeding sites due to heavy rainfall or an intrusion of too much freshwater.

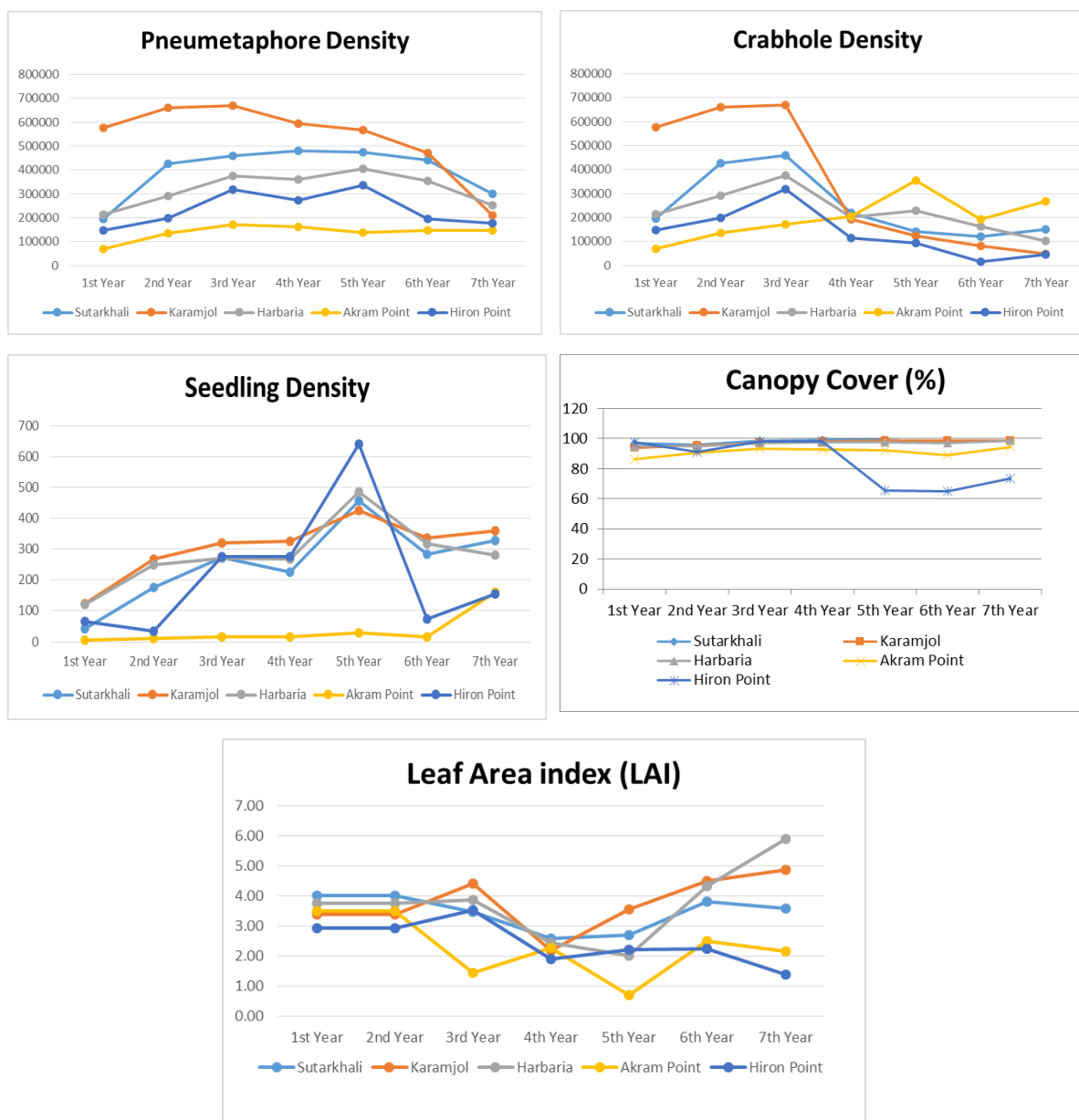
An increasing trend of seedling survival was found in all sites from previous year monitoring period and seedling density varies significantly ( $P < 0.05$ ) from previous all monitoring period (**Figure 3.21**). This is because of the time of seed germination and seedling survival in the observed PSPs.

Canopy coverage is nearly same in all sites except Hiron point but did not differ significantly ( $P > 0.05$ ) from the previous all year monitoring period. Canopy overage in Hiron point decrease after 4<sup>th</sup> year monitoring period (**Figure 3.21**). This is may be due to the top broken of Gewa and Sundari as the plot was observed carpeted by sand during monitoring period.

The LAI (Light Area Index) influences daily rate of net canopy photosynthesis which results in exchange of atmospheric CO<sub>2</sub>. The minimum the ratio of under canopy to open canopy light intensity value indicates the maximum LAI. There was significant difference ( $P < 0.05$ ) observed of leaf area index at all PSP's (**Figure 3.23**). It was found that the LAI fluctuates in all monitoring locations from previous census period.

There were no changes observed in phenological behavior of the dominant tree species during the monitoring period. Diseases in trees can also be used as forest health bio-indicator. A number of diseases has been identified by researchers as chief causes of population decline of the tree species *Avicennia* spp., *Rhizophora* spp., *Heritiera* spp., *Pandanus* spp., *Phoenix* spp. and *Acanthus* spp (Rahman et al. 2010). Certain important diseases of Sundarban mangroves are leaf blight, Dieback, stump and collar rot, trunk gall, root rot, leaf blight, leaf necrosis, powdery mildew (Rahman et al. 2010). However, in the present study,

'top dying' of Sundari and bark hollow of gewa was observed in all the PSPs. Almost most of the Sundari trees were suffering from 'top dying' disease.



Note: Each year represent average of four monitoring periods.

**Figure 3.21: Seedling Density, Pneumatophore, Crab Hole Density, LAI and Diameter Increment (DBH) over different census period**



## 4. Social Environment

### 4.1 Introduction

Social safeguards refer to the policies, procedures, and measures intended to mitigate unintended negative impacts of the development projects. This safeguard monitoring is a follow-up study that occurred following the guidelines of DoE and Environmental Management Plan (EMP), suggested in the Environmental Impact Assessment (EIA) Report.

The objective of the social safeguard monitoring is to ensure compliance during the project's construction phase. The monitoring held to check the compliance status of the working environment, community safety and security and impact on livelihoods (due to project intervention), and status of Corporate Social Responsibility (CSR). Additionally, the Corrective Action Plan (CAP) suggested addressing the non-compliance issues based on the findings of the safeguard monitoring.

### 4.2 Methodology

This monitoring was conducted using social data collection tools. There is consultation, informal interviews, and structured observation applied to collect data from the study area as well as the project management unit. The consultation meeting was held at the MSTPP, whereas project officials attended and provided feedback based on the checklist. The locations of Socio-economic aspect monitoring are shown in **Figure 4.2**. However, informal interviews and physical observation were held with the workers and local people. The informal interview was carried out at Zero Point, Kapasdanga, Rajnagar, Bajua, Gaurambha, Pankhali, Foylarhat, Borodurgapur and Rajnagar getting people's opinions about the safeguard issues.

### 4.3 Results of Social Safeguard Status

#### *Impact on Employment and Livelihood*

According to the local inhabitants and the Project Management Unit (PMU), engagement of labourers was increasing, but presently, it is decreasing because of less work volume at the construction site. However, it is estimated that about 15% local labor force is working (during this monitoring phase) at the project site, according to the Project Management Unit (PMU). Besides, the employment opportunity increased because of the fully equipped access road, bazar at the zero point, and other development initiatives (i.e. small industry, solar power plant etc.) adjacent to the project area. In addition, local people are trying to make some scope to develop business opportunities which become only possible due to the project intervention. Moreover, people from outside the area made some temporary shops, which is also remarkable for getting earning opportunities for local inhabitants. Additionally, about 270 people were registered (under the motor vehicle federation) to run motor vehicles (i.e. easy bike, auto rickshaw and Van) at the approach road to carry both goods and passengers. As a result, it helps people to involve more earning opportunities than the previous time. According to the vehicle federation, "now we have paved roads due to this project intervention; because of that number of vehicles increased that made a scope of earning for us". The number of vehicles for carrying passengers and goods increasing because of the development activities associated with the MSTPP. Furthermore, local people started thinking to be skilled and also started learning welding, machinery works, electrical works to catch the future jobs related to the project as well as other scopes that will be developed in the future in this area.

#### *Working Environment*

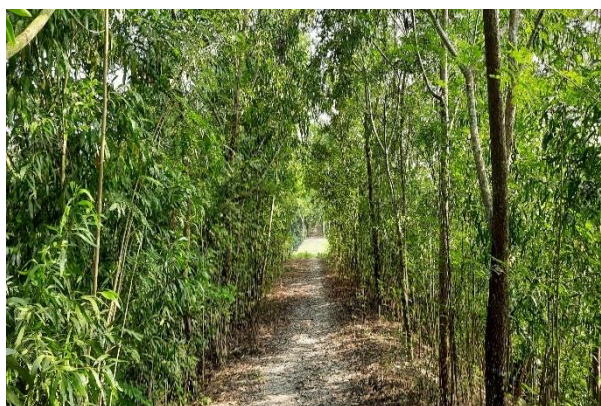
This pandemic situation made some learning for the laborers working at the project site. Without having masks, no laborers cannot get entrance the project site. Local laborers got training to use hand sanitizer or soap to ensure safety from the coronavirus at both the project site and labor colony.

The PMU regularly monitors the safety issues keeping a good and friendly working environment. The tri-party coordination meeting was held with all safety officers from BIFPCL, BHEL, and other construction

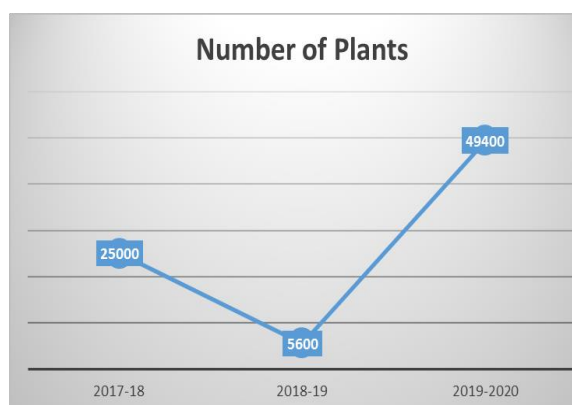
companies to ensure compliance with the working environment. Regular toolbox training is held every day before starting the construction activities. However, the “no training” and “no work” campaigns continue. The PMU monitors the issue, and without getting a pass from the safety exam, no new laborers can join as a working force at the project site. Labor sheds were found clean with adequate toilet facilities of drainage, waste management, and drinking water facilities.

#### *Community Health*

During the monitoring period, no grievance found from the local community due to the project construction activities. Usually, water sprays the whole day for suppressing dust when the roads become dry every day. According to the field findings, the local communities at Gaurambha, Rajnagar, and Bajua union local people are not encountering noise problems due to the construction activities of MSTPP. However, the PMU is trying to ensure a green environment following the conditions of DoE. In this regard, a total of 80,000 (Figure 4.1) mangrove, fruits, coconut, and herbal plants planted around the project area in different fiscal years. Local people stated that though the plantation program is ongoing, the survival rate is not good. So it is urgently required to take the additional steps. Recent observations stated that the plants grown in the Rampal area had made a green environment on the east side of the plant. A caretaker from the Forest Department is involved and stay here day and night to monitor the plants of this green belt zone. According to the caretaker, after the plantation of mangrove trees, it is happening that more mangrove trees are growing naturally. Because of that, the number of plants is increasing day by day, and the forest coverage is potentially increasing, changing the environment of this area.



Source: BIFPCL, November, 2021



**Figure 4.1: Green Belt at the MSTPP and Number of Plants Planted in Different Fiscal Year**

#### **4.4 Corporate Social Responsibility (CSR)**

The BIFPCL is committed to continue the activities under the CSR. It made a significant impact to the community in which community people get better interaction with the project. However, the CSR was the part of operation phase but it was observed that the BIFPCL committed to organize different programs during the phase of construction. They have been conducting medical campaigns along with different socially demand-based programs. They allocated vaccination program under the CSR in which officials and labor force got vaccinated.

#### *Traditional Cultural Program: Puppet Show and Drama*

Retrieving local traditional culture, a puppet shows and drama organized by UNO Rampal. This program was financed and coordinated by the MSTTP. The objective of this program is to aware people about the traditional culture. In this ground, this fund was allocated from CSR fund of MSTPP. Local people enjoyed and praised to continue this kind of activities (Figure 4.3).



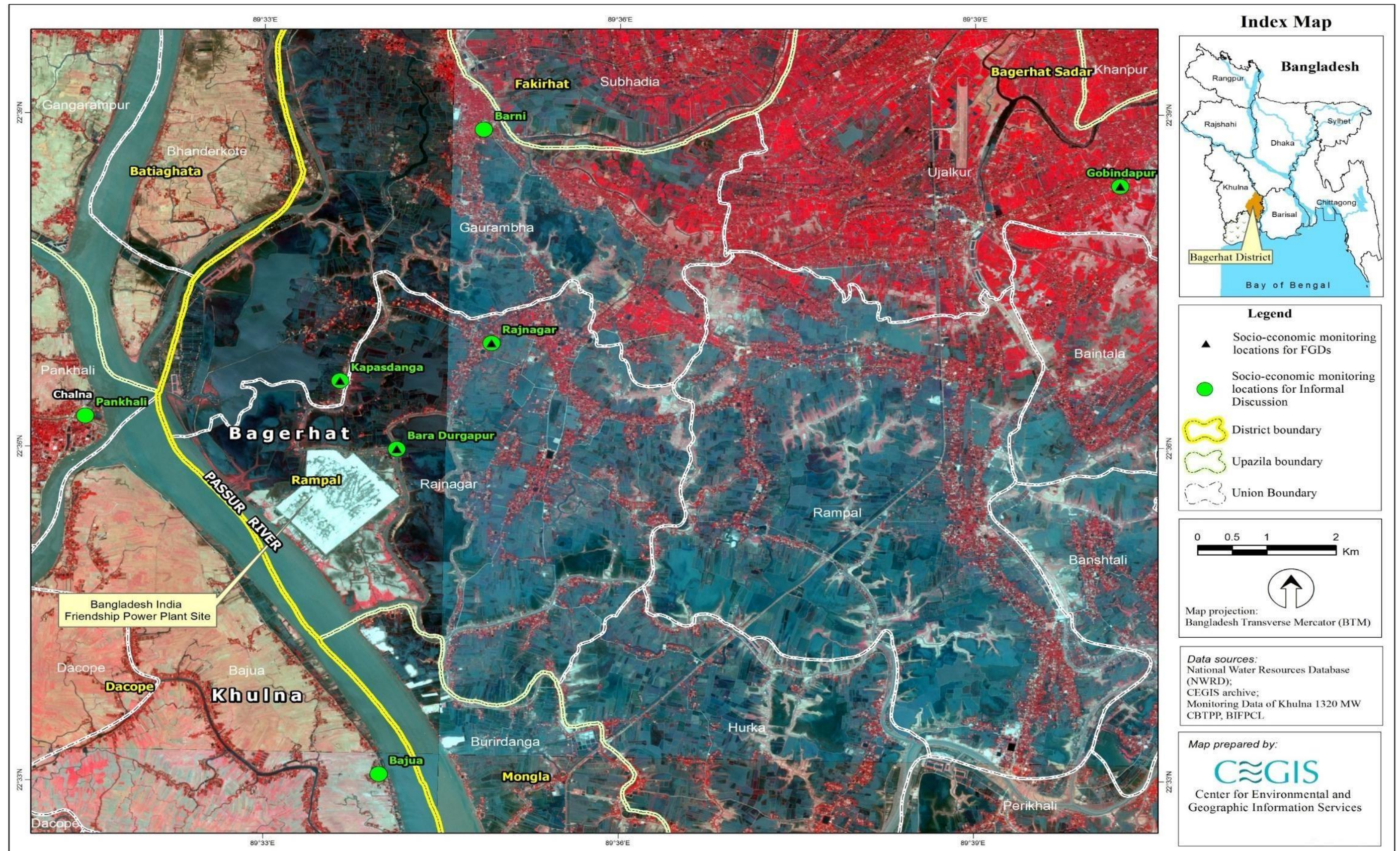


Figure 4.2: Socio-Economic Environment Monitoring Location







Figure 4.3: Local people enjoying the Puppet Show and Drama

#### Education Kit Distribution

A cub holiday program of Bangladesh Scouts was organized at the Rampal Upazila whereas education kits (i.e. book, pencil, pen, gaming instruments etc.) distributed among the students. This program was organized by the Bangladesh Scouts, Rampal, Bagerhat and financed by the MSTTP (Figure 4.4).



Figure 4.4: Cub Holiday Program and distribution of education Kits

#### Covid 19 Response and Vaccination Program

The PMU has brought an extraordinary contribution to tackle the Coronavirus taking some responsive measures. Under the CSR program, the PMU made a special medical unit to mitigate the impacts of Covid 19. A total of six (6) oxygen cylinders and medicines bought to tackle the emergency situation and covid patients. A mini hospital with modern equipment, ICU bed and permanent doctor, inaugurated by the PMU. Here, project officials and affected or injured labors get the emergency support. This help to make safeguards for officials as well as the construction workers. Additionally, leaflet in both Bengali and Hindi languages were distributed among the local and international labors. This help them to raise awareness to mitigate the risks of coronavirus (Figure 4.5).

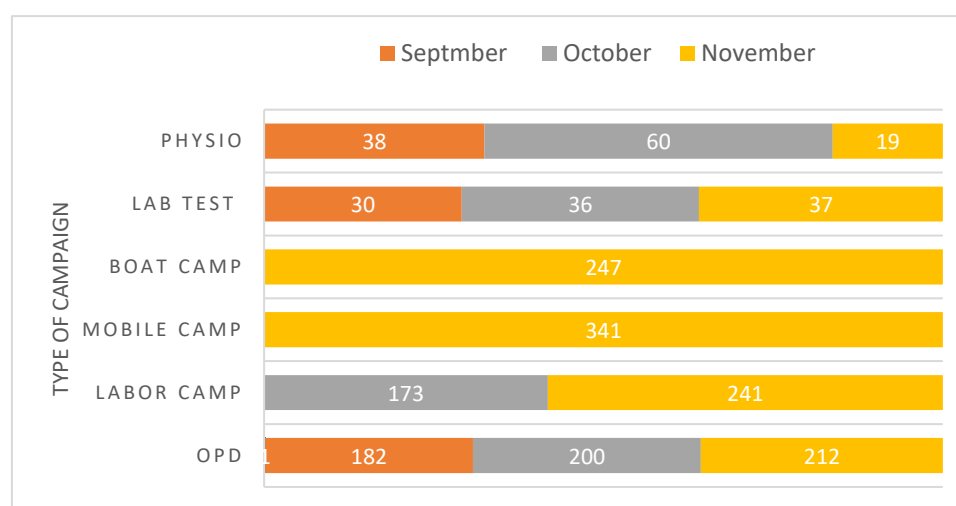




**Figure 4.5: Inauguration of Niramoy Medical Center at the project site**

### *Medical Campaign*

Medical campaign is one of the major program under the CSR of MSTPP. From September to November 2021, a total of 1816 people (**Figure 4.6**) received free treatment under the OPD, mobile, boat, labor colony medical campaign and services from the medical center. According to the officials of MSTPP, till now (November 2021), a total of 59,309 people received free treatment from different medical campaign.



Source: PMU, MSTPP, November 2021

**Figure 4.6: Medical Campaign from August - November 2021 under the CSR**

## **4.5 Recommendations**

- Involve more local work forces by building capacity to them on plumbing, masonry, carpentering, electrician & electronics, welding, driving, safety, rock binding, and machineries as they can be prepared as semi-skilled working force for this project;
- It is required to establish a grievance redress team to monitor and solve the problem of localities regarding the aspect of construction activities of MSTTP;
- Local people are not aware how they can involve in the construction activities; because of the GAP, local people join through the 3<sup>rd</sup> party. As a result, grievance raised from the local people. Therefore, it is very much required to launch some awareness program especially on labor recruitment process, as they can understand the issue easily.
- A gender action plan regarding the women employment is required for the local communities;

- 
- e. The coverage of training on women skill development is required to be strengthen as more women can participate at the programs;
  - f. A group of people rehabilitated at the Kapasdanga Mauza, but they have no proper sanitation and drinking facilities. Therefore, it is suggested to take steps to make available proper drinking and sanitation facilities; A deep tube and wash block can be established, according to the rehabilitee at the Kapasdanga Mauza under the CSR;
  - g. Regular refilling is to be continued for making the desired and committed greenery effectively as per conditions of DoE;
  - h. Continuing regular health checkup and disease monitoring for the daily laborer at work place as well as for the laborer staying at labor colony;
  - i. Special attention should be given on `workers if they have any syndrome related to the COVID 19;
  - j. CSR activities should be performed primarily among the PAPs on equitable manner. This should be audited by a third party monitoring team;
  - k. Ensure proper safety equipment for combatting against the COVID 19 virus;
  - l. Create awareness about the Coronavirus disease (COVID-19);
  - m. Wash hands and face immediate after entering the office substation from outside;
  - n. Ensure masks for everyone who are working at the Project site;
  - o. Health temperature should be checked before entering the Project site;
  - p. Avoid (as much as possible) public transports, if possible, walk on foot;
  - q. All officials and workers should be vaccinated to prevent the spread of coronavirus;
  - r. Social distancing should be maintained in the labor shed as well as in the Project site;
  - s. Paste poster on how to work during the COVID 19 situation for raising more awareness;
  - t. Rehabilitees should be given preference in implementing CSR program as they are under serious threat of another shifting;
  - u. Dust suppression by spraying water should be continued on construction sites, and other places where necessary to suppress dust and minimize air pollution; Special monitoring team required to monitor the dust pollution;
  - v. River water should be used for dust suppression activities and ground water use should be avoided completely;
  - w. The PMU should be active and efficient in maintaining vehicle speed limits in the Project site;
  - x. PAPs should be given priority in recruitment of manpower based on their skills;
  - y. Special attention should be taken to introduce new programs under the CSR;
  - z. Special attention should be taken care for assessing the needs to local schools and colleges for implementing different programs under the CSR;
  - aa. People are more positive about the project. To increase more awareness, it is required to arrange some consciousness program in which they can be more aware how this power plant will be operated and how this project will be beneficial for the local people;
  - bb. Local people are becoming aware about the new entrepreneurship development in this area; in this regard, training on entrepreneurship development should be arranged under the CSR activities;
-

- cc. Digital Billboard about the MSTPP work progress status, and operation system would be placed on the road side to create more awareness about the construction and operation of the MSTPP.
- dd. It is required to arrange program at schools, high schools and colleges about the operation and impact of the power plant to disseminate the progress of the project and create more awareness about the MSTPP;

## 5. Environmental Compliance

### 5.1 Introduction

Environmental monitoring has been conducted during the month of November 2021. All of the bio-physical parameters have been monitored through rigorous field visit and lab analysis. The environmental compliance monitoring was conducted in the mid of COVID pandemic as Government of Bangladesh has relax all the restrictions that was imposed to manage the spreading of COVID-19 virus. At this time, the environmental compliance monitoring of Maitree Super Thermal Power Plant Construction has been conducted through face to face interviewing, filed investigation, document checking and stakeholder consultation to fill-up questionnaires.

The construction works is running amply amid the COVID situation. Most of the mechanical and electrical construction works are progressively installing. The Boiler, Turbine hall and Generator, cooling tower, Chimney and FGD, ESP, WTP, ash silo, 275 chimneys, Jetty area, covered coal storage, covered coal conveyer system, township area, internal road networks, permanent drainage networks are developing. EPC contractor i.e. Bharat Heavy Electricals Limited (BHEL) employed different local specialized sub-contractor i.e. KELLER, AFCON, POWER MAC etc. for progressing the construction works simultaneously.

The bridges and culvert area of the approach road has completed and extended up to the Block-B Permanent entrance gate of the MSTPP power plant structure has been placed at the security check point. The main Administrative center of BIFPCL and EPC contractor were shifted to the newly constructed buildings and maximum professionals of BIFPCL were shifted to the newly constructed township named Padma Abason.

According to the project planning, the first unit of Maitree Super Thermal Power plant will be in operation by September 2021. But unfortunately, the COVID-19 outbreak has retarded the project progress upto June 2022. Though, the project work was almost halted at the end of the March 2020, it came into full pace in July 2020. But, the second lockdown, has again slowdown the construction works. However, the construction activities are progressing the project site strict maintaining the Government Decision on COVID Guidelines. EPC tried to expedite the contractors and sub-contractors for completion of the project works within the stipulated timeframe maintaining the instruction and health safety guideline of the existing pandemic.

However, the present environmental compliance monitoring includes the status of EMP implementation based on physical observation, investigation and interviews/discussion to the proponents and project officials, contractor or sub-contractors, or relevant authorities. A comprehensive due diligence checklist was prepared to monitor the environmental compliance of different components e.g., Environmental and Social Management System and Action Plan; Labor and Working Condition; Community Health, Safety and Security; Biodiversity and Sustainable Management of Living Natural Resources.

The aim of this compliance checklists is to check the implementation and effectiveness of mitigation measures as stated in EIA. The checklists are produced as Compliance Data Sheet that contains both quantitative and qualitative data. The summary of findings of the environmental compliance monitoring are presented in the following **Table no. 5.1, 5.2, 5.3 and 5.4** respectively. And the compliance status to the DoE conditions for Power Plant study as well as Coal Transportatoin study has been presented in **Table 5.5 and 5.6**.

**Table 5.1: Monitoring of Environmental and Social Management System Action Plan Implementation**

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
1	Generation of Noise within the BIFPCL's Plant construction premises.	<ul style="list-style-type: none"> <li>Switch off / throttle down all site machinery, vehicles, water vessels, and generator when not in use</li> <li>No construction activities at night</li> <li>Use noise damper within the project boundary, Limit vehicle speed and monitor it at every suitable point.</li> </ul>	<ul style="list-style-type: none"> <li>Noise data are being monitored monthly and quarterly basis both night and day time at different potentially sensitive areas and compared with the ECR-2006 Standard which are being documented by EPC contractor.</li> <li>Noise levels were found within the permissible limit near the project boundary.</li> <li>Vehicular speed is being maintained in the project site</li> <li>Workers at heavy noise generating activities (i.e., piling, rod cutting etc.) have been provided PPE (ear plug and ear muff) and its usage are being insured through safety audit clearance before start of work on every day.</li> <li>Silenced equipment's were utilized.</li> <li>Idle machines / equipment / generators are switched off/throttled down.</li> <li>Uses of noise damper has been ensured inside the project boundary.</li> </ul>	Complied	<ul style="list-style-type: none"> <li>If construction activity would prolong at night, additional measures to be adopted to limit noise (within permissible standard).</li> </ul>
2	Dust generation from construction works	<ul style="list-style-type: none"> <li>Limiting activities for producing fugitive dust particle within project area</li> <li>Vegetation clearance and base stripping should be minimized.</li> <li>Vehicle speed restriction must be enforced to control dust generation.</li> <li>Earthen roads and undeveloped roads should be avoided to minimize dust generation</li> <li>Construction materials must be covered to protect from wind action</li> </ul>	<ul style="list-style-type: none"> <li>Monthly and quarterly air quality monitoring in and around the project sites is being conducted and checked with ECR, 2005 standard.</li> <li>Mixing machine may generate localized dust during cement and concrete mixing. But all the crashing and storage of materials were recorded wet.</li> <li>Maintaining the vehicular speed</li> <li>Regular water spraying is being conducted by two tankers from 9:00 am to 5:00pm in the project area as per requirement to suppress fugitive dust.</li> </ul>	Complied	<ul style="list-style-type: none"> <li>Stockpiles of dusty materials should be covered/watered for the coming dry season</li> <li>Face mask must be used wear throughout the workplace especially for this pandemic situation</li> </ul>



Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> <li>Spray water regularly for suppressing fugitive dust</li> <li>Dust particle generated from access road must be controlled by spraying water during dry season.</li> <li>Stock piles of construction materials must be covered in order to protect from wind action.</li> <li>An appropriate freeboard must be maintained in trucks hauling construction materials.</li> </ul>	<ul style="list-style-type: none"> <li>Substantial warning sign, speed limit and convex mirror have been displayed at the strategic locations.</li> <li>Monitoring of pollution control systems are done on a regular basis.</li> <li>All vehicles are carrying dusty loads are not covered / watered prior to leaving the site.</li> <li>No black smoke observed because of plant and equipment are well maintained.</li> <li>Visual monitoring of dust is also being conducted.</li> </ul>		
3	Water Quality	<ul style="list-style-type: none"> <li>Surface water must be saved from any harmful effluent emission and waste dumping from project site</li> <li>Provide closed system facilities and wastewater treatment plant to minimize discharge of effluents from worker's colony.</li> <li>Good housekeeping at workshop and construction site</li> <li>Appropriate equipment with safety measures should be used for storage and handling of lubricant</li> <li>Provide training and awareness building program to the workers during construction. The training and awareness programs are:               <ol style="list-style-type: none"> <li>Arrange weekly consultation session among the workers through plant site managers. The duration of consultation is one hour according to ISO-14001 standard,</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Surface water is regularly monitored. The discharge water quality has been recorded within the standard limit (ECR, 1997)</li> <li>Surface concreting is being done at places where equipment is coming.</li> <li>Ground water is not used for construction purpose.</li> <li>Construction waste water discharge is minimum and need based only. They are also meeting effluent norms.</li> <li>Permanent drainage for water discharge has been constructed. Some are already in operation.</li> <li>Closed system facility and wastewater treatment system on site and worker's colony is under construction.</li> <li>Silt trap has been prepared which is controlling the sediment discharge to the nearby river system</li> <li>Chemical components like caustic soda, and acid have been placed in confined site</li> <li>For chemical storage license has been taken from the District Commissioner (DC) office, Bagerhat and Gaseous License has taken from the Department of Explosion.</li> </ul>	Complied at present	<ul style="list-style-type: none"> <li>Good housekeeping at workshop and construction site should be continued</li> </ul>

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		Arrange monthly environmental meeting among the mid-level officers through top management when those issues will be discussed under guidance of ECR 1997.	<ul style="list-style-type: none"> <li>• Training and awareness program are being conducted regularly through PEP talks, lectures, one to one talk etc.</li> </ul>		
4	Waste Generation	<ul style="list-style-type: none"> <li>• Limiting site clearance and base stripping activities within the project boundary.</li> <li>• Gathering and stocking of construction materials and machinery must be within a limited area in the project boundary.</li> <li>• The project area has to be fenced prior to initiation of construction activities.</li> <li>• Stock piles of construction materials requiring cover up in order to protect them from wind and weathering action.</li> <li>• The existing right of way have to be used for material transportation without creating any block</li> <li>• Location of spoil stock pile ought to be located in safe area and protected from wind and rain action.</li> <li>• No spoil store on River bank/slope</li> <li>• Construction wastes must be reused or recycled as and where possible</li> <li>• Burning of waste material should be restricted</li> <li>• Quality housekeeping practice must be maintained by regular inspection and checking.</li> <li>• Keep onsite waste collection and disposal facilities</li> <li>• Keep provision of different colored waste bin for dumping biodegradable, reusable and recyclable wastes.</li> </ul>	<ul style="list-style-type: none"> <li>• Construction wastes are being collected and put at demarcated places in limited scale.</li> <li>• The project area is being tightly protected.</li> <li>• The specific site for waste disposal were relatively kept clean.</li> <li>• Onsite waste collection and disposal facility has been observed.</li> <li>• Heavy / mechanical equipment is kept at demarcated places.</li> <li>• Wastes are not segregated and not kept in separate labelled container despite 625 bins have been established.</li> <li>• Burning of waste materials was not recorded inside plant.</li> <li>• Battery and iron waste are collecting separately</li> <li>• Chemical wastes are properly stored and labelled.</li> <li>• Proponent has engaged a company name Rahman Brothers in collaboration with the KCC for collection of waste from the disposal.</li> <li>• Waste management training has been included in induction training of the labor.</li> <li>• Local languages (Bengali) and English are being included in the signboards.</li> <li>• There development of solid waste management system has been progressing gradually according to the clause no B12, Part no 9 of book no -2, page no 147-161. In The waste management system has to be prepared through collection, waste segregation at source, recycling, treatment and disposal of waste.</li> </ul>	Complied	<ul style="list-style-type: none"> <li>• Awareness raising programs regarding waste segregation should be introduced.</li> </ul>

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> <li>Keep provision of awareness building meeting and training for employees</li> </ul>			
5	Compensation and Resettlement	<ul style="list-style-type: none"> <li>Proper resettlement action plan and compensation plan if the Project needs any land acquisition addressing compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies.</li> <li>Resettlement of the PAPs</li> <li>Cash for compensation of land (CCL) before resettlement formal agreement with the affected people prior to migration/resettlement</li> <li>Sufficient standing crop compensation</li> <li>Compensation for movable structures</li> <li>Retention of salvageable materials</li> <li>Compensation for loss of trading income one-time moving assistance grant to cover loss of regular wage income</li> <li>Has a resettlement plan been developed which includes compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies?</li> <li>Human provide/ take extra care/caution for the disadvantaged/ vulnerable group/s (i.e. women, children, ethnic minorities, indigenous people etc.)</li> </ul> <p>Provision of monitoring the compensation and resettlement process</p>	<ul style="list-style-type: none"> <li>Compensation has been given to the rightful owners of the land as per the laws of Bangladesh e.g., 'Acquisition and Requisition of Immovable Property Ordinance, 1982'.</li> <li>Compensation was paid by the local DC office as per law of the land.</li> <li>Local DC office facilitates to obtain house of the PAPs (settlers of the project area) in cluster villages provided by the GoB.</li> <li>Almost 32 affected families are now having their houses at Foyla cluster villages.</li> <li>BIFPCL is giving priority to affected people in project employment or trained them as much possible.</li> <li>A significant number of affected people (especially who deserve) are working at the construction site.</li> <li>136 indirectly affected people were given compensation by the DC Office, Bagerhat.</li> <li>One fourth of the labor has been recorded from the locals.</li> <li>The project authority is planning to give training on computer and swing to the nearby villagers including PAPs which after reducing the COVID cases</li> <li>17 families got their residence who have shifted their houses from project area to Kapashdanga.</li> </ul> <p>The project authority has developed plans to monitoring the resettled PAPs</p>	In the process of Compliance	<ul style="list-style-type: none"> <li>The CSR activities should be oriented towards the affected people or household;</li> </ul>
6	Livelihood and living condition	<ul style="list-style-type: none"> <li>The labor recruitment policy must be formulated in such a way that the local</li> </ul>	<ul style="list-style-type: none"> <li>BIFPCL are recruiting the local people especially PAPs with the help of local government.</li> </ul>	Complied	<ul style="list-style-type: none"> <li>Health facilities and financial support should be available for the labour in</li> </ul>

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<p>laborers can easily get the chance of employment in the project work force.</p> <ul style="list-style-type: none"> <li>Govt./NGOs need to provide support the skill development program and income generation activities to local people;</li> <li>For the increased movement of people and heavy vehicles, the road networks must be developed.</li> <li>Keep provision of sanitary toilet, one toilet for 10 persons.</li> </ul>	<ul style="list-style-type: none"> <li>Accidental log sheet or injury log book are being maintained.</li> <li>Provisions has been kept for health facilities to the labors as well as for the communities.</li> <li>Proponent has taken numbers of potential measures for COVID protection which is continued</li> <li>The wage of the labor was found compatible with the national standard.</li> <li>Facemask and other sanitation facilities are provided for the labors and employees in association with medical check-up by the authority</li> <li>Available drinking water, sanitation facilities, prayer room are provided at site.</li> </ul>		case of COVID and other health effects.
7	Green House Gas Controlling Measures	<ul style="list-style-type: none"> <li>Restriction of any kind of solid waste disposal</li> <li>Approved pollution control devices to be fitted in equipment and machinery.</li> <li>Transport vehicles must not be overloaded.</li> <li>Avoid queuing of vehicles in areas adjacent to site, particularly near sensitive receptors including housing.</li> <li>Switch off / throttle down all site vehicles, water vessels, generator and machinery when not in use.</li> <li>Regular maintenance of water vessels, vehicles, generator and machinery in accordance with manufacturer's</li> </ul>	<ul style="list-style-type: none"> <li>Fitness certification of vehicles and equipment are lacking for the construction works</li> <li>The EPC Contractor using relatively new equipment and vehicles to reduce the GHGs emission.</li> <li>Energy efficient equipment like light, AC and other equipment are used.</li> <li>Equipment, generators and vehicles were observed switched off during non-operation period.</li> <li>Vehicles are maintaining the road safety regulations and</li> <li>No GHG inventories were prepared yet.</li> </ul>	Partially Complied	<ul style="list-style-type: none"> <li>GHGs inventory checklist should be prepared;</li> </ul>

Table 5.2: Monitoring of Labor and Working Condition

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
1	Working Conditions and Management of Worker Relationship	<ul style="list-style-type: none"> <li>• Preparation of Human Resources Policies and Procedures for Direct workers;</li> <li>• Defined Working condition and Terms of Employment for direct worker;</li> <li>• Sustainably equivalent terms and condition for migrant workers;</li> <li>• Compliance to national law of forming workers' organization;</li> <li>• No discrimination and equal opportunity for all;</li> <li>• Grievance Redress Mechanism.</li> </ul>	<ul style="list-style-type: none"> <li>• BIFPCL is run through the HR polices and switching their professionals as per demand of the project.</li> <li>• EHS department has been established where Environment, Health and safety issues are taking care</li> <li>• Electric system and firefighting facilities are properly maintained</li> <li>• Accidents, incidents, near miss, corrective actions, preventive measures, are reviewed and recorded.</li> <li>• In total 11 officers have been employed for safety, fire and environment section.</li> <li>• The OHAS Company named Cholamandalam has been looking into the occupational safety system of this project.</li> <li>• The EHS department is also monitoring and the occupational health safety issues carefully under this COVID situation.</li> <li>• No major accident has been recorded from the last monitoring period except few injuries</li> <li>• No discrimination was recorded among at labor level between local or migrating labor in Bangladesh</li> <li>• BIFPCL has ensured minimum wage and working hours for the labor as per GoB rules and regulation.</li> <li>• Routine medical checkup and emergency medical care has been ensured.</li> <li>• Induction training and regular training of first aid, toolbox are being Continued in association with COVID management guideline.</li> </ul>	Being Complied	<ul style="list-style-type: none"> <li>• To develop labour association protecting labour interest</li> <li>• Create fund to support the labour/his families in case of any fatalities</li> <li>• Investigate the payment of recruited labour though sub-contractor or local contractor</li> </ul>



Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
2	Protecting Work Force	<ul style="list-style-type: none"> <li>The client will not employ children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child health or physical, mental, spiritual, moral, or social development.</li> </ul> <p>No Forced Labor</p>	<ul style="list-style-type: none"> <li>EPC contractors and sub-contractors are not employing any child labor in the project area.</li> <li>No forced labor has been recorded in the project.</li> <li>Proper documentation of contract with the worker is being maintained which includes working hour, wage and benefit.</li> <li>First Aid support is provided to the labors as required.</li> <li>Wearing the PPEs on the site is mandatory on this pandemic situation</li> <li>Work in hot condition and height need another permission</li> <li>Sanitization is being done at regular intervals at Offices and labor sheds</li> <li>Workers must get the safety clearance before initiating any work like – routine checkup of the work places and administrative clearance</li> <li>Awareness about Covid-19 is being spread among workers and office support staff.</li> </ul>	Being complied	<ul style="list-style-type: none"> <li>Awareness work should be continued regarding the local cultural values, STD, redressing of worker's grievances, insurance policy related facilities and also contract clauses of the job to get maximum benefit.</li> <li>Keep watching about the use of drug in the labor camps</li> </ul>
3	Safety at site	<ul style="list-style-type: none"> <li>Installation/Construction of Safety Fence around the Project area</li> <li>Use of Personnel Protective Equipment's (i.e. safety vest, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.);</li> <li>Safety trainings for workers (i.e. fire control, working at height, working in heat, first aid etc.);</li> <li>Practice of Tool box meeting, safety talks</li> </ul>	<ul style="list-style-type: none"> <li>BIFPCL has demarcated the specific construction site with warning sign;</li> <li>Basic Medical care with free medicine and counseling is being provided to workers on regular basis at site.</li> <li>Labors and Project personnel are using appropriate PPEs like reflecting vest, helmet, and safety shoes etc. But they are lenient to use face mask around throughout the working hours.</li> <li>The existing temporary hospital are fully running with doctors and 24hr availability of ICU supporting ambulance at the Project site;</li> </ul>	Being Complied	<ul style="list-style-type: none"> <li>Monitoring about PPE and body temperature of labors.</li> <li>Musk have to be compulsory for each of the worker.</li> <li>Isolate the labour in case of COVID positive</li> </ul>

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> <li>• Safe Storage of Hazardous Chemicals (e.g. fuel, flammable chemical, toxic chemicals, etc.);</li> <li>• Maintaining Material Safety Data Sheet (MSDS);</li> <li>• Provision of Health care facilities such as doctor, hospital etc. available at/nearby the Plant construction site;</li> <li>• Availability of First Aid at work place;</li> <li>• Preparation and Follow of Emergency Response Plan (ERP);</li> <li>• Adequate fire precautions in place (e.g., fire extinguishers, escape routes etc.);</li> <li>• Documentation and reporting of occupational accidents, diseases, and incidents;</li> <li>• Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS</li> </ul>	<ul style="list-style-type: none"> <li>• Emergency contact address was found on the board at the site for any kind of sudden incident;</li> <li>• Weekly checking of all the safety records and implementation of HIRA at site.</li> <li>• The proponent arranged a meeting once in a week with EPC contractor on safety measures and follow up actions.</li> <li>• EPC has made a contract with the Gazi Medical of Khulna city for emergency medical support.</li> <li>• The major construction work at site has been performed in presence of safety officer.</li> <li>• Fire extinguisher was found sufficiently at required places.</li> <li>• Medical checkup is mandatory for all employee before starting the work at the project site.</li> <li>• They are arranging COVID vaccination program for the officer and encourage the labours to take COVID vaccine early basis.</li> </ul>		
4	Occupational Health and Safety procedure	<ul style="list-style-type: none"> <li>• Provision of complete EHS division in the Human Resources Planning/ Organogram</li> <li>• Preparation of Safety Policy to be adopted during Plant operation</li> </ul>	<ul style="list-style-type: none"> <li>• Adequate number of safety officers have been employed by the EPC contractor and Sub-contractors.</li> <li>• One safety park has been established for continual training as well as training during induction level.</li> <li>• The necessity of PPE and safety protocol has been displayed at signboard which are need to be re-installed</li> <li>• Medical aid, fire extinguishers, PPEs are being provided adequately.</li> </ul>	Being Complied	<ul style="list-style-type: none"> <li>• Continued the safety training, buildup the awareness and make the labour habituated with the safety procedure</li> </ul>

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			<ul style="list-style-type: none"> <li>Regular Safety talk, safety meetings are being organized at site and also in class rooms. Photo are being attached.</li> <li>Keys safety instruction has been hanged at the eye sight places.</li> <li>Adequate safety bill-boards etc. have been displaced all over the construction area.</li> <li>Speed barriers are being instructed by substantial warning sign, speed limit and convex mirror have been displayed at the strategic locations.</li> </ul>		
5	Workers Well Being	<ul style="list-style-type: none"> <li>Provision of Welfare facilities for Worker/Labor such as, timely bonuses, wage, overtime, sick leaves, vacations etc.;</li> <li>Routine medical check-up and emergency medical care for the sick and injured;</li> <li>Appointment of a leader amongst the labor group, who will look into workers' well- being.</li> </ul>	<ul style="list-style-type: none"> <li>Workers are generally satisfied with the residence facilities</li> <li>BIFPCL has developed apps <a href="https://bifpcl.com/safety.aspx">https://bifpcl.com/safety.aspx</a> for stepping up the safety issues well.</li> <li>BIFPCL has ensured the benevolent grant for the victim's family as per Government' rule.</li> <li>Basic services like food, medicines, hygiene etc. are being ensured in labor colony</li> <li>Basic Medical care with free medicine and counseling is being provided to workers on regular basis.</li> <li>Grievance of the workers were usually addressed especially for safety issues.</li> </ul>	Being Complied	<ul style="list-style-type: none"> <li>Freedom of Association, Rights &amp; scope of bargaining should be open for the workers.</li> <li>Investigate the payment of the labors who are engaged by sub-contractor or local contractor. It should not be lower than the national standard fixed by the PWD for the labors.</li> </ul>

**Table 5.3: Monitoring of Community Health, Safety and Security**

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
1	Disturbance to nearby community due to dust from developed land and Noise from construction activities	<ul style="list-style-type: none"> <li>• Construction of boundary wall around the Project area;</li> <li>• Installed water spraying system to control dusts;</li> <li>• Conducting dust monitoring and visual inspection around the site boundary;</li> <li>• Adopted noise management plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Boundary wall has been constructed around the project area.</li> <li>• Water spraying has been conducted at least four times in a day by two water tankers or as per requirement are being done to suppress fugitive dust.</li> <li>• Water is also being sprayed regularly on the stockpiles and registered.</li> <li>• Third party is routinely communicating with the nearby communities for assessing impacts and related complaints on dust generation issue.</li> <li>• Regular communication and consultation have been halt with the local government and local administration officials due to COVID situation</li> <li>• Environmental parameters are continuously monitored in and around the project site by separate entities</li> </ul>	Being complied	<ul style="list-style-type: none"> <li>• Any complaint regarding noise and dust from local people must be addressed immediately and recorded accordingly in to the register.</li> <li>• The grievance register should be placed at the gate of MSTPP so that the communities could easily raise their issues on this ground.</li> </ul>
2	Grievance of local people	<ul style="list-style-type: none"> <li>• Availability and operation of Grievance Redress Mechanism;</li> </ul> <p>Maintaining open communication channel with the local community.</p>	<ul style="list-style-type: none"> <li>• Social liaison officer is working for maintaining relation with local communities especially the CSR activities.</li> <li>• BIFPCL regularly display the progress of the development through their website (<a href="https://www.bifpcl.com/">https://www.bifpcl.com/</a>) and disclosure meeting at the local government</li> <li>• BIFPCL is also receiving grievance from local community through local government like Union Chairman or Local Administration</li> <li>• Grievance register has been placed at the BIFPCL main office inside the project boundary.</li> </ul>	Being complied	<ul style="list-style-type: none"> <li>• Put the grievance register outside the project boundary or at the project entrance gate so that the local community could easily state any grievance properly.</li> </ul>

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			<ul style="list-style-type: none"> <li>Proponent is observing the community grievance or quarries through the monitoring study conducted by CEGIS or local government</li> </ul>		
3	Risk of breaching Community Safety	<ul style="list-style-type: none"> <li>Construction of boundary wall/safety fence around the Project area;</li> <li>Practicing Risk Assessment and Evaluation Process;</li> <li>Practicing safe management for hazardous materials which may pose threat to the community;</li> <li>Availability and operation of Emergency Response Plan;</li> <li>Maintaining open communication channel with the local community;</li> <li>Training and instruction to the security personnel about their behavior and communication with the local people;</li> <li>Aware the security personnel about the right of the community people.</li> </ul>	<ul style="list-style-type: none"> <li>Implement numbers of pollution mitigating system for protecting the dust and other pollution outside to the project area.</li> <li>Strictly prohibited to enter outsider to the project site or labor camp.</li> <li>Entry pass is required to enter the project site area.</li> <li>Health check-up is mandatory to every labor during the induction training on which they get pass for work.</li> <li>No conflict has been noticed between local communities and project authorities or workers.</li> <li>The routine (twice in every week) medical checkup with essential medicine facilities from BIFPCL and specialized medical camp nearby village will be initiated like pre-COVID situation for the community</li> <li>All the CSR activities is being stopped in this quarter due COVID restriction</li> </ul>	Being complied	<ul style="list-style-type: none"> <li>Maintain social distancing with the communities during this COVID situation</li> <li>Keep on tack about the communicable diseases transmission between the labors and nearby communities</li> </ul>
4	Community Health and Risk	<ul style="list-style-type: none"> <li>Provision of providing health service facilities to community if the Project poses any health risk like sexually transmitted disease, contract disease, vector-borne diseases;</li> <li>Implement all pollution mitigation measures to ensure safeguarding to community.</li> </ul>	<ul style="list-style-type: none"> <li>Continued the medical facilities (consisting medical officer, medical assistant, office assistant) at Plant site for checkup the communicable diseases of the workers and staffs;</li> <li>BIFPCL is going to arrange again the weekly health service program (medical consultation and free medicine) for the local community considering the COVID situation.</li> <li>Medical facilities for the local people has been running amid the COVID situation</li> </ul>	Being Complied	<ul style="list-style-type: none"> <li>BIFPCL may introduce awareness program on the COVID</li> </ul>



Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			<ul style="list-style-type: none"> <li>Local people are coming to the office medical center for health issues where they are supported with health check-up and common medicine.</li> <li>EPC contractor is educating to the labors about protective action taken to avoid vector borne diseases and HIV positives and COVID pandemic</li> </ul>		
5	Youth Employment (Local)	<ul style="list-style-type: none"> <li>Providing training/awareness program for the local youth to let them aware about the required qualification to get involved in the Project related activities Emphasis to recruit local labors according to their skills and capacities.</li> </ul>	<ul style="list-style-type: none"> <li>Regular communication is being maintained with the local government and community representatives for labor recruitment;</li> <li>The proponent took a number of initiatives to encourage local students through awarding them scholarships before the COVID situation. They will work again on this field after the COVID pandemic</li> </ul>	Being Complied	<ul style="list-style-type: none"> <li>Assist the nearby villagers to restore their livelihoods</li> </ul>
6	Public Communication, Consultation and Awareness	<ul style="list-style-type: none"> <li>Arranging public communication/consultation meeting;</li> <li>Sharing of Project information with local people;</li> <li>Organizing environmental and social awareness programs/meetings.</li> </ul>	<ul style="list-style-type: none"> <li>One social liaison officer is working continuously for developing relation with local communities.</li> <li>Environmental and social awareness programs are organized and conducted by proponent on a regular basis except during the COVID situation.</li> <li>BIFPCL regularly display the progress (thru Video) of the development through their website (<a href="https://www.bifpcl.com/">https://www.bifpcl.com/</a>) and also disclosure meeting at the local government.</li> <li>The local people are aware regarding the project activities from multiple sources like consultation, display board, website etc.</li> </ul>	Being Complied	<ul style="list-style-type: none"> <li>BIFPCL may use print media, social media, digital media might be used for spreading the project right information</li> <li>The proponent should aware and clarify about the project the local people to stopover any rumor.</li> </ul>

**Table 5.4: Monitoring of Biodiversity and Sustainable Management of Living Natural Resources**

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
1	Rainfall runoff from the construction site would cause deterioration of aquatic ecosystem.	<ul style="list-style-type: none"> <li>• Installation of proper runoff drains;</li> <li>• Use of sediment fences, traps and basins for trapping the sediment, if required.</li> </ul>	<ul style="list-style-type: none"> <li>• Construction of permanent drainage system to discharge water from the project area.</li> <li>• The connectivity of Maidara River is being maintained.</li> <li>• EPC Contractor is monitoring the water quality on monthly basis at every outlet of the project site.</li> <li>• Bank protective works has been continued at the western bank of Maidhara River for block-B.</li> <li>• Construction waste water discharge is minimum and need based only which are also meeting effluent norms.</li> <li>• The same is being discharged through north-east corner of the project &amp; also monitored regularly.</li> <li>• BIFPCL is also receiving grievance from local community through local government like Union Chairman or Local Administration</li> <li>• BIFPCL is also receiving grievance from local community through local government like Union Chairman or Local Administration</li> </ul> <p>A sediment trap has been prepared to trapping the sediment before final discharge of the storm water to the river in this monsoon.</p>	Being complied	<ul style="list-style-type: none"> <li>• Maintain the roads and bank protective works during the heavy rainfall.</li> </ul>
2	Disturbance to nearby ecosystem due to different construction activities	<ul style="list-style-type: none"> <li>• No cutting/ felling of trees along the river bank;</li> <li>• Implementation of onsite waste and air quality management plan;</li> <li>• Limiting soil extraction activities within the defined area;</li> </ul>	<ul style="list-style-type: none"> <li>• Main project activities (Construction and erection) are limited within the project boundary.</li> <li>• Limiting the vegetation clearance within the Project boundary especially around the ash impoundment.</li> <li>• Plantation program is in progress with the help of forest department.</li> </ul>	Being Complied	<ul style="list-style-type: none"> <li>• Regular monitoring of the planted trees.</li> <li>• Reduce the rate of mortality at the sapling stages.</li> <li>• Bird sheds shall be created at the green belt areas.</li> </ul>

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		<ul style="list-style-type: none"> <li>Limiting the vegetation clearance and base stripping process within the Project boundary;</li> <li>Safety fence around the construction site;</li> <li>Limiting the use of night light;</li> <li>Using shade (directed downwards) around the outdoor lights;</li> <li>Provision of cut-off time to switch off unnecessary lights at night;</li> <li>Initiate Green plantation;</li> <li>No plantation of non-native species;</li> <li>Retaining top soil for future habitat restoration;</li> <li>No degradation of sensitive habitat.</li> </ul>	<ul style="list-style-type: none"> <li>The client is going to plant 50000 of fruits and medicinal plants as per the greenbelt position of layout by 2019-2020</li> <li>Local plant species like Goalpata, Sundori, Bain, Keora for green plantation are being planted</li> <li>They are maintaining the EMP for protecting the adjacent ecosystem</li> <li>No alien species has been recorded</li> <li>Wild species like avifauna and mammals are now recorded in the greenery areas of the project site</li> <li>Employees are aware about the rescues of species and no harm to wild species</li> <li>Local fishes are cultured in the fallow low lying areas of the southern part of the project</li> </ul>		
3	Disturbance to river, inter-tidal areas and wet lands	<ul style="list-style-type: none"> <li>No encroachment of inter-tidal flood plain area;</li> <li>No disturbance to Dolphin community;</li> <li>Monitoring of Ecosystem Health and Monitoring of Sundarbans Forest Health;</li> <li>If required, embankment should be constructed considering a setback distance from river/canal bank;</li> <li>Slope protection work along the Maidara River should be completed on an urgent basis before rainy season come, and;</li> <li>BIFPCL may take initiatives of excavating of silted reach of Maidara river near proposed township area to facilitate proper functioning of River for maintaining tidal flow dynamics</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of ecosystem health of Sundarbans, and around the Project site is being continued.</li> <li>The project is not obstructing the surface water flow.</li> <li>BIFPCL has been started maintenance of the slop protection works</li> <li>Bank protection works of western bank of Maidhara river is progressing</li> <li>EPC Contractor is monitoring the discharged water quality at each of the outlet from this project on a monthly basis.</li> <li>The project authority is constructing the permanent jetty as per approved layout.</li> <li>The Maidara River is showing its natural phenomena.</li> </ul>	Being Complied	<ul style="list-style-type: none"> <li>Initiatives should be taken for excavation of silted reach of Maidara River to protect the rainfall runoff washout.</li> </ul>

Table 5.5: Status of Compliance to the Conditions of DoE

Sl. No	Condition of DoE	Compliance Status	Remarks
1	This EIA Report is approved only for 1320 MW Khulna Coal Based Power Plant. Any expansion or extension of this Power Plant will require obtaining further Environmental Clearance with additional EIA Study.	BIFPCL has not yet initiated any plan for expansion or extension of the 2x660 MW Maitree Super Thermal Power Plant.	BIFPCL will comply with the condition prior to initiation of any expansion or extension of the Power Plant.
2	The Coal Specification and Power Plant technology should be maintained as per EIA report. In case any change in design the proponent must obtain consent from DoE.	The Coal Specification and Power Plant technology will be maintained as per EIA report. In case of any change in Plant design and coal specification, the proponent shall have to obtain early consent from DoE.	Suggested to comply as and when required.
3	Project Proponent may undertake activities for land development and infrastructural development of the Project.	BIFPCL has already completed land development activities for the Block-A area. Infrastructure development activities are in progress.	Being Complied.
4	Project Proponent may open L/C (Letter of Credit) for importing machineries for the Project, which shall also include machineries relating to waste treatment plant and other pollution control devices.	The appointed EPC contractor has already imported maximum Equipment & machineries relating to waste treatment plant and other pollution control devices through opening the L/C.	Being Complied.
5	The activity under Proposed Khulna 1320 MW Coal based Thermal Power Plant Construction and operation shall not release any pollutant that affect human health or will have damaging impact on the environment or natural resources.	BIFPCL engaged CEGIS as an independent entity for monitoring the construction activities for examining environmental impacts on quarterly basis before the construction works started and accordingly the environmental and social impacts are being monitored as per EMP since 2014. No significant impact of Power Plant activities on the surrounding environment or on the natural resources has been recorded and reported (by the community) yet.  Moreover, all the necessary pollution control measures and technologies i.e. Effluent Treatment Plant, ESP, and FGD etc. have already been incorporated in the technical specification of main Plant of EPC package as per DoE stipulations. The EPC contractor is constructing the Plant as per the contracted technical specification. Moreover, environmental compliance monitoring is also being continued in the project site in order to assess the impact on project ambient air quality, discharge water quality and noise level around the project site, working and labor conditions, occupational safety procedures community grievances etc. as per the monitoring plan stated in the EIA.	Being Complied.
6	Proper and adequate mitigation measures shall be ensured throughout preparation, construction and	BIFPCL has taken befitting mitigation measures as per EMP and technical specification of main Plant at each of the stages of Project Development.	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
	operation period of the proposed Khulna 1320 MW Coal based Thermal Power Plant Project activities.		
7	Any heritage sight, ecologically critical area, and other environmentally, religious and archaeologically sensitive places shall be kept protected during Project construction phase.	There is no religious, archaeological place in and around the site. Quarterly monitoring program has been continuing since 2014 to the potentially project influence area of the Sundarbans Reserve Forest, Ecologically Critical Area and World Heritage Site as per the guidance of DOE and Bangladesh Forest Department (BFD).	Being Complied.
8	Environment friendly construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding & nursery sites.	During the monitoring activities no noticeable impacts on fish habitats and fish breeding, feeding & nursery sites were recorded.	Being Complied.
9	Construction works shall be restricted to daytime hours so as to avoid/mitigate the disturbance of local lives as well as implementation schedules of the works shall be notified in advance to nearby residents.	The construction works has been reduced due to Covid-19 from April, 2020. Working activities are restricted to daytime and sometimes extends to the late evening. The community responses towards construction works of Power Plant are being monitored and recorded regularly. Moreover, BIFPCL has appointed one social liaison officer who is working (24x7) for developing relation with local communities. Regular consultation meetings are carried out with the local government and administration in order to receive and realize the grievances and accordingly to redress those. There is no grievances related to the noise effects registered yet from the nearby communities.	Being Complied.
10	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed Project period.	EPC contractor and sub-contractor are providing adequate sanitation facilities for the workers. Sanitation facilities for health safety from COVID are supplied by the Contractor at the labor camps as well as in the work areas.	Being Complied
11	In order to control noise pollution, vehicles & equipment shall undergo regular maintenance; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.	All vehicle & equipment used at site are under regular maintenance and registration process. Working during sensitive hours like late evening, the machineries are being avoided or managed through appropriate measures as observed during the monitoring period.	Being Complied
12	No solid waste can be burnt in the Project area. An environment friendly solid waste management should be in place during the whole period of the Project in the field.	Burning of waste materials is being prohibited inside the project area. Now, solid waste is managed with systematic processes. A solid waste management company is now collecting the solid waste from the project and dump it to the Khulna City Corporation (KCC) designated places. Development of environment friendly waste collection and disposal system like Solid Waste Management (SWM), STP etc. are being developed at the demarcated place in plant premises. In addition, waste management training has been included in induction training of the labor.	Being complied



Sl. No	Condition of DoE	Compliance Status	Remarks
13	Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be endangered or destructed.	Quarterly monitoring activities are being carried out to examine the potential impacts on habitat of flora and fauna. No significant changes are yet recorded. Moreover, monthly environmental monitoring has been performed for noticing any harmful air pollutant emission or waste discharge from the project area.	Being Complied
14	All the required mitigation measures suggested in the EIA report along with the emergency response plan are to be strictly implemented and kept operative / functioning on a continuous basis.	The project authority has increased the medical facilities for workers. An ICU supported ambulance and an MBBS with two paramedical doctors are now available at site. EPC contractor has established their own Medical facilities for the labors. In case of emergency situation for both BIFPCL and EPC contractor, a contract has been signed with a private hospital (GAZI medical, Khulna) for medical services. EHS team of BIFPCL, BHEL and Cholanmandalam are compelling to ensure the safety mitigation measures as per EIA and EHS guideline. Moreover, Periodic training has been made as mandatory for the workers.	Being Complied
15	To control dust, spraying of water over the earthen materials should be carried out from time to time.	Periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR, 2005 standard. Monthly air quality monitoring at three locations inside the project boundary are being carried out. Based on the air quality monitoring findings and seasonal aspects, site specific water spraying is scheduled. At least four times in a day by two numbers of water tankers or as per requirement are being used to suppress fugitive dust.	Being Complied
16	Storage area for soils and other construction materials shall be carefully selected to avoid disturbance of the natural drainage.	BIFPCL authority has selected designated areas for safe storage of construction materials. In addition, the maximum stock piles are sprinkling. They have established a silt trap to control sediment running out from the projects with rainfall runoff.	Being Complied
17	Adequate considerations should be given to facilitate drainage system for runoff water from rain/tidal surge.	Adequate drainage system has been developed to facilitate storm water drainage runoff from rain from the project area.	Being Complied.
18	Adequate facilities should be ensured for silt trap to avoid clogging of drain/canal/water bodies	Silt trap has been developed at the north-east corner of the project site. It is used to depositing the sediments coming with the storm water and finally discharge relatively sediment free storm water through the drainage line.	Being Complied.
19	The entire coal handling system should be designed as an enclosed (and not only covered) conveyor system. There should be integrated dust control system with dust extraction and bag filters at unloading areas and at each transfer points on the conveyor system.	Entire coal handling system is designed and constructed as an enclosed conveyor system as per DoE requirement. Integrated dust control system with dust extraction system/bag filter and dust suppression system at crusher house, unloading points, transfer points has been specified in the technical specification of Main Plant EPC contract package. Refer Section (V), B4 of Technical Specification. The tender for coal transportation shall include the technical specification and EMP of coal transportation study.	Compliance action initiated.

Sl. No	Condition of DoE	Compliance Status	Remarks
20	Coal Plant should have high-efficiency bag filter for arresting dust emissions.	Integrated dust control system with dust extraction system/bag filter and dust suppression system at crusher house, unloading points, transfer points has been specified in the technical specification of EPC contract. Refer Section (V), B4 of Technical Specification (Clause no B4.3.1.4). High-efficient ESP is now at construction stage.	Compliance action initiated.
21	Coal should be stored in a covered storage yard.	All these stipulations have been included in the technical specification of Main Plant EPC contract package, Section (V), B4 of Technical Specification (Clause No B4.3.1.6). Now, the covered coal stockyard is being constructed at site.	Being complied
22	The entire coal stockyard should be covered with water sprinkler provided with automated moisture sensor to control self-combustion.	All these stipulations have been included in the technical specification of Main Plant EPC contract package, Section V, B4 of Technical Specification. The covered Coal stockyard is now at the initial stages of construction.	Compliance action initiated.
23	100% utilization of fly ash and bottom ash should be planned and implemented throughout the operation of the Plant. There should only be a provision of small ash dyke that will not exceed 25 (twenty-five) acres of land to store residual ash.	100% utilization of fly ash has been planned and shall be implemented throughout the operation of this Plant. EOI has been received in this regard from nearby Cement Industries. 25 acres' area has been allocated to store residual ash in case of emergencies. The ash dyke is now under construction stage.	Compliance action initiated.
24	Integrated dry ash handling, loading, unloading and transportation system should be established.	Integrated dry ash handling, loading, unloading and transportation system will be established during the operation stage of the power plant. Provisions in line with this has been included in Technical Specification of main Plant EPC contract package (Section V, Chapter B4). Ash silo is constructing beside the jetties in order to transport the dry ash with ships/cargo.	Compliance action initiated.
25	There should be adequate and properly sized and designed dry ash silo with appropriate conveyor system.	Adequate and properly sized dry ash silo with appropriate conveying system have been specified in Technical Specification of main Plant EPC contract package (Section V, Chapter B4). The construction work is progressing fast near the jetty.	Compliance action continued
26	Bottom ash should be extracted, crashed and stored in silos for utilization with proper collection and conveyor system.	Bottom ash shall be extracted, crushed and stored in silos for utilization with proper collection and conveying system during the operation stage of the power plant. The procedures have been included in the technical Specification of EPC contract package. (Section V, Chapter B4). The construction silo is progressing.	Compliance action initiated
27	Resettlement and rehabilitation of the displaced population (including those who do not own land) should be done properly.	Land has been acquired as per the legal procedure of GoB. However, BPDB wrote to Ministry for suitable resettlement and rehabilitation as per DoE requirement. BPDB prepared an assessment (Livelihood Restoration Plan) regarding the rehabilitees (including those who do not own land) for this Power Plant. As per the recommendation of the LRP, a NGO "Samahar" completed Their tasks. This monitoring has recorded that DC office has rehabilitated around 32 families at Foyla and 17 families at Koigardaskati.	Compliance action continued

Sl. No	Condition of DoE	Compliance Status	Remarks
28	Resettlement plan should be properly implemented and people should be adequately compensated.	Resettlement and rehabilitation action had been taken as per the law of the land, Bangladesh. However, BPDB conducted an assessment (Livelihood Restoration Plan) regarding the rehabilitees (including those who do not own land) for this Power Plant. Based on the recommendation of the LRP, local NGO conducted the training and other tasks to the PAPs. DC office is trying to resettle the PAPs at their selected sites according to the LRP.	Compliance action continued
29	Construction material should be properly disposed-off after construction work is over.	At present, the construction work is going on. Construction wastes are being collected and put at demarcated places Heavy/mechanical equipment are kept at demarcated places. Proponent has engaged one of the contractor (Khulna City Corporation (KCC) for safe disposal of waste materials from site.  Further development of environment friendly waste collection and disposal system like Solid Waste Management (SWM), STP etc. are being developed at the demarcated place in plant premises.  There is a provision of development of solid waste management system which is given at clause no B12 ,Part no 9 of book no -2 ,page no 147-161.In which there is development of WMC which has waste collection ,waste segregation at source, recycling ,treatment and disposal of waste will be done	Compliance action initiated
30	As described in the report environmental monitoring should be strictly followed and monitoring report should be shared with DoE to ensure the environmental management properly.	BIFPCL has engaged CEGIS as a third party independent entity for conducting environmental monitoring on a quarterly basis in February 2014. Accordingly, each quarterly monitoring report has been prepared, submitted and shared with DoE, which are also available at BIFPCL web site.	Being Complied.
31	All activities (pre-construction, construction and post-construction stage) should be implemented according to EMP clearly listed in the EIA report.	BIFPCL has adopted the EMP suggestions applicable at construction stages. BIFPCL is taking appropriate actions based on EMP monitoring report. BIFPCL regularly updates the EMP and OHAS which assist to reduce the risk of accidental events further.	Being Complied
32	A third party/independent monitoring bodies excluding JVC/BPDB should be engaged immediately for monitoring of all activities during pre-construction, construction and operation phases as per monitoring plan of EIA report and monitoring report must be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	CEGIS has been engaged by BIFPCL as an independent monitoring entity for conducting environmental monitoring on a quarterly basis since February 2014. Since the contract, CEGIS has been conducting the monitoring programs quarterly and producing monitoring reports on quarterly basis which are submitted by CEGIS to BIFPCL for onward submission to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment as directed by DoE.	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
33	Regular monitoring of the susceptible places of Sundarbans for protecting ecosystem, biodiversity and forest coverage should be made using latest high-resolution image for keeping ambient environment.	The Monitoring activities of CEGIS included monitoring of the susceptible places of Sundarbans. The monitoring report contains analysis of biodiversity and forest coverage. However, in addition to this, Forest Department has also suggested some survey & analysis which have also been monitored and reported by CEGIS through the quarterly monitoring report.	Being Complied.
34	Air, water, soil, biological and social data should be monitored regularly with a network monitoring system with a view to assess the natural quality of the Sundarbans and other fragile ecosystem and report of monitoring results should be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	The network monitoring system will be installed as a part of the project construction and it will be run as online monitoring system during the operation of the Power Plant.  All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5). However, air, water, soil and biological components are regularly monitored as per recommendation of EMP. Each of the monitored environmental data has been incorporated in the Monitoring report and displayed on the BIFPCL website at present.	Compliance action initiated.
35	There should be regularly disclosure of the report through workshops and websites and responses should be taken care accordingly.	CEGIS has been regularly carrying out public consultation at different levels.. All the monitoring reports are being kept available on website of BIFPCL ( <a href="http://www.bifpcl.com">www.bifpcl.com</a> )	Being Complied.
36	Online air and water quality monitoring system should be made functional throughout the life of the Plant.	The online monitoring system will be installed when the Plant will be in operation phase. This will be continued throughout the life time of the Power Plant.  All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5).	Compliance action initiated
37	Management Information System (MIS) is to be developed for this coal-based Power Plant. The scope of MIS services will obviously include representing the real time monitored data especially environmental parameters displaying at Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment, BPDB and other concerned agencies/Ministries. The MIS should be web based for accessing every individual to show the real time monitored records.	The MIS will be prepared before commissioning of the Power Plant. For developing MIS, consultant will be engaged earlier. Specifications of MIS system is already included in EPC contract document. Technical Specification like DDCMIS, DDCS, PADO System, HART system, Plant MMS, Information management security system etc. have been included. Moreover, the EPC contractor is going to initiate this activity.	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
38	JVC should provide all sort of logistics support to DoE and other relevant agencies for monitoring environment related items/events.	BIFPCL is ready to provide all sort of logistic support as and when required by DoE and other relevant agencies for monitoring of Plant construction activities and environmental items/events maintain the health and safety protocol of the construction site.	Being complied
39	No ground water should be allowed to use for plant purposes.	<p>The Power Plant has been designed considering use of surface water only during all stages of project development and operation.</p> <p>The authority has already installed Reverse Osmosis (RO) Water Treatment Plant (ABM Water) for use ground water for potable and domestic purposes. A second unit of RO plant is now in operation fulfilling fresh water from both domestic and construction requirements.</p> <p>However, a 1200ft deep tube well has been recorded near the ABM water plant for backup during emergencies. Proponent informed that some time it is used to supply the drinking water.</p>	Being complied
40	Conduct stakeholder meetings on regular basis for better performance of the Project as a whole.	Pre-construction phase of the Plant was completed and the construction phase has been continued. BIFPCL has appointed a social worker and officers who regularly visits nearby community to consult with the local people. Besides CEGIS, appointed by the Project authority, is also carrying out consultation with the local people with interviews on regular basis maintaining the COVID protocols for better performance of the Project as a whole.	Being Complied
41	Additional Environmental baseline data to be collected as suggested in the EIA report and conveyed to DoE and other concern authorities.	All quarterly monitoring reports containing latest baseline data are being collected as suggested in the EIA study and are disseminated to DoE and other concerned authorities.	Being Complied
42	The Environmental Management Plan under the EIA study shall strictly be implemented and kept functioning on a continuous basis.	BIFPCL has been implementing all the EMP measures realistically phase by phase as suggested in EIA report and approval condition of DoE. The status of EMP implementation are also regularly monitored. Based on the monitoring, BIFPCL continuously updated the site specific EMP for better management of the potential impacts.	Being Complied
43	The Project authority shall submit a detail work plan with time schedule of development activities at least 7 (seven) days ahead of the work commences in the field to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	The construction works is now going on. BIFPCL has submitted the detailed work plan seven (7) days before start of the construction activities to the suggested offices of DOE.	Being complied



Sl. No	Condition of DoE	Compliance Status	Remarks
44	Environmental Monitoring Reports according to specific format specified in the EIA Report shall be made available simultaneously to DoE Bagerhat District Office, Khulna Divisional Office and Headquarters on a monthly basis during the construction period of the Project.	Environmental Monitoring Reports as per specific format provided in the EIA Report made available by BIFPCL and submitted to DoE Bagerhat District Office, Khulna Divisional Office and Headquarters accordingly.	Being Complied
45	The following records must be kept in respect if any samples required to be collected for the purpose of environmental monitoring activities: <ul style="list-style-type: none"> <li>• The date(s) on which the sample was taken;</li> <li>• The time(s) at which the sample was collected;</li> <li>• The point at which the sample was taken; and</li> </ul> The name of the person who collected the sample.	The Monitoring report keeps all the records as suggested.	Being Complied
46	The results of any monitoring, required to be conducted under this EIA report must be recorded.	BIFPCL has been collecting all the monitoring data and submitting with proper documentation and accordingly sharing with DoE on regular basis.	Being Complied
47	In case of any emergency, the following information shall be immediately being reported to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DoE) simultaneously. Nature of incident (oil spill, fire, accident, Collision, land slide, etc.). Personnel affected (injured, missing, fatalities, etc.). Emergency support available and its location (standby transport, medical facilities, etc.). Weather conditions Current operations (abandoning the site, firefighting, etc.)	No single emergency incident has been since April, 2021. The COVID restriction has been withdrawal by GoB with the decreasing infection which also implemented for the MSTPP construction site. At present, the labors are working fully to this project with proper COVID safety measures.  BIFPCL has given top priority on safety issues as like environment for this project after the bitter experience of two incidents. They have instructed the EPC contractor to establish best practices on OHAS and keep all records for avoiding any incident as like earlier. However, taking numbers of initiatives by the EPC and proponent significantly improve the safety system of the project. No environmental, accidental, anthropogenic incident has been not recorded since April 2021.	Complied at present
48	The Project authority or its employees must notify the department of Environment of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.	BIFPCL has established a proper mechanism for recording such incident as suggested and notify the department of Environment regarding incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.  EPC have already revised the health and safety management manual to continue the work amid the COVID pandemic. Moreover, CEGIS is monitoring the EMP implementation as a whole.	Complied at present.

Sl. No	Condition of DoE	Compliance Status	Remarks
49	All pollution incidents shall be reported immediately and simultaneously to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DoE) in Dhaka.	BIFPCL has established a proper mechanism for recording such incident as suggested in the ERP	Being complied
50	Appropriate permission would require to be obtained from the Forest Department in favor of cutting/felling on any plant/tree/sapling forested by any individual or government before doing such type of activity.	There is no need of cutting/felling down of any trees outside the project boundary. However, in future, if any such case arises, BIFPCL would seek for appropriate permission from the Forest Department.	Being complied
51	Re-vegetation and re-plantation under green belt activities shall be undertaken in consultation with the Forest Department according to those mentioned in the EIA report.	An MoU has been signed with Forest Dept., Bangladesh on 24.02.2015 for implementation of Afforestation Program. Initial target is to plant 2 lac saplings in 3 years. By this time, Forest Department has targeted initially to plant about 116000 nos. of saplings of different species. A fresh Agreement with BFD was signed on 24.01.2018 for plantation of 5 Lakh trees for at the end of construction stages. They planted 15000 fruits and medicinal plants at the laydown areas in the project site. However, they will fulfill the target before commissioning of the power plant.	Being Complied
52	Climate Change impacts and maximum storm surge height shall have to consider at the design and construction phase.	The design level (elevation) of the land and earthen embankment has been designed and constructed considering the climate change impact and maximum storm surge height.	Being Complied
53	A separate EIA/morphological study shall have to be conducted for coal transportation and river dredging to develop sound environmental management plan towards conservation of ecosystem and biodiversity.	Coal transportation will be done through the existing maritime route, which is Mongla Port Authority (MPA) controlled waterways. M/s. Institute of Water Modelling (IWM) has already completed the EIA study for the dredging activity and submitted the report to MPA. A separate EIA study for Coal Transportation was conducted by M/s. Center for Environment and Geographic Information Services (CEGIS) which has been approved by DoE.	Being Complied.
54	A full-fledged institutional setup for EHS and CSR must be put in place before operation of the Power Plant.	A full-fledged institutional setup for EHS activities have been operated. After the consecutive accidents, the EHS process has been drastically re-arranged and reshaped. No major incident has been occurred since April, 2021. Meanwhile, a number of CSR activities are ongoing at Project site, like free medical camp, Boat Medical camp, and medicines, free potable water supply to the local people, medical campaign, training etc. infrastructure development of nearby school.	In the process of compliance
55	The Project authority shall extend active cooperation to DoE officials to facilitate their visit to the site as and when necessary.	BIFPCL is extending its all-out cooperation to DoE.	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
56	Violation of any of the above conditions shall render this approval void.	Noted by BIFPCL	
57	Any injunction on this Project from the Honorable Supreme Court/High Court Division shall render this approval void.	Noted by BIFPCL	
58	Without installation of 275 Meter Height Chimney, Effluent Treatment Plant (ETP), Waste Water Treatment Plant (WWTP), Settling Pond, Desalinization Plant, API Oil Water Separator, High Efficiency Electro Static Precipitator (ESP), 'closed-loop' Flue Gas Desulfurization (FGD), Low NOx Burner, online air and water quality monitoring system and other pollution control equipment and obtaining Environmental Clearance Certificate, the proponent shall not start operation of the Project.	At present, the Plant is in construction phase. EPC contractor is constructing the main Plant includes 275-Meter-high Chimney, Effluent Treatment Plant (ETP), Waste Water Treatment Plant (WWTP), Settling Pond, Desalinization Plant, API, Oil Water Separator, High Efficiency Electro Static Precipitator (ESP), 'closed-loop' Flue Gas Desulfurization (FGD), Low NOx Burner, online air and water quality monitoring system for preventing pollution as per technical specification. Moreover, BIFPCL has got the Environmental Renewal Certificate each of the year through maintaining the conditions of DOE.	Compliance action initiated
59	This EIA Approval has been issued with the approval of the appropriate authority.	BPDB and BIFPCL are thankful to DoE.	

## 5.2 Compliance to the Conditions of DoE (EIA study of Coal Transportation)

However, with reference to the approval of EIA study of coal transportation for 2x660 MWMSTPP having (Memo no: DoE/ clearance/ 5532 / 2016/50, dated 31/01/2018), Department of Environment has set some specific conditions to be followed as a fulfillment of the condition no.53 of the EIA approval letter of 2x660 MWMSTPP. The conditions and compliance status have been listed as follows-

**Table 5.6: Compliance conditions of DoE (EIA study of Coal transportation)**

Sl. No.	Conditions	Compliance status	Remarks
1	This EIA Report is approved only for Coal Transportation for the Proposed 2x660 MW Maitree Super Thermal Power Plant Project. Any modification of this project as well as Coal Transportation will require further EIA approval with additional EIA Study.	The power plant is now in construction stage. BIFPCL will notify to DOE prior to initiation of any modification, expansion or extension of the Power Plant.	Suggested to comply as and when required.
2	The route of coal Transportation should be maintained as per EIA Report. In case of any changes the proponent must obtain consent from DoE.	The route of coal Transportation will be maintained as stated in the EIA report. In case of any changes in the transportation route, the proponent shall obtain consent from DoE.	Suggested to comply as and when required.
3	Project Proponent may open L/C (Letter of Credit) for importing machineries for the project which shall also include machineries relating to waste treatment plant and plant and other pollution control devices.	EPC contractor has been appointed for this Project. Currently, they are importing Power Plant machineries complying the national laws and regulations.	Being Complied.
4	The activity under Coal Transportation for the Proposed 2x660 MW Maitree Super Thermal Power Plant Project shall not release any pollutant that affect human health or will have damaging impact on the environment or natural resources.	So far, no activity under Coal Transportation for the Proposed 2x660 MW Maitree Super Thermal Power Plant Project has been commenced. So, there is no issue for impact on the surrounding environment or natural resources from the coal transportation activities.  BIFPCL engaged CEGIS for monitoring and examining status of the environment or natural resources. A strong baseline has been prepared throughout the coal transportation route for assessing the impact in future.	Suggested to comply as and when required.
5	Proper and adequate mitigation measures shall be ensured throughout the operation period of the Project	The project proponent has included all the mitigation measures in their BID document of Coal Transportation. However, BIFPCL is monitoring the implementation of mitigation measures for the construction period. They have developed a skilled manpower and system for ensuring the EMP during operation stage.	Suggested to comply at operation phase.
6	Any heritage site, ecologically critical areas, and other environmentally, religious and archeologically sensitive places	There is no Religious and Archaeological place in and around the Project site. As a third party, CEGIS is now monitoring the potentially vulnerable locations and indicators which are sensitive to coal transportation in the	Suggested to comply at operation phase.

Sl. No.	Conditions	Compliance status	Remarks
	shall be kept protected during project operation.	Sundarbans ECA, Sundarbans Reserve Forest and Sundarbans World Heritage Site. Those information and data assist to protect the ecological critical areas in future during the operation of coal transportation.	
7	Environment friendly construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding and nursery sites.	Development of coal transportation system will be followed through best practices, EMPs of EIA of Coal Transportation Report, national and international rules and guideline. Since, the environmental monitoring indicators are not observed any anomalies, it can be concluded that the construction work is progressing in environment friendly procedure yet now.	Being Complied
8	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.	At present, the civil construction of the Project including Jetty construction activities are progressing. The jetty construction works is running increasingly under this COVID situation. BIFPCL, EPC contractor and sub-contractors are providing sufficient safety materials, training, instruction and facilities for managing COVID and improve hygiene at labor camps and workplaces.	Being Complied
9	Proper and adequate on-site precautionary Measures and safety measures shall be ensured so that no habitat of any flora and fauna would be endangered or destructed.	The construction of Jetty is being carried as per EMP guidelines. Moreover, regular monitoring activities are being carried out to assess the significant changes due to jetty construction activities. The quarterly monitoring reports do not reflect any significant changes of the habitat of flora and fauna of the project influenced Passur river and Sundarbans ecosystem.	Being Complied
10	All the required mitigation measures Suggested in the EIA report along with the emergency response plan are to be Strictly implemented and kept operative/functioning on a continuous basis.	The proponent is giving top priorities to occupational health and safety issues after few incidents. They have significantly revised the OHAS guideline and practice it seriously. During this COVID situation, BIFPCL is tried aware and manage Covid-19 of the workers and office support staff.	Compliance action initiated
11	To control dust, spraying of water over the earthen materials should be carried out from time to time	Periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR, 2005 standard. Water spraying at least four times in a day by two water tankers or as per requirement are being done to suppress fugitive dust.	Being Complied
12	The entire coal handling system should be designed as an enclosed (and not only covered) conveyor system. There should be integrated dust control system with dust extraction and bag filters at unloading areas and at each transfer points on the conveyor system.	In the BID document, the coal handling system has been mentioned as closed system with the integration of dust control measures. Moreover, continuous monitoring system has been instructed in the EIA monitoring section.	Compliance action initiated
13	Coal should be stored in a covered storage yard.	All these stipulations have been included in the technical specification of Main Plant EPC	Compliance Action initiated.

Sl. No.	Conditions	Compliance status	Remarks
		contract package, Section V, B4 of Technical Specification (Clause No B4.3.1.6). The Covered coal stockyard is now under construction stage.	
14	The entire coal stockyard should be Covered with water sprinkler provided with automated moisture sensor to control self-combustion.	EIA study of the Power Plant suggested to install water sprinkler in coal stockyard which has been repeated in EIA study of Coal transportation. However, all these stipulations have been included in the technical specification of Main Plant EPC contract package. The coal stockyard is now under construction stage.	Compliance Action initiated.
15	Construction material should be properly disposed of after the construction work is over.	The construction scrubs are recorded scattered in the project site. They are now trying to contract a third party to remove the construction scrubs from the project site. The proponent is preparing an environmentally friendly procedure for disposing off the construction material like scraps as well as other construction wastes. They have already contracted one organization in association with KCC for solid waste management. They are now working at the project site.	Compliance Action initiated.
16	As described in the report environmental monitoring should be strictly followed and monitoring report should be shared with DOE to ensure the environmental management properly.	BIFPCL has engaged CEGIS for environmental monitoring the environmental management plan in February 2014. Accordingly, each quarterly monitoring report has been submitted and shared with DoE, which are also available at BIFPCL web site.	Being Complied.
17	A third party/independent monitoring bodies excluding BIFPCL should be engaged immediately for monitoring of all the activities during pre-construction, construction and operation phases as per monitoring plan of EIA report and monitoring report must be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	CEGIS, as an independent monitoring body has been engaged by BIFPCL since February 2014 and still continued. From then on, CEGIS has been conducting the monitoring programs quarterly and producing monitoring reports on regular basis which are submitted by CEGIS to BIFPCL for onward submission to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment as directed by DoE.	Being Complied
18	Regular monitoring of the susceptible places of the Sundarbans for protecting ecosystem, biodiversity and forest coverage should be made using latest high-resolution image for keeping ambient environment.	The Monitoring activities have been carried out by CEGIS as third-party independent entity. The study includes all of recommended issues vastly. The monitoring report contains analysis of ecosystem, habitat, and biodiversity and forest coverage at susceptible sites of Sundarbans. In addition to this, Forest Department has also suggested some survey & analysis of Sundarbans ecosystem along with the quarterly compliance monitoring report.	Being Complied.
19	Air, water, soil, biological and social data should be monitored	The network monitoring system will be installed as a part of the project construction	Being Complied.



Sl. No.	Conditions	Compliance status	Remarks
	regularly with a network monitoring system with a view to assess the natural quality of the Sundarbans and other fragile ecosystem and report of monitoring results should be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	for online monitoring and it will run at the time in operation phase. All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5).  All the environmental monitoring reports are available on the BIFPCL website at present.	
20	There should be regular disclosure of the report through workshops and websites and responses should be taken care accordingly.	All of the environmental monitoring reports and other relevant reports are available on website of BIFPCL ( <a href="http://www.bifpcl.com">www.bifpcl.com</a> ). BIFPCL as well as CEGIS is regularly carrying out public consultation at local level to get the responses from the community.	Being Complied.
21	BIFPCL should provide all sort of logistics support to DOE and other relevant agencies for monitoring environment related items/events.	BIFPCL is ready to provide all sort of logistic support as and when required by DoE and other relevant agencies for monitoring of Plant construction activities and environmental items/events.	Suggested to Comply as and when required.
22	In order to control noise pollution, vessels and equipment shall undergo regular maintenance; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.	Not applicable in this stage	Suggested to Comply as and when required.
23	Vessels of this project should follow the MPA guidelines and protocol to ensure no hindrance to other vessels.	Not applicable in this stage	Suggested to Comply as and when required.
24	The vessels used for this project should maintain IMO criteria to enable identification of substances harmful to the marine environment.	Not applicable in this stage	Suggested to Comply as and when required.
25	All the vessels should follow applicable MARPOL Convention, Appendix V on the prevention of pollution by garbage from ships.	Not applicable in this stage	Suggested to Comply as and when required.
26	Additional Environmental baseline data to be collected as suggested in the EIA report and conveyed to DOE and other concern authorities.	Environmental baseline data has been collected by third party <i>i.e.</i> CEGIS. CEGIS has submitted reports of quarterly monitoring containing latest baseline data to BIFPCL for further dissemination to DoE and other concerned authorities.	Being Complied
27	The Environmental Management Plan under the EIA study shall strictly be implemented and kept functioning on a continuous basis.	BIFPCL has so far been implementing the EMP measures phase by phase as suggested in EIA report and approval condition of DoE. The status of EMP implementation are also regularly monitored by CEGIS.	Being Complied
28	The project authority shall submit a detail work plan with time schedule of development	The jetty construction works is now going on. Beforehand, BIFPCL has submitted the detailed work plan seven (7) days before	Being complied

Sl. No.	Conditions	Compliance status	Remarks
	activities at least 7 (seven) days ahead of the work commences in the field to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	starting of the construction activities to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously. It must be maintained in future.	
29	Environmental Monitoring Reports According to specific format specified in the EIA Report shall be made available simultaneously to DOE Bagerhat District Office, Khulna Divisional Office and Headquarters on a quarterly basis during the project period.	Environmental Monitoring Reports of the Power Plant project including Jetty construction as per specific format provided in the EIA Report made available by BIFPCL and submitted to DoE Bagerhat District Office, Khulna Divisional Office and Headquarters on monthly basis since April, 2018.	Being Complied
30	The following records must be kept in respect of any samples required to be collected for the purposes of environmental monitoring activities: a) the date(s) on which the sample was taken; b) the time(s) at which the sample was collected; c) the point at which the sample was taken; and The name of the person who collected the sample.	The Monitoring report of CEGIS keeps all the records as suggested.	Being Complied
31	The results of any monitoring required to be conducted under this EIA report must be recorded.	CEGIS is recording all the monitoring data and submitting to BIFPCL through proper documentation. The report is being shared with DoE on regular basis through monitoring reports.	Being Complied
32	In case of any emergency, the following information shall immediately be reported to Bagerhat District Office, Khulna Divisional office and Headquarters of the Department of Environment (DOE) simultaneously: a. Nature of incident (oil spill, fire, accident, collision, land slide etc.) b. Personnel affected (injured, missing, fatalities, etc.) c. Emergency support available and its location (standby transport, medical facilities, etc.) d. Weather conditions Current operations (abandoning the site, firefighting, etc.)	Emergency Reporting/ Emergency response Plan have been prepared for the Power Plant which includes the Jetty. Health and safety management manual have been revised for better and precautions implementation of OHAS after few fatal incidents.  They have taken a lot of care regarding occupational health and safety.  BIFPCL will adopt the ERP suggested on the EIA study of coal transportation in association with the NOSCOP and NPDM for any future incidents as suggested.	Compliance Action initiated.

Sl. No.	Conditions	Compliance status	Remarks
33	National Oil Spill Contingency Plan (NOSCAP) should be followed to establish an organizational structure to combat marine pollution	Not applicable in this stage	Suggested to comply as and when required.
34	The project authority or its employees must notify the Department of Environment of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.	<p>BIFPCL has strengthening the mechanism for the incident as suggested that is notify to the department of Environment regarding incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.</p> <p>The institutional arrangement for managing the incident during coal transportation will be set up before operation stage based on the EIA and DoE recommendations. Moreover, monitoring activities is continued for checking any significant changes in natural ecosystem.</p>	Complied at Present.
35	All pollution incidents shall be reported immediately and simultaneously to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DOE) in Dhaka.	BIFPCL has established a proper mechanism for recording such incidents as suggested in the ERP. CEGIS has been engaged to monitor the social and environmental compliance monitoring on a regular interval.	Complied at Present.
36	Climate Change impacts and maximum storm surge height shall have to consider at the design and construction phase of the jetty.	The design level (elevation) of the land and earthen embankment has been fixed considering the climate change impact and maximum storm surge height.	Being Complied
37	The transshipment point Faraway Buoy at the Bay should be used from November to March, and Mazhar point should be used from April to October every year for transporting coal which has been mentioned in the EIA Report.	Not applicable in this stage	Suggested to comply as and when required.
38	Violation of any of the above conditions shall render this approval void.	Noted by BIFPCL	-
39	Any injunction on this project from the Honorable Supreme Court/High Court Division shall render this approval void.	Noted by BIFPCL	-
40	This EIA approval is valid for one year from the date of issuance and the project authority shall apply for renewal to the Bagerhat District Office of DoE at Bagerhat with a copy to Head Office of DOE in Dhaka.	The authority is maintaining the renewal process as suggested. As like previous years, BIFPCL has got the renewal for this year.	Being complied



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## **Appendices**



## Appendix I: Checklist of Monitoring Environmental Compliances

**Table A: Checklist of Monitoring for ESMP Implementation (During Construction Phase)**

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Generation of Noise within the BIFPCL's Plant premises	Conduct noise survey around and inside the site boundary Reducing Noise and Vibrations to country's ambient standards, and occupational health and safety standards Introducing vehicle speed limit and speed limit monitoring system Green Plantation around the Project boundary Switching off/ throttling down of machines/equipment's/generators which are not in use			
2	Dust Generation from Land development activities and other construction works	Conducting dust monitoring and visual inspection around the site boundary No use of earthen and undeveloped roads by vehicles related to the Project use Installation of water spraying system to control fugitive dusts Introducing vehicle speed limit and speed limit monitoring system If yes, do they monitor vehicle speed regularly?			
3	Water Quality	Fencing the construction site by drum sheet or Tarja of any other fencing Arrangement of runoff drainage for reducing any water logging Location of backfilling stockpile in safe area and protected from wind and rain action No storing of backfilling materials/spoil stored on river bank/slope No disposal of waste and wastewater to river or canal.			
4	Waste Management System	Provision of onsite waste management system			
5	Compensation and Resettlement	Prepare Proper resettlement action plan and compensation plan if the Project needs any land acquisition addressing compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies Resettlement of the PAPs cash for compensation of land (CCL) before resettlement formal agreement with the affected people prior to migration/resettlement Sufficient standing crop compensation			

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		Compensation for shift able structures? Retention of salvageable materials? Compensation for loss of trading income? one-time moving assistance grant to cover loss of regular wage income Has a resettlement plan been developed which includes compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies? Provide/take extra care/caution for the disadvantaged/vulnerable group(s) (i.e., women, children, ethnic minorities, indigenous people etc.) Provision of monitoring the compensation and resettlement process			
6	Livelihood and living	Does the Project pose any threat to the livelihood/living standards of the local people? If yes, are adequate steps taken to reduce the impacts? Has the company developed any policy which prioritizes the local laborers in employment opportunities? Is there any possibility that large vehicle related to the Project will cause traffic induced disturbance/s to the local dwellers? If yes, are there any mitigative steps taken to decrease the disturbance/s? Has the road network been developed after the Project being proposed and during the construction phase? Are there separate water and sanitation facilities for the construction workers in the Project area?			
7	Green House Gas Controlling Measures	Use of efficient generator in the construction activities Regular maintenance of vehicles, generator and machinery in accordance with manufacturer's specifications Use of approved pollution control devices fitted in the equipment's and machineries Switching off and throttling down the machines/equipment's/generators which are not in use			



**Table B: Checklist of Monitoring ESMP Implementation (During Construction phase)**  
**(Labor and Working Condition)**

**Basic Data**

SI No	Description	Values
1	Direct Workers	
2	Contracted Workers	
3	Supply Chain Workers	
4	Child labor	
5	0 - 12	
6	13 - 14	
7	14 - 18	

**Checklist for Labor and Working Condition**

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Working Conditions and Management of Worker Relationship	<ul style="list-style-type: none"> <li>Preparation of Human Resources Policies and Procedures for Direct workers</li> <li>Defined Working condition and Terms of Employment for direct worker</li> <li>Sustainably equivalent terms and condition for migrant workers</li> <li>Compliance to national law of forming workers' organization</li> <li>No discrimination and equal opportunity for all</li> <li>Measures for diminishing past discrimination</li> <li>Grievance Mechanism</li> </ul>			
	Protecting Workforce	<ul style="list-style-type: none"> <li>The client will not employ children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.</li> <li>No Force Labor</li> </ul>			
2	Safety at site	<ul style="list-style-type: none"> <li>Installation/Construction of Safety Fence around the Project area</li> <li>Use of Personnel Protective Equipment (i.e. safety suit, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.)</li> </ul>			

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		<ul style="list-style-type: none"> <li>• Safety trainings for workers (i.e. fire control, working at height, working in heat, first aid etc.)</li> <li>• Practice of Tool box meeting, safety talks,</li> <li>• Safe Storage of Hazardous Chemicals (e.g. fuel, flammable chemical, toxic chemicals, etc.)</li> <li>• Maintaining Material Safety Data Sheet (MSDS)</li> <li>• Provision of Health care facilities such as doctor, hospital etc. available at/nearby the plant construction site</li> <li>• Availability of First Aid at work place</li> <li>• Preparation and Follow of Emergency Response Plan</li> <li>• Adequate fire precautions in place (for example, fire extinguishers, escape routes etc.)</li> <li>• Documentation and reporting of occupational accidents, diseases, and incidents</li> <li>• Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS</li> </ul>			
3	Occupational Health and Safety Procedure	<ul style="list-style-type: none"> <li>• Provision of complete EHS division in the Human Resources Planning/Organogram</li> <li>• Preparation of Safety Policy to be adopted during plant operation</li> </ul>			
4	Worker's Well Being	<ul style="list-style-type: none"> <li>• Establishment Grievance Mechanisms</li> <li>• Ensuring fair treatment, non-discrimination and equal opportunity</li> <li>• Compliance of Project's labor policy with the national labor law</li> <li>• No Child Labor</li> <li>• No incident of forced labor</li> <li>• Provision of Welfare facilities for Worker/Labor</li> </ul>			

**Table C: Checklist of Monitoring ESMP Implementation (During Construction phase)**  
**(Community Health, Safety and Security)**

SI No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Disturbance to nearby community due to dust from newly developed land and Noise from construction activities	<ul style="list-style-type: none"> <li>• Construction of boundary wall around the Project are</li> <li>• Installation of water spraying system to control dusts</li> <li>• Conducting dust monitoring and visual inspection around the site boundary</li> <li>• Adoption of Noise management plan</li> </ul>			
2	Grievance of local people	<ul style="list-style-type: none"> <li>• Availability and operation of Grievance Redress Mechanism</li> <li>• Maintaining open communication channel with the local community</li> </ul>			
3	Risk of breaching Community Safety	<ul style="list-style-type: none"> <li>• Construction of boundary wall/safety fence around the Project area</li> <li>• Practicing Risk Assessment and Evaluation Process</li> <li>• Practicing safe management for hazardous materials which may pose threat to the community</li> <li>• Availability and operation of Emergency Response Plan</li> <li>• Maintaining open communication channel with the local community</li> <li>• Training and instruction to the security personnel about their behaviour and communication with the local people</li> <li>• Aware the security personnel about the right of the community people</li> </ul>			
4	Community Health Risk	<ul style="list-style-type: none"> <li>• Provision of providing health service facilities to community if the Project possess any health risk like sexually transmitted disease, communicable disease, vector-borne diseases</li> <li>• Implement all pollution mitigation measures to ensure safeguarding to community</li> </ul>			<i>(Continued)</i>
5	Youth Employment	<ul style="list-style-type: none"> <li>• Providing training/awareness program for the local youth to let them aware about the required qualification to get involved in the Project related activities</li> </ul>			
6	Public Communication, Consultation and Awareness	<ul style="list-style-type: none"> <li>• Arranging public communication/consultation meeting</li> <li>• Sharing of Project information with local people</li> <li>• Organizing environmental and social awareness programs/meetings</li> </ul>			

**Table D: Checklist of Monitoring ESMP Implementation (During Construction phase)**  
**(Biodiversity and Sustainable Management of Living Natural Resources)**

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Runoff (contain mostly sediment load) from newly developed land falls into nearby river and channel.	<ul style="list-style-type: none"> <li>• Installation of proper run on/runoff drains</li> <li>• Use of sediment fences, traps and basins for trapping the sediment, if required</li> </ul>			
2	Disturbance to nearby ecosystem due to different construction activities	<ul style="list-style-type: none"> <li>• No cutting/ felling of trees along the river bank</li> <li>• Implementation of on-site waste and air quality management plan</li> <li>• Limiting soil extraction activities limited within the defined area</li> <li>• Limiting the vegetation clearance and base stripping process within the Project boundary</li> <li>• Safety fence around the construction site</li> <li>• Limiting the use of night light</li> <li>• Using shade (directed downwards) around the outdoor lights</li> <li>• Provision of cut-off time to switch off unnecessary lights at night</li> <li>• Initiate Green plantation</li> <li>• No plantation of non-native species</li> <li>• Retaining top soil for future habitat restoration</li> <li>• No degradation of critical habitat?</li> </ul>			
3	Occupation of river, inter-tidal areas and wetlands	<ul style="list-style-type: none"> <li>• No encroachment of inter-tidal flood plain area</li> <li>• No disturbance to Dolphin community</li> <li>• Monitoring of Ecosystem Health and Monitoring of Sundarbans Forest Health</li> <li>• If required, embankment should be constructed considering a setback distance from river/canal bank</li> <li>• Slope protection work along the Maidara River should be completed on an urgent basis before rainy season come and</li> <li>• BIFPCL may take initiatives of excavating of silted reach of Maidara river near proposed township area to facilitate proper functioning of River for maintaining tidal dynamics</li> </ul>			

## Appendix II: Photo Album

### Environmental and Socio-economic Monitoring of Khulna 2×660 MW Power Plant for 28<sup>th</sup> monitoring program (April, 2021)



Monitoring team



Canopy cover measurement



Forest health data collection





Data collection



Observing Fisheries resources



Marking trees



Sampling data collection



Observing the fishing activities and data collection




## Appendix III: Terms of References (ToR)

### Background

Bangladesh-India friendship Power Company (Pvt.) Ltd. (BIFPCL), a 50:50 Joint Venture Company of Bangladesh Power Development Board (BPDB) of Bangladesh & NTPC Limited of India is implementing a coal based thermal power plant named 2X660 MW Maitree Super Thermal Power Project at Rampal in Bagerghat District of Khulna Division of Bangladesh. The plant is envisaged to be based on super critical technology and is to be operated as Base Load Plant. The fuel envisaged is imported coal.

### General Description of 2X660 MW Maitree Super Thermal Power Plant Project

<b>Project Location:</b>	<p>Upazila: Rampal, District: Bagerhat</p> <p>Site is located at 23 kms Southward of Khulna City and 14 kms. North-Eastward from Mongla Port.</p> 
<b>Project Capacity:</b>	1320 MW (2x660 MW), based on Ultra Super-critical Technology
<b>Mode of Operation:</b>	Base Load
<b>Fuel:</b>	Imported Coal
<b>Fuel Transportation:</b>	It is envisaged that imported coal from countries like Indonesia, Australia shall be transported through bigger ships, up to trans-shipment point, from where the coal shall be transported through barges to the coal

	unloading jetty at the plant end. From jetty to the power plant coal shall be transported through coal conveyor system.
<b>Land&amp; Land Development:</b>	Based on the layout in the FR, it is estimated that approx. 575 acres of land will be required for the project. (375 Acres for Main Plant, 50 Acres for Township, 50 Acres for Jetty).
<b>Evacuation of power:</b>	Provision of line bays in generation switchyard for one no. 400 kV Double Circuit line and one no. 230 kV Double Circuit line have been kept. The Power evacuation (transmission line) system from the Project shall be at 400 kV level and will be outside the scope of the Project. 400 kV is being introduced for the first time in Bangladesh.
<b>Expected Timeline for project implementation</b>	The first unit of capacity 660 MW is scheduled to be synchronised in 41 months from the date of NTP to the EPC contractor for the Power project. Commissioning of the first unit of capacity 660 MW is envisaged at an interval of 5 months thereafter.

### **Broad Scope of Works**

The study covers quarterly monitoring of different environmental and social parameters, and implementation of EMP (Environment Management Plan) during implementation phases as per DoE approval/requirement. The monitoring locations were selected based on physical activities, wind direction, sensitive receptors, etc. and were finalized through the consultation with DoE, Department of Fisheries (DoF), MPA and Forest Department (FD).

### **The Broad objectives of independent monitoring covers the following activities**

- Monitoring implementation of EMP and environmental compliance;
- Monitoring of ambient air quality, noise level and water quality;
- Monitoring of cropping pattern and soil quality;
- Monitoring of fisheries resources covering fish habitats, biodiversity, migration and production;
- Monitoring of ecosystem and biodiversity;
- Monitoring of the Sundarbans Forest Health; and
- Monitoring of socio-economic condition and livelihoods.
- To evaluate the project environmental performance as due to construction activities.

### **The main objectives of this works are**

- Monitoring of Social and Environmental parameters to update the baseline.
- Monitoring of Social and Environmental parameters during Implementation of the Project.
- Assistance to BIFPCL for implementation of Environmental Management Plan (EMP) during construction period.

- 
- The scope of work of the Independent Monitoring will include the following specific tasks
  - Develop specific monitoring indicators, checklists, and questionnaires to undertake independent monitoring (a preliminary list of monitoring indicators has been given in the EMP) in consultation with BIFPCL, DoE, Forest Department and the Financer;
  - Review and verify the implementation progress of various EMP elements, particularly, mitigation plan, compliance monitoring, environmental trainings, documentation, and grievance redress mechanism;
  - Physical aspects would cover air quality, noise level, water quality and land resources;
  - Biological environment includes fisheries resources, ecological resources, Sundarbans Reserve Forest (SRF) health conditions including WHS;
  - Environmental compliance monitoring includes Monitoring of Environmental and Social Management System Action Plan Implementation, monitoring of labour and working conditions, monitoring of community health, safety and security and monitoring of biodiversity and sustainable management of living natural resources.
  - To establish baseline environmental conditions;
  - Provide and monitor the environmental parameter during construction activities.
  - To detect adverse environmental impacts for river dredging and other activities of site development;
  - Provide technical assistance to the client for implementation of the EMP during the power plant construction at different sector of construction activities.
  - To demonstrate whether the environmental control measures are operating as per designed;
  - To provide data for emission inventories;
  - To provide data at regular intervals for dissemination to the stakeholders
  - To provide data for improvement and updating of the monitoring program;
  - To assist in investigating the event of a trigger level or emission limit value being crossed.
  - Update baseline data as per monitoring schedule and location.
  - Provide technical assistance to the client for implementation of the EMP during power plant construction.
  - Review the EIA document to evaluate the EMP measures incorporated in the contract to mitigate different social and environmental hazards and risks during construction of the Project
  - Submit progress reports to the client.
  - Physical observation to assess that all mitigation measures mentioned in EMP are carried out in all place.
  - Sampling and carrying out necessary analysis of Environmental parameter such as surface & ground water quality, air quality, noise, Biological Environment, Socio-economic environment, Sundarbans Forest health etc. according to the monitoring framework in construction phase.
  - Morphological changes of the adjacent river of the project will be influenced by the constructional activities. River bank erosion-accretion, drainage system, tidal inundation etc. will be investigate after regular intervals in the study area as per monitoring location of the EIA. The procedure of investigation and methodologies of analysis will be the same as pre-

construction phases. River bed pollution will be identified through this study during construction of the power plant.

- Monitoring of floral resources will be performed quarterly. The indicators and procedures of flora monitoring will be relatively same as earlier studies of this projects. Plant composition, canopy coverage, indigenous and exotic species, plant intensities will be the main monitoring indicators during construction phases.
- Monitoring of faunal resources will be performed quarterly at the construction period. Faunal resources survey will coincide with floral resources survey as it will provide more insight about the inter-dependency between flora and fauna in an ecosystem.
- Render any other related services as and when requested.
- Conduct community level consultation in a regular interval and disclose project level information.
- Keep liaison with different organization like Govt department, NGOs, and relevant stakeholders.

**The Monitoring parameter & associated indicator are given below**

Monitoring Parameter	Indicators
Socio-economy	Livelihood and Occupation
	Income and expenditure
	Displacement and Migration
	Cultural and heritage
	Health and sanitation
	Risks and accidental assessment
	Transportation and communication
	Public and private Infrastructure development
Ecology and Biodiversity	Bio-indicator Assessment
	Movement of indigenous/ native species
	Envision of exotic species and regime dominance
	Species composition (Flora and Fauna)
	Assessment the services of dependent ecosystem
Agriculture	Land use and canopy coverage
	Soil quality (Salinity, pH, OM,)
	Cropping pattern and crop intensities
	Irrigation and crop production
	Farmers survey result
Fisheries	Fish diversity and specification
	Fish production and availability
	Fisher survey result
Noise level	Sound level at the sensitive zone
Water resources	DO, BOD, COD, Salinity, TDS, TS, pH, Hg, Pb

Monitoring Parameter	Indicators
	Total Hardness, Hg, NO <sub>3</sub> and PO <sub>4</sub>
	River Morphology,
	Tidal inundation
	Drainage Network
	Erosion and Accretion
	Ground water quality
Air quality	SO <sub>x</sub>
	NO <sub>x</sub>
	SPM (PM <sub>10</sub> and PM <sub>2.5</sub> )
	CO

### Air quality monitoring progress

The most commonly used method for automatically monitoring air pollutant such as those above are:

- SO<sub>x</sub>: measured by Fluorescent signal generated by exiting SO<sub>2</sub> with UV light
- NO<sub>x</sub>: measured by Chemiluminescent reaction between NO<sub>x</sub> & O<sub>3</sub>
- O<sub>3</sub>: measured by ultra violet absorption analyzer, this determines the Ozone concentration by the attenuation of 254 nm UV light along this signal fixed path cell
- Particulate matter (SPM, PM<sub>10</sub>, PM<sub>2.5</sub>): measured by gravimetric methods including true micro weighing technology for automatic monitoring & instrument named 'Tapered element oscillating micro balance (TOEM)' has been most frequently used. Measurement on filter tape using the principles of beta attenuation for estimating 30 mnt or 1 hr average concentrations of PM<sub>10</sub> or PM<sub>2.5</sub> has also been used.
- CO: In urban air pollution studies, a non-disruptive infrared photo meter utilizing a gas filter co relation technology & state of the art optical & electronic technology is used to measure low concentration of CO accurately & reliably.

### Expected Output

A breach of a trigger level or emission limit values may indicate a significant increase of a contaminate concentration in an environmental medium.

Baseline Monitoring is monitoring in and around the location of a proposed site so as to establish background environmental conditions prior to any development of the proposed site. In case of existing facilities, baseline-monitoring serves as a reference point to which later monitoring results are compared. The information will be used to evaluate in future compliance monitoring.

Compliance monitoring is periodic monitoring and is to determine whether there is any release of contaminants to the environment and to demonstrate compliance within the project area. It includes measurements of process conditions, process emissions and levels in receiving environments and the reporting of the results of such measurements to demonstrate compliance with limits specified in the legislation.

The information provided by compliance monitoring is also valuable for other environmental and management activities (e.g. for optimizing process, protecting sensitive ecosystems and informing the public of the effectiveness of environmental protection measures).

Assessment monitoring is investigative monitoring which is initiated after detection of the impacts to the environment or on attaining a trigger level. The assessment monitoring will:

- Identify the source of release materials;

- Characterize the nature, extent and rate of releases;
- Evaluate the risk to the environment and to human health;
- Evaluate measures to prevent or minimize future releases;
- Provide information for the design and implementation of corrective measures and
- Express the residual environmental impacts for proper compensation.

**Reporting Requirements**

As it is proposed to carry out the monitoring program for two quarters and the proposed deliverables are scheduled below:

SL	Name	No. of copies
1	Monitoring Report after each monitoring mission (each in one quarter) with complete data, analysis, lab. Results, discussion etc. as intended in the scope of work.	12
2	CD-ROM in respect of documents/datasheets	2



## Appendix IV: Monitoring Data

### (A) Air Quality Data

Table A1: Ambient Air Quality Monitoring Results

Locations of Monitoring		1 <sup>st</sup> QM, Apr 2014	2 <sup>nd</sup> QM, Jul 2014	3 <sup>rd</sup> QM, Oct 2014	4 <sup>th</sup> QM, Jan 2015	5 <sup>th</sup> QM, Apr 2015	6 <sup>th</sup> QM, Jul2015	7 <sup>th</sup> QM, Oct 2015	8 <sup>th</sup> QM, Jan 2016	9 <sup>th</sup> QM, Apr 2016	10 <sup>th</sup> QM, Jul 2016	11 <sup>th</sup> QM, Oct 2016	12 <sup>th</sup> QM, Jan 2017	13 <sup>th</sup> QM, April, 2017	14 <sup>th</sup> QM, Oct, 2017	15 <sup>th</sup> QM Jan, 2018	16 <sup>th</sup> QM April, 2018	17 <sup>th</sup> QM, Jul 2018	18 <sup>th</sup> QM, Nov, 2018	19 <sup>th</sup> QM, Feb, 2019	20 <sup>th</sup> QM, Apr, 2019	21 <sup>st</sup> QM, Jul, 2019	22 <sup>nd</sup> QM, Jul, 2019	23 <sup>rd</sup> QM, Feb, 2020	25 <sup>th</sup> QM, July, 2020	26 <sup>th</sup> QM, Oct, 2020	27 <sup>th</sup> QM, Jan, 2021	28 <sup>th</sup> QM, April, 2021	29 <sup>th</sup> QM, Aug, 2021	30 <sup>th</sup> QM, Nov, 2021	Bangladesh (DoE) Standard (ECR, 2005)	
Weather	Pollutants	Sunny	Rainy/ Cloudy	Sunny	Sunny	Sunny	Rainy/ Cloudy	Sunny/ Rainy	Sunny	Sunny	Rainy/ Cloudy	Rainy/ Cloudy	Sunny	Sunny/ Cloudy	Sunny	Sunny	Sunny/ Cloudy	Rainy/ Cloudy	Sunny/ Cloudy	Sunny	Sunny	Sunny/ Cloudy	Sunny/ Cloudy	Sunny	Rainy/ Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny		
Concentrations are in µg/m <sup>3</sup>																																
SW Corner of the PP area	PM <sub>2.5</sub>	33	37	25	33	47	25	22	34	19	5	9	24.8	8.12	28.2	32.9	28.4	15.2	31.1	27.3	21.7	37.76	51.32	27.12	18.71	44.18	55.35	49.13	38.25	56.83	65 <sup>24hr</sup>	
	PM <sub>10</sub>	78	77	53	79	83	35	52	135	117	32	22	79	43.8	73.6	133	70	15.8	106	105.4	98.2	67.15	127.6	68.1	80.28	107.16	106.13	103.88	59.17	83.46	150 <sup>24hr</sup>	
	SPM	207	239	190	200	177	42	91	175	332	51	53	115.7	122.4	169.4	145.6	121.5	12.9	137.4	151.6	128.6	109.25	183.56	108.4	98.26	149.73	163.48	155.14	99.44	144.48	200 <sup>8hr</sup>	
	SO <sub>2</sub>	21	24	19	23	15	52	35	14	18	9	8	9.5	9.0	7.2	14.3	11.4	11.9	12.7	11.6	13.9	56.5	31.53	18.35	19.91	26.63	14.74	16.26	14.49	16.28	365 <sup>24hr</sup>	
	NO <sub>x</sub>	26	29	27	31	29	35	29	18	18	12	10	11.3	10.7	7.5	17.7	12.8	10.2	14.8	12.4	16	55.08	24.97	12.12	8.82	16.62	37.16	22.31	19.87	21.64	100 <sup>Annual</sup>	
	CO	120	188	140	190	144	146	88	74	57	35	119	59	91	73	61	32	11.1	28	15	18	4	16	28	0	2	0	0	1	0	(10000) <sup>8hr</sup>	
	O <sub>3</sub>	27	26	19	22	26	12	5	4	1	1	1	5	03	10	03	9	13.2	7	9	6	25	10	8	8	8	9	16	42	11	157 <sup>8hr</sup>	
Shapmari area	PM <sub>2.5</sub>	39	48	48	39	34	18	17	35	25	3	8	25	14.6	8.5	31.5	26.7	15.8	35.7	30.6	18.9	50.24	19.34	19.14	20.35	29.17	52.74	48.64	41.2	44.65	65 <sup>24hr</sup>	
	PM <sub>10</sub>	814.6	90	74	102	97	31	48	116	44	11	11	99.5	56.9	40.4	147.8	52	64.4	109.9	126.3	106.1	63.94	82.27	83.22	71.06	84.3	112.04	83.1	64.28	71.35	150 <sup>24hr</sup>	
	SPM	2156.3	263	217	274	266	47	79	192	187	27	23	154.2	136.7	45.3	181.4	138.7	113.4	143.9	168	150.8	123.56	120.45	106.3	95.24	119.22	170.33	139.26	116.48	118.49	200 <sup>8hr</sup>	
	SO <sub>2</sub>	19	28	22	21	22	58	27	13	11	4	6	12.9	10	4.3	15	9.6	10.8	12.2	12.3	12.1	31.53	60.26	27.41	17.44	14.15	18.32	14.06	11.77	14.55	365 <sup>24hr</sup>	
	NO <sub>x</sub>	29	39	27	26	24	46	25	16	22	6	8	15.7	11.8	6	18.6	10.2	13.1	13.6	13.8	13.9	24.97	58.39	18.77	10.17	14.18	29.9	21.65	21.394	20.85	100 <sup>Annual</sup>	
	CO	165	210	230	164	136	127	102	77	22	31	108	66	78	79	69	27	25	30	21	20	4	11	44	4	0.013	0	0	1	1.1	(10000) <sup>8hr</sup>	
	O <sub>3</sub>	33	26	26	23	21	16	1	1	1	1	0	0	1	08	25	04	4	8	6	4	1	34	22	9	6	2	6	9	28	41	157 <sup>8hr</sup>
	PM <sub>2.5</sub>	37	44	19	42	59	28	19	24	11	3	10	29	10.3	15.2	40.7	27.7	12.9	32.3	20.3	14.2	37.27	33.2	21.61	21.93	46.73	68.26	58.81	22.66	41.98	65 <sup>24hr</sup>	

Locations of Monitoring		1 <sup>st</sup> QM, Apr 2014	2 <sup>nd</sup> QM, Jul 2014	3 <sup>rd</sup> QM, Oct 2014	4 <sup>th</sup> QM, Jan 2015	5 <sup>th</sup> QM, Apr 2015	6 <sup>th</sup> QM, Jul2015	7 <sup>th</sup> QM, Oct 2015	8 <sup>th</sup> QM, Jan 2016	9 <sup>th</sup> QM, Apr 2016	10 <sup>th</sup> QM, Jul 2016	11 <sup>th</sup> QM, Oct 2016	12 <sup>th</sup> QM, Jan 2017	13 <sup>th</sup> QM, April, 2017	14 <sup>th</sup> QM, Oct, 2017	15 <sup>th</sup> QM Jan, 2018	16 <sup>th</sup> QM April, 2018	17 <sup>th</sup> QM, Jul 2018	18 <sup>th</sup> QM, Nov, 2018	19 <sup>th</sup> QM, Feb, 2019	20 <sup>th</sup> QM, Apr, 2019	21 <sup>st</sup> QM, Jul, 2019	22 <sup>nd</sup> QM, Jul, 2019	23 <sup>rd</sup> QM, Feb, 2020	25 <sup>th</sup> QM, July, 2020	26 <sup>th</sup> QM, Oct, 2020	27 <sup>th</sup> QM, Jan, 2021	28 <sup>th</sup> QM, April, 2021	29 <sup>th</sup> QM, Aug, 2021	30 <sup>th</sup> QM, Nov, 2021	Bangladesh (DoE) Standard (ECR, 2005)	
Weather	Pollutants	Sunny	Rainy / Cloudy	Sunny	Sunny	Sunny	Rainy / Cloudy	Sunny / Rainy	Sunny	Sunny	Rainy / Cloudy	Rainy / Cloudy	Sunny	Sunny / Cloudy	Sunny	Sunny	Sunny / Cloudy	Rainy / Cloudy	Sunny / Cloudy	Sunny	Sunny	Sunny / Cloudy	Sunny / Cloudy	Sunny	Rainy / Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	
Concentrations are in µg/m <sup>3</sup>																																
NW Corner of the PP area	PM <sub>10</sub>	67	78	56	98	91	96	29	125	29	24	14	108.7	31.3	49.9	136.3	100.1	44.3	117.4	93.6	58.7	42.99	1119.34	77.69	76.76	110.43	131.84	97.61	48.19	61.48	150 <sup>24hr</sup>	
	SPM	234	217	157	310	244	321	66	187	115	31	35	168	91.7	63.9	161.7	116.2	76.3	156.2	125.5	119.2	60.45	175.13	100.04	101.33	160.3	180.43	161.8	77.149	104.73	200 <sup>8hr</sup>	
	SO <sub>2</sub>	19	22	18	27	21	56	32	13	17	4	8	12.2	5.8	7.5	9.6	13.2	5.8	13.4	10.7	11.6	60.26	54.02	19.68	16.21	25.82	16.19	16.58	13.58	12.19	365 <sup>24hr</sup>	
	NOx	23	28	22	32	39	43	21	18	16	5	11	14.7	7.1	9.2	11.7	14.3	5.9	15	11.3	13.5	58.39	43.45	17.53	10.55	18.91	34.1	27.42	20.49	18.39	100 <sup>Annual</sup>	
	CO	110	178	110	210	140	133	87	77	38	47	127	31	74	80	45	43	21	32	20	16	7	0	30	2	0.012	0	0.2	1	1.4	(10000) <sup>8hr</sup>	
	O <sub>3</sub>	25	19	17	36	44	11	8	2	0	1	1	3	05	10	05	7	6	8	1	5	18	2	9	8	8	12	14	17	34	157 <sup>8hr</sup>	
Barni, Gaurambha	PM <sub>2.5</sub>	39	47	57	39	41	34	11	29	23	9	10	21.7	7.9	13.8	52.3	18	11.9	15.4	19.3	19.7	57.51	31.28	26.66	18.04	38.69	61.29	62.29	21.8	58.34	65 <sup>24hr</sup>	
	PM <sub>10</sub>	103	122	67	97	82	65	26	97	82	45	13	105.4	30.5	30.2	140	30.5	20.5	50.1	102	69.9	33.25	69.32	61.11	59.02	91.79	93.36	103.42	50.26	73.17	150 <sup>24hr</sup>	
	SPM	233	244	183	277	236	79	112	176	268	69	30	167.8	95.6	57.2	171.9	90.6	5.2	113.5	127.5	92.2	75.13	102.17	98.74	82.02	128.48	159.8	154.35	83.2	134.6	200 <sup>8hr</sup>	
	SO <sub>2</sub>	21	23	17	22	25	41	31	16	20	10	7	12.2	5.5	4.1	13.8	6.1	6.1	9.5	11.5	12.6	54.02	59.33	18.88	24.29	20.17	16.47	13.52	14.44	21.39	365 <sup>24hr</sup>	
	NOx	25	28	22	26	27	44	32	21	16	12	9	19.3	9.8	5.0	16.7	7.3	7.4	10.7	13.8	13.8	43.45	57.02	11.58	10.62	14.47	21.18	19.371	19.48	38.46	100 <sup>Annual</sup>	
	CO	175	210	190	150	196	96	96	81	73	41	98	63	85	77	59	24	20	20	17	18	6	0	32	0	0	0	0	0	0	(10000) <sup>8hr</sup>	
	O <sub>3</sub>	26	29	22	19	15	9	6	4	0	0	3	5	08	6	04	6	6	2	3	4	7	52	12	8	0	6	2	19	28	157 <sup>8hr</sup>	
Chunkuri-2, Bajua Dacope	PM <sub>2.5</sub>	35	39	46	37	33	35	28	31	25	7	5	25.2	8.7	17.3	33.4	11.4	10.2	26.8	22.8	15	19.46	33.74	39.44	18.22	43.91	59.18	53.36	33.27	29.61	65 <sup>24hr</sup>	
	PM <sub>10</sub>	77	86	69	68	61	109	49	98	60	23	20	74.4	44.4	100.2	157.1	40.6	30.6	105.9	126.7	72.7	46.37	78.27	100.08	59.91	88.93	117.42	86.44	61.9	44.28	150 <sup>24hr</sup>	
	SPM	117	113	162	183	188	175	94	167	167	31	48	162	110.6	127.8	200	108	78.6	128.5	146.6	117.6	80.31	100.95	146.72	146.72	139.04	188.27	128.36	104.29	77.88	200 <sup>8hr</sup>	
	SO <sub>2</sub>	19	24	21	18	11	55	33	21	13	7	9	18.9	8.2	7.9	19	10.4	7.5	12.1	12.4	11.2	45.81	35.42	36.14	18.74	29.94	16.45	19.66	15.98	10.59	365 <sup>24hr</sup>	
	NOx	23	26	27	24	18	49	23	16	25	10	8	18	11.2	8.4	20.7	11.6	8.4	14	13.8	13.7	44.92	40.09	20.04	10.19	18.32	26.14	24.21	18.66	17.21	100 <sup>Annual</sup>	
	CO	190	205	170	170	33	133	75	70	33	38	79	36	94	69	58	42	23	27	25	20	10	0	18	10	0	0.1	0.1	0.8	1	(10000) <sup>8hr</sup>	
	O <sub>3</sub>	27	24	18	22	41	21	2	1	1	0	2	2	03	5	05	2	4	5	9	8	2	38	22	8	0	23	28	11	9	157 <sup>8hr</sup>	
	PM <sub>2.5</sub>	47	49	57	41	39	34	25	47	15	8	10	38.7	15.8	17	72.3	15.9	11.1	24.8	28.6	15.8	24.03	24.03	33.26	16.63	33.32	66.31	42.62	32.45	42.59	65 <sup>24hr</sup>	

Locations of Monitoring	Pollutants	1 <sup>st</sup> QM, Apr 2014	2 <sup>nd</sup> QM, Jul 2014	3 <sup>rd</sup> QM, Oct 2014	4 <sup>th</sup> QM, Jan 2015	5 <sup>th</sup> QM, Apr 2015	6 <sup>th</sup> QM, Jul2015	7 <sup>th</sup> QM, Oct 2015	8 <sup>th</sup> QM, Jan 2016	9 <sup>th</sup> QM, Apr 2016	10 <sup>th</sup> QM, Jul 2016	11 <sup>th</sup> QM, Oct 2016	12 <sup>th</sup> QM, Jan 2017	13 <sup>th</sup> QM, April, 2017	14 <sup>th</sup> QM, Oct, 2017	15 <sup>th</sup> QM Jan, 2018	16 <sup>th</sup> QM April, 2018	17 <sup>th</sup> QM, Jul 2018	18 <sup>th</sup> QM, Nov, 2018	19 <sup>th</sup> QM, Feb, 2019	20 <sup>th</sup> QM, Apr, 2019	21 <sup>st</sup> QM, Jul, 2019	22 <sup>nd</sup> QM, Jul, 2019	23 <sup>rd</sup> QM, Feb, 2020	25 <sup>th</sup> QM, July, 2020	26 <sup>th</sup> QM, Oct, 2020	27 <sup>th</sup> QM, Jan, 2021	28 <sup>th</sup> QM, April, 2021	29 <sup>th</sup> QM, Aug, 2021	30 <sup>th</sup> QM, Nov, 2021	Bangladesh (DoE) Standard (ECR, 2005)	
		Sunny	Rainy/ Cloudy	Sunny	Sunny	Sunny	Rainy/ Cloudy	Sunny/ Rainy	Sunny	Sunny	Rainy/ Cloudy	Rainy/ Cloudy	Sunny	Sunny/ Cloudy	Sunny	Sunny	Sunny/ Cloudy	Rainy/ Cloudy	Sunny/ Cloudy	Sunny	Sunny	Sunny/ Cloudy	Sunny/ Cloudy	Sunny	Rainy/ Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny		
Concentrations are in µg/m <sup>3</sup>																																
Pankhali, Dacope	PM <sub>10</sub>	119	127	139	101	105	144	62	128	46	42	18	141.6	105	63.4	208.9	74.3	58.4	92	125.8	92.7	56.56	119.28	127.52	55.78	74.83	102.73	73.29	74.89	64.71	150 <sup>24hr</sup>	
	SPM	297	266	254	208	299	339	183	198	114	78	34	194.6	179	87.5	223.9	154.1	98.4	139	178.2	141.1	93.5	100.95	160.02	70.23	111.95	156.56	116.73	118.4	107.31	200 <sup>8hr</sup>	
	SO <sub>2</sub>	28	31	31	24	30	58	36	18	9	8	8	16.1	12.9	8	16.3	12.2	9.4	10.4	13.3	10.4	59.41	44.29	30.89	16.73	21.39	16.16	13.1	14.61	12.8	365 <sup>24hr</sup>	
	NOx	41	39	36	26	27	47	23	15	19	9	9	19	18.7	10.2	17.7	13.7	12.1	13.4	14.9	11.7	51.09	17.72	19.02	10.52	12.12	28.54	17.18	20.27	19.33	100 <sup>Annual</sup>	
	CO	230	217	250	188	177	125	105	101	55	29	112	48	83	87	49	34	29	30	14	14	9	0	11	0	0	1	0	1	1.1	(10000) <sup>8hr</sup>	
	O <sub>3</sub>	49	38	36	27	11	13	5	2	2	0	0	3	06	0	06	6	8	8	8	3	22	26	2	2	4	20	2	10	19	157 <sup>8hr</sup>	
Mongla Port area	PM <sub>2.5</sub>	47	55	39	41	26	33	19	34	21	9	11	25.7	22.6	33.2	70.1	23.2	13.2	30.3	26.6	35	56.67	39.69	38.92	41.33	40.75	74.19	65.37	22.54	51.83	65 <sup>24hr</sup>	
	PM <sub>10</sub>	139	174	77	82	35	52	33	132	45	29	15	119.3	93.6	97	209.1	89.9	47.5	103.7	109.3	131	119	64.12	119.61	126.13	114.61	118.67	129.71	64.44	72.4	150 <sup>24hr</sup>	
	SPM	288	303	197	217	214	118	65	189	144	50	6	172.3	196	187.2	242	144.7	73.7	161.9	157.1	183.1	192.17	83.9	173.36	166.16	152.76	201.16	180.22	85.2	128.3	200 <sup>8hr</sup>	
	SO <sub>2</sub>	27	28	26	24	14	45	36	16	10	8	7	16.8	10.5	8.2	15.5	11.8	6.5	12	10.8	16.8	59.33	57.24	31.33	22.04	20.06	12.26	18.91	10.28	17.44	365 <sup>24hr</sup>	
	NOx	44	39	33	27	17	40	20	13	14	10	8	15.3	15.1	10.7	18.4	13.2	7.2	16.8	12.6	17.8	57.02	46.58	13.34	11.29	9.69	19.25	30.2	19.73	29.16	100 <sup>Annual</sup>	
	CO	230	320	220	211	24	110	84	71	29	31	97	44	72	79	52	29	20	33	28	17	15	48	29	24	0	2	0.9	2	2.4	(10000) <sup>8hr</sup>	
	O <sub>3</sub>	57	52	37	26	09	15	8	3	1	2	1	4	04	9	02	3	1	9	7	3	5	40	4	2	1	66	91	23	43	157 <sup>8hr</sup>	
Harbaria, Sundarbans	PM <sub>2.5</sub>	19	22	33	27	24	27	24	26	13	6	10	19.2	10.5	28.3	43.5	11.6	11.4	20.6	15.4	14.2	28.03	39.69	17.81	20.11	34.42	53.28	46.13	34.94	31.2	65 <sup>24hr</sup>	
	PM <sub>10</sub>	41	39	59	56	49	42	50	82	42	20	14	85.2	36.7	89.9	152.4	29.1	24.3	80.5	92.6	63.9	21.85	64.12	63.27	62.24	79.38	100.11	82.83	61.53	49.07	150 <sup>24hr</sup>	
	SPM	111	117	129	139	109	70	73	159	91	43	44	93.5	103.7	107	189.9	72.4	47.6	90.3	118.3	90.9	48.09	83.9	87.51	87.71	122.94	146.2	133.1	108.74	83.16	200 <sup>8hr</sup>	
	SO <sub>2</sub>	9	10	14	12	16	51	34	15	11	6	7	11.9	5.7	7.6	13.2	7.9	4.9	11.6	9.5	11.6	49.72	57.24	16.47	13.31	19.74	14.66	16.58	14.75	12.68	365 <sup>24hr</sup>	
	NOx	19	22	27	18	22	34	22	14	16	8	10	13	7.7	9.3	15.2	8.3	5.4	13	10.1	13	41.91	46.58	9.9	8.13	10.16	21.44	0	23.28	22.27	100 <sup>Annual</sup>	
	CO	65	58	70	64	56	112	81	62	47	32	110	67	73	84	57	31	20	20	25	16	16	48	30	8	0	0	3	1	1	(10000) <sup>8hr</sup>	
	O <sub>3</sub>	13	12	13	11	14	12	4	2	2	0	1	4	08	0	02	2	6	4	3	5	8	40	12	22	3	6	46.13	9	11	157 <sup>8hr</sup>	
	PM <sub>2.5</sub>	17	19	23	18	49	NO	25	18	9	4	4	14.3	13.2	7.5	35.4	13.7	14	29.1	16.2	13	19.68	36.67	23.04	13.16	22.74	48.2	41.33	39.16	23.6	65 <sup>24hr</sup>	

Locations of Monitoring	Pollutants	1 <sup>st</sup> QM, Apr 2014	2 <sup>nd</sup> QM, Jul 2014	3 <sup>rd</sup> QM, Oct 2014	4 <sup>th</sup> QM, Jan 2015	5 <sup>th</sup> QM, Apr 2015	6 <sup>th</sup> QM, Jul 2015	7 <sup>th</sup> QM, Oct 2015	8 <sup>th</sup> QM, Jan 2016	9 <sup>th</sup> QM, Apr 2016	10 <sup>th</sup> QM, Jul 2016	11 <sup>th</sup> QM, Oct 2016	12 <sup>th</sup> QM, Jan 2017	13 <sup>th</sup> QM, April, 2017	14 <sup>th</sup> QM, Oct, 2017	15 <sup>th</sup> QM Jan, 2018	16 <sup>th</sup> QM April, 2018	17 <sup>th</sup> QM, Jul 2018	18 <sup>th</sup> QM, Nov, 2018	19 <sup>th</sup> QM, Feb, 2019	20 <sup>th</sup> QM, Apr, 2019	21 <sup>st</sup> QM, Jul, 2019	22 <sup>nd</sup> QM, Jul, 2019	23 <sup>rd</sup> QM, Feb, 2020	25 <sup>th</sup> QM, July, 2020	26 <sup>th</sup> QM, Oct, 2020	27 <sup>th</sup> QM, Jan, 2021	28 <sup>th</sup> QM, April, 2021	29 <sup>th</sup> QM, Aug, 2021	30 <sup>th</sup> QM, Nov, 2021	Bangladesh (DoE) Standard (ECR, 2005)
Weather		Sunny	Rainy / Cloudy	Sunny	Sunny	Sunny	Rainy / Cloudy	Sunny / Rainy	Sunny	Sunny	Rainy / Cloudy	Rainy / Cloudy	Sunny	Sunny / Cloudy	Sunny	Sunny	Sunny / Cloudy	Rainy / Cloudy	Sunny / Cloudy	Sunny	Sunny	Sunny / Cloudy	Sunny / Cloudy	Sunny	Rainy / Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	
Concentrations are in µg/m <sup>3</sup>																															
Akram Point, Sundarbans	PM <sub>10</sub>	39	44	32	39	77	NO	32	77	31	15	14	85.5	96.0	37.8	150.6	36.4	41.6	100.2	93.2	51.9	43	87.15	82.91	58.82	56.74	90.12	84.16	76.18	51.88	150 <sup>24hr</sup>
	SPM	114	133	97	88	102	NO	51	128	46	23	27	90.9	137.0	41.8	175.1	90.3	58	121.4	117.8	71.1	83.9	122.62	121.68	78.8	80.31	144.95	131.46	123.59	79.47	200 <sup>8hr</sup>
	SO <sub>2</sub>	7	9	12	13	21	NO	27	14	9	4	6	8.4	6	5.8	14	8.3	6.3	10.8	10.1	8.9	57.24	35.23	24.21	15.06	12.74	15.05	17.44	16.55	15.89	365 <sup>24hr</sup>
	NO <sub>x</sub>	17	19	22	17	27	NO	19	15	10	5	6	12.7	10.1	5.9	15.1	9.9	9.3	11.7	11.3	9.4	46.58	31.26	16.74	10.47	6.64	20.6	23.5	21.28	21.39	100 <sup>Annual</sup>
	CO	49	60	50	46	163	NO	92	64	21	37	101	58	79	69	52	21	25	28	17	14	38	24	20	14	0	0.2	0	2	1	(10000) <sup>8hr</sup>
	O <sub>3</sub>	11	14	9	10	27	NO	8	1	0	0	2	3	0	0	03	3	4	5	3	1	9	90	2	4	6	8	8	11	8	157 <sup>8hr</sup>
Hiron Point, Sundarbans	PM <sub>2.5</sub>	15	23	19	17	28	NO	27	NO	17	NO	9	21.7	NO	17.0	40.5	NO	NO	23.4	18.2	NO	NO	27.76	17.39	NO	28.15	55.71	NO	25.3	38.51	65 <sup>24hr</sup>
	PM <sub>10</sub>	44	38	34	41	60	NO	45	NO	40	NO	14	104.5	NO	92.1	149.8	NO	NO	86.7	96.1	NO	NO	67.89	72.45	NO	59.31	99.64	NO	59.7	49.27	150 <sup>24hr</sup>
	SPM	101	119	107	97	110	NO	88	NO	132	NO	26	111.4	NO	102	173.7	NO	NO	107.9	127.8	NO	NO	90.31	94.28	NO	91.06	155.39	NO	94.7	89.36	200 <sup>8hr</sup>
	SO <sub>2</sub>	8	7	13	14	15	NO	28	NO	15	NO	9	13.5	NO	6	15.8	NO	NO	10.6	10.7	NO	NO	45.81	13.33	NO	11.36	16.2	NO	13.92	14.33	365 <sup>24hr</sup>
	NO <sub>x</sub>	18	18	19	22	20	NO	23	NO	19	NO	9	15.9	NO	7.8	18.1	NO	NO	12.5	10.9	NO	NO	44.92	8.65	NO	9.74	23.53	NO	20.06	16.27	100 <sup>Annual</sup>
	CO	52	62	65	60	60	NO	93	NO	40	NO	121	43	NO	72	71	NO	NO	22	21	NO	NO	2	36	NO	0	0	NO	0	0	(10000) <sup>8hr</sup>
	O <sub>3</sub>	14	13	11	9	23	NO	2	NO	0	NO	0	4	NO	0	04	NO	NO	6	6	NO	NO	16	7	NO	1	11	NO	14	22	157 <sup>8hr</sup>
	PM <sub>2.5</sub>	54	39	52	42	55	46	19	35	11	16	9	34.6	23.1	19.5	78.7	12.4	12.5	21.3	20.8	33	38.59	18.65	40.22	46.73	48.32	88.71	71.2	29.47	65.66	65 <sup>24hr</sup>

Locations of Monitoring		1 <sup>st</sup> QM, Apr 2014	2 <sup>nd</sup> QM, Jul 2014	3 <sup>rd</sup> QM, Oct 2014	4 <sup>th</sup> QM, Jan 2015	5 <sup>th</sup> QM, Apr 2015	6 <sup>th</sup> QM, Jul2015	7 <sup>th</sup> QM, Oct 2015	8 <sup>th</sup> QM, Jan 2016	9 <sup>th</sup> QM, Apr 2016	10 <sup>th</sup> QM, Jul 2016	11 <sup>th</sup> QM, Oct 2016	12 <sup>th</sup> QM, Jan 2017	13 <sup>th</sup> QM, April, 2017	14 <sup>th</sup> QM, Oct, 2017	15 <sup>th</sup> QM Jan, 2018	16 <sup>th</sup> QM April, 2018	17 <sup>th</sup> QM, Jul 2018	18 <sup>th</sup> QM, Nov, 2018	19 <sup>th</sup> QM, Feb, 2019	20 <sup>th</sup> QM, Apr, 2019	21 <sup>st</sup> QM, Jul, 2019	22 <sup>nd</sup> QM, Jul, 2019	23 <sup>rd</sup> QM, Feb, 2020	25 <sup>th</sup> QM, July, 2020	26 <sup>th</sup> QM, Oct, 2020	27 <sup>th</sup> QM, Jan, 2021	28 <sup>th</sup> QM, April, 2021	29 <sup>th</sup> QM, Aug, 2021	30 <sup>th</sup> QM, Nov, 2021	Bangladesh (DoE) Standard (ECR, 2005)	
Weather	Pollutants	Sunny	Rainy / Cloudy	Sunny	Sunny	Sunny	Rainy / Cloudy	Sunny / Rainy	Sunny	Sunny	Rainy / Cloudy	Rainy / Cloudy	Sunny	Sunny / Cloudy	Sunny	Sunny	Sunny / Cloudy	Rainy / Cloudy	Sunny / Cloudy	Sunny	Sunny	Sunny / Cloudy	Sunny / Cloudy	Sunny	Rainy / Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny		
Concentrations are in µg/m <sup>3</sup>																																
Khulna City, near Khan Jahan Ali Bridge	PM <sub>10</sub>	139	117	91	84	75	89	49	112	69	68	24	145.9	99.5	39.6	213.9	38.8	45.4	57.9	91.3	125.9	47.05	59.19	116.16	119.11	109.63	159.22	120.38	64.44	124.55	150 <sup>24hr</sup>	
	SPM	301	287	239	219	222	181	101	181	112	107	64	189.7	187.2	127.9	243.4	78.9	69.9	102.9	158	173.4	100.95	78.09	157.28	167.18	157.35	240.18	193.61	101.85	195.17	200 <sup>8hr</sup>	
	SO <sub>2</sub>	33	29	33	28	31	59	28	16	11	10	10	17.1	7.2	7.1	21	7.5	7.5	8.7	10.4	15.3	35.42	49.72	28.31	30.73	29.58	18.8	20.64	12.73	26.18	365 <sup>24hr</sup>	
	NO <sub>x</sub>	49	41	39	36	33	38	26	16	15	15	14	18.6	11.7	8.8	25	8.4	11.1	9.7	11.1	17.1	40.09	41.91	24.14	24.24	20.44	34.2	28.35	20.45	38.58	100 <sup>Annual</sup>	
	CO	330	370	330	296	101	89	94	98	68	36	104	66	79	81	69	36	28	121	19	23	11	24	32	18	0.7	2	3	4	4.9	(10000) <sup>8hr</sup>	
	O <sub>3</sub>	59	67	57	39	21	7	4	2	1	0	2	3	07	07	09	9	7	4	5	6	6	18	10	4	0	80	63	21	59	157 <sup>8hr</sup>	
Township area	PM <sub>2.5</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	29.1	13.7	28.6	21.2	17.2	21.24	29.64	44.26	22.08	41.29	166.72	67.82	59.2	79.64	65 <sup>24hr</sup>	
	PM <sub>10</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	70.3	60.8	111.7	88.7	61.6	96.71	98.15	122.73	86.26	97.16	234.41	108.16	94.6	102.33	150 <sup>24hr</sup>	
	SPM	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	120.6	98.1	144.6	129.4	102.5	127.79	127.79	171.29	111.73	142.36	347.39	170.37	158	193.43	200 <sup>8hr</sup>	
	SO <sub>2</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	13.1	8.4	10.2	11.3	7.9	9.32	19.32	34.12	20.61	21.73	18.61	23.72	19.7	16.92	365 <sup>24hr</sup>	
	NO <sub>x</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	14	9	11.6	12.1	11.9	15.63	15.63	21.72	11.17	13.36	33.48	34.49	27.3	48.41	100 <sup>Annual</sup>	
	CO	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	46	32	30	18	21	9	0	18	2	0	3	1	1	1	(10000) <sup>8hr</sup>	
Access road bridge	O <sub>3</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	9	4	9	1	5	19	11	4	2	0	212	108	92	68	157 <sup>8hr</sup>	
	PM <sub>2.5</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	33.1	20.9	40.9	26.9	36.1	39.65	14.65	26.26	20.16	38.72	94.23	64.73	52.2	55.31	65 <sup>24hr</sup>	
	PM <sub>10</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	118.1	83.7	128.3	112.9	137	142.84	79.92	91.39	78.69	93.48	188.64	119.73	96.1	69.4	150 <sup>24hr</sup>	
	SPM	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	142.5	106.2	177.8	168.2	163.2	171.2	109.25	126.13	102.03	136.66	269.3	173.92	151	129.45	200 <sup>8hr</sup>	
	SO <sub>2</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	12.2	10.9	13.4	12.5	15.7	17.37	56.5	16.16	18.82	18.11	20.23	19.16	13.3	20.76	365 <sup>24hr</sup>	
	NO <sub>x</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	14.8	13.4	15	13	17.6	21.32	55.08	9.04	9.22	9.92	26.3	23.74	20.1	31.69	100 <sup>Annual</sup>	
CO	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	38	34	32	23	21	8	0	22	0	0	0.8	0.2	2	1	(10000) <sup>8hr</sup>		
O <sub>3</sub>	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	5	7	9	6	7	6	6	6	8	2	68	46	16	29	157 <sup>8hr</sup>		

Note(s): Concentrations are in  $\mu\text{g}/\text{m}^3$

- DoE- Department of Environment, NF- Not found; NO-Not observed; x-not measured at pre-construction stage.
- Fine Particulate Matter (PM<sub>2.5</sub>), Respirable Dust Content (PM<sub>10</sub>), Suspended Particulate Matter (SPM), Oxides of Nitrogen (NO<sub>x</sub>). Sulfur dioxide (SO<sub>2</sub>), Carbone Monoxide (CO) & Ozone (O<sub>3</sub>);
- Standards for 1hr, 24hr or Annual are indicated using superscript;
- This monitoring was carried out by - Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model-Envirotech India APM-550).
- All data presented here are 8 hrs. Monitoring data.

Table A.2: Baseline conditions of emission of different infrastructures and sources

Sampling Locations	Criteria Pollutant	Cement Industry	Condensate Fractionating Plant	LPG Bottling Plant	Brick Field	Road Traffic	Small vessels, engine boat	Inland Water Cargo vessel	Sea going Mother Vessel (MV)	Fly ash Carrier	Clinkers Carrier	Clinker, Fly Ash Handling	Coal Carrier (MV)	Coal Ash Carrier (MV)	Coal Carrier (Lighter Vessel)	Coal Ash Carrier (Lighter Vessel)	Coal Loading and Unloading	Coal Handling (Stock Yard, Conveyor belt, etc)	BIF Power Plant (PP)	Other Coal Based PP	Other Fuel Based PP	Dredging and Land Filling	Earth excavation	Other Construction Activities	Residential sources
SW Corner of the PP area	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	√	X	√	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Proposed Township area of the PP	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
NW Corner of the PP area	PM	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Barni, Gaurambha	PM	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√
	SOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Chunkuri-2, Dacope	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Pankhali, Dacope	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√



Sampling Locations	Criteria Pollutant	Cement Industry	Condensate Fractionating Plant	LPG Bottling Plant	Brick Field	Road Traffic	Small vessels, engine boat	Inland Water Cargo vessel	Sea going Mother Vessel (MV)	Fly ash Carrier	Clinkers Carrier	Clinker, Fly Ash Handling	Coal Carrier (MV)	Coal Ash Carrier (MV)	Coal Carrier (Lighter Vessel)	Coal Ash Carrier (Lighter Vessel)	Coal Loading and Unloading	Coal Handling (Stock Yard, Conveyor belt, etc)	BIF Power Plant (PP)	Other Coal Based PP	Other Fuel Based PP	Dredging and Land Filling	Earth excavation	Other Construction Activities	Residential sources
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Mongla Port area	PM	√	√	√	X	√	√	√	√	√	√	√	X	X	X	X	X	X	X	X	√	X	X	X	√
	SOx	X	√	X	X	√	√	√	√	√	√	X	X	X	X	X	X	X	X	X	√	X	X	√	√
	NOx	X	√	X	X	√	√	√	√	√	√	X	X	X	X	X	X	X	X	X	√	X	X	X	√
	GHGs	X	√	X	X	√	√	√	√	√	√	X	X	X	X	X	X	X	X	X	√	X	X	X	√
Harbaria, Sundarbans	PM	X	X	X	X	X	√	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOx	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Akram Point Sundarbans	PM	X	X	X	X	X	√	√	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hiron Point Sundarbans	PM	X	X	X	X	X	√	√	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Khulna City, near Khan Jahan Ali Bridge	PM	√	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	√	√	√
	SOx	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	√
Township area	PM	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√	√	√

Sampling Locations	Criteria Pollutant	Cement Industry	Condensate Fractionating Plant	LPG Bottling Plant	Brick Field	Road Traffic	Small vessels, engine boat	Inland Water Cargo vessel	Sea going Mother Vessel (MV)	Fly ash Carrier	Clinkers Carrier	Clinker, Fly Ash Handling	Coal Carrier (MV)	Coal Ash Carrier (MV)	Coal Carrier (Lighter Vessel)	Coal Ash Carrier (Lighter Vessel)	Coal Loading and Unloading	Coal Handling (Stock Yard, Conveyor belt, etc)	BIF Power Plant (PP)	Other Coal Based PP	Other Fuel Based PP	Dredging and Land Filling	Earth excavation	Other Construction Activities	Residential sources
	SO <sub>x</sub>	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NO <sub>x</sub>	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√	√	√
Access road bridge area	PM	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√	√	√
	SO <sub>x</sub>	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	X	X	X	X
	NO <sub>x</sub>	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	X	X	X	X
	GHGs	√	√	X	√	√	X	X	X	X	X	√	X	X	X	X	X	X	√	X	X	√	√	√	√

Legend X-Absence of source or no emission

√-Presence of source, emission of pollutant

(B) Water Quality Data  
Surface Water Quality Monitoring Data

Table B.1: pH Values of Passur River Water

SI	Sampling Locations	Monitoring periods																														Std*
		Apr	July	Oct	Jan	Apr	July	Oct	Jan	Apr	July	Oct	Jan	Apr	Oct	Jan	Apr	July	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct		
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30th		
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	7.2	7.0	8.1	7.9	7.6	7.8	7.6	7.1	7.5	7.27	6.9	7.6	7.2	7.1	8.28	8.1	8.4	7.9	8.18	9.0	6.8	7.9	8.4	6.9	6.9	8.5	8.3	5.5	7.8	6.5-8.5	
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	7.2	7.0	8.2	8.0	7.7	7.9	7.58	7.3	7.8	7.3	7	7.5	7.3	6.9	8.25	8.1	8.4	6.04	8.03	9.9	6.8	7.8	8.3	7.0	6.66	7.8	8.1	6.5	7.5		
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	7.2	6.9	8.0	8.1	7.8	7.8	7.64	7.3	7.2	7.93	7.2	7.8	7.3	6.9	8.17	8.1	8.4	8.09	8.06	8.7	7.1	7.8	8.8	7.1	6.59	8.0	8.0	8.5	6.5		
4	Left Bank of Passur River at Project Site-Jetty	7.9	7.1	8.1	7.9	7.5	7.9	7.6	7.1	7.4	7.56	7.3	8.2	7.2	6.9	8.2	8.1	8.3	7.65	7.78	8.9	7.5	7.5	8.3	7.0	6.6	7.7	8.6	7.4	6.8		
5	Middle Passur River at Project Site-Jetty	7.1	6.9	8.1	7.9	7.6	8	7.58	7.5	7.8	7.6	7	8.5	7.8	7.2	8.21	8.1	8.3	8.20	7.97	8.4	7.2	7.4	8.3	7.2	6.77	7.7	8.0	8.4	7.6		
6	Right Bank of Passur River at Project Site-Jetty	7.1	6.9	8.2	7.9	7.7	8	7.62	7.6	7.4	7.9	6.9	8.7	7.4	7.2	8.2	8.1	8.2	7.87	8.04	8.5	6.7	7.4	8.0	7.2	6.88	7.8	8.9	5.8	7.6		
7	Left Bank of Passur River at South West corner from the Project boundary	7.4	7.0	8.1	7.6	7.5	8.1	7.78	8.1	7.6	7.94	7.2	8.1	6.9	7.2	8.39	8.0	8.4	8.11	7.89	9.3	7.4	7.3	8.6	7.4	7.13	7.8	8.2	6.7	8.2		
8	Middle of Passur River at South West corner from the Project boundary	7.4	6.9	8.0	7.5	7.2	8	7.6	8	7.1	8.04	7.5	8.6	6.8	7.1	8.15	8.1	8.5	7.44	7.85	8.7	6.5	7.2	8.2	7.6	6.82	8.0	8.4	8.6	8.2		
9	Right Bank of Passur River at South West corner from the Project boundary	7.3	6.8	8.0	7.8	7.3	8.1	7.64	7.9	7.2	8.2	7.3	8.9	7.1	7	8.16	8.1	8.5	7.07	8.06	8.4	7.3	7.2	8.3	7.8	6.8	7.8	8.3	8.5	7.9		
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	7.4	6.9	8.1	7.7	7.5	8.1	7.3	7.3	7.1	8.1	6.8	8.1	7.2	7.1	8.4	8.1	8.6	7.94	8.05	9.3	7.2	7.4	8.0	7.1	6.85	7.4	8.0	5.9	7.8		
11	Maidara river near proposed township area	7.4	6.8	8.1	7.3	7.6	6.9	7.56	7.1	7.4	7.8	7.1	7.6	7.4	7	7.92	7.6	7.3	7.631	7.8	8.2	7.0	7.3	7.9	6.9	6.83	7.5	8.3	6.9	8.5		
12	Passur river at Passur-Ghasiakhali confluence	7.3	6.8	7.4	8.2	7.5	7.9	7.1	7.4	7.3	7.3	6.9	7.2	6.9	6.8	7.48	7.3	8.3	7.02	8.65	8.1	7.0	8.0	8.3	7.1	7.06	7.8	8.6	7.3	8.1		
13	Passur river at Harbaria of Sundarbans	7.9	6.9	8.0	8.1	7.7	7.9	7.8	8.2	7.3	7.63	7.4	7.8	6.9	7.1	8.19	8.1	8.4	7.19	7.71	8.2	7.2	8.0	8.4	7.4	6.1	8.2	7.8	6.6	7.3		
14	Passur river at Akram point of Sundarbans	7.2	6.9	7.9	8.1	7.7	NS	7.63	8	7.9	7.67	7.1	8.2	7.2	7.1	8.22	8.2	8.2	8	7.77	7.9	7.1	7.8	8.2	7.7	6.6	7.7	8.2	6.0	6.9		
15	Passur river at Hiron po.000int of Sundarbans	7.2	7.0	7.0	8.1	7.7	NS	7.39	NS	7.8	NS	7.6	8.5	NS	6.8	8.2	NS	NS	7.18	7.79	NS	NS	7.8	8.2	NS	6.7	7.6	NS	8.0	6.7		

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring, NS – Not Surveyed

Table B.2: Surface Water Temperature (°C) in Passur River

Sl. No.	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Apr	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct		
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30th		
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	31	33	31	19	30	31.8	31.2	22.0	31.2	29.6	30.1	22.8	30	29.8	19.7	30	30	28	22.02	31	30	27	25	30	27.67	20	31	30.26	26	20°C – 30°C	
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	31	33	31	20	30	30.5	31.8	21.0	31.1	29.1	30.8	22.5	30	30.1	19.8	30	30	26.85	21.96	31	30	27	25	30	27.68	20	30	30.46	26		
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	31	33	30	20	30	30.5	30.9	21.0	30.8	29.4	30.4	22.1	29.8	30.2	20.2	31	30	27.49	21.82	31	30	27	24	31	27.7	20	30	30.46	26		
4	Left Bank of Passur River at Project Site-Jetty	31	33	31	19	31	30.8	31.3	22.0	31.4	30.1	30.1	22.8	31.3	30.1	20.3	28	30	28.38	22.62	31	30	28	24	30	27.82	20	30	30.55	28		
5	Middle Passur River at Project Site-Jetty	30	32	31	19	30	30.6	31.6	22.0	30.9	30.5	31.0	21.8	30.0	29.8	20.3	29	30	27.97	22.55	31	31	28	24	30	27.76	20	30	30.44	27		
6	Right Left Bank of Passur River at Project Site-Jetty	30	32	31	19	30	30.4	31.1	21.0	31.0	30.5	31.1	21.9	30.0	29.9	20.3	28	31	28.05	22.35	31	30	28	24	30	27.67	20	30	30.54	30		
7	Left Bank of Passur River at South West corner from the Project boundary	31	32	30	20	31	30.5	30.3	23.0	30.7	30.7	30.4	22.1	29.9	30.0	20.6	28	31	27.85	22.17	33	30	27	25	30	28.42	21	30	30.44	27		
8	Middle of Passur River at South West corner from the Project boundary	31	31	29	19	30	30.8	30.5	22.0	30.4	29.8	30.2	22.0	29.8	30.1	20.2	28	31	28	22.27	31	30	27	25	30	27.9	20	30	30.5	27		
9	Right Bank of Passur River at South West corner from the Project boundary	31	31	29	19	31	30.6	30.8	21.0	30.1	29.8	31.1	22.1	30.1	30.1	20.3	28	31	28	22.54	32	30	27	25	30	27.83	21	30	30.46	27		
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	30	31	28	19	30	30.8	31.8	22.0	31.2	30.4	31.1	21.9	30.3	29.9	19.1	28	31	27.62	22.06	33	30	27	25	30	28.67	22	31	30.39	27		
11	Maidara river near proposed township area	30	32	27	20	30	31.6	31.2	23.0	30.6	30.7	31.2	21.8	30.1	30.0	21.1	31	31	30.2	21	32	30	27	23	30	28	21	31	30.54	29		
12	Passur river at Passur-Ghasiakhali confluence	29	30	32	19	30	29.8	30.7	21	31.3	30.7	30.38	22.1	30.2	30	20.8	30	29	26.82	21.89	31	30	28	22	30	28.07	21	29	30.15	27		
13	Passur river at Harbaria of Sundarbans	30	30	27	22	30	29.0	30.8	22.0	31.5	30.9	29.9	23.1	30.2	29.8	21	30	29	27.62	21.81	31	31	30	24	31	28.35	21	30	29.6	27		
14	Passur river at Akram point of Sundarbans	29	29	30	21	30	NS	30.2	21.0	30.8	30.4	30.4	22.5	30.8	29.9	21.2	32	30	27.21	22.42	31	31	29	24	31	29.48	22	30	29.75	28		
15	Passur river at Hiron point of Sundarbans	29	30	29	21	30	NS	30.4	NS	31.4	NS	31.3	21.4	NS	29.4	21.2	NS	NS	28.66	23.78	NS	NS	31	23	NS	29.02	22	NS	30.66	28		

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring, NS – Not Surveyed

Table B.3: Salinity (ppt) in Passur River

Sl. No	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct		
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30th		
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	11.5	2.5	0.0	4.5	13	0	0	4.1	8	0	0	3.7	6.3	0	2	11.5	0.2	0.9	11.1	16.6	0.5	0.4	3.8	0.2	0.1	2.4	7.1	0.1	0.1	No Specific standard for salinity has Been mention-ed in the ECR'1997	
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	11.5	0.3	0.0	4.1	15	0	0	4.3	7.4	0	0	3.8	5.9	0	2	11.5	0.2	0.1	11.1	16.2	0.2	0.3	3.9	0.3	0.1	2.7	7.5	0.1	0.1		
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	11.5	0.2	0.0	4.5	16	0	0	4.3	7	0	0	3.6	6.2	0	2	11.5	0.4	0.8	10.6	16.5	0.3	0.3	4.0	0.2	0.1	2.7	7.2	0.1	0.1		
4	Left Bank of Passur River at Project Site-Jetty	12.0	2.2	0.0	4.7	9	0	0	4.4	6	0	0	4	6.8	0	2.6	12.0	0.3	0.9	10.8	16.6	0.2	0.5	3.8	0.1	0.1	2.5	7.2	0.1	0.1		
5	Middle Passur River at Project Site-Jetty	12.0	0.3	0.0	5.1	13	0	0	5.1	6.2	0	0	3.9	6.9	0	2.6	12.0	0.2	0.8	10.8	16.9	0.2	0.3	3.9	0.2	0.1	2.7	7.3	0.1	0.1		
6	Right Left Bank of Passur River at Project Site-Jetty	12.0	0.5	0.0	5.0	14	0	0	5	9	0	0	4.2	6.1	0	2.7	12.0	0.2	0.8	11	16.9	1.2	0.3	3.9	0.1	0.1	2.4	7.3	0.1	0.1		
7	Left Bank of Passur River at South West corner from the Project boundary	9.5	4.0	0.0	5.2	14	0	0	5.2	8	0	0	4.2	6.5	0	2.8	9.5	0.2	1	9.9	12.0	0.3	2.1	3.7	0.2	0.2	2.6	7.0	0.1	0.1		
8	Middle of Passur River at South West corner from the Project boundary	9.0	0.0	0.0	5.2	13	0	0	4.9	7	0	0	4.1	7.1	0	2.8	9.0	0.3	0.2	11.5	16.7	0.2	0.1	0.1	0.2	0.1	2.5	7.3	0.1	0.1		
9	Right Bank of Passur River at South West corner from the Project boundary	10.0	2.5	0.0	5.1	12	0	0	5.5	6.8	0	0	4.1	7	0	2.8	10.0	0.3	0.3	11.1	16.9	0.3	0.4	3.5	0.3	0.1	2.7	7.4	0.1	0.1		
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	10.0	0.5	0.0	5.2	10	0	0	3.8	7.1	0	0	3.9	7	0	2.6	10.0	0.3	0.9	11.3	16.5	0.3	0.3	4.0	0.3	0.2	2.5	7.0	0.1	0.1		
11	Maidara river near proposed township area	9.0	4.5	0.0	4.5	9	0	0	2.5	6.3	0	0	3.8	6.9	0	2.52	9.0	0.2	0.02	9.9	8.0	1.0	0.3	4.0	0.5	2.	2.5	6.5	0.8	0.5		
12	Passur river at Passur-Ghasiakhali confluence	10.0	9.5	0.0	5.0	14	0	0	4.8	6	0	0	6.7	10.4	1.2	10.8	10.0	0.6	1	7.9	14.9	0.4	0.5	3.6	0.4	0.2	1.8	6.9	0.1	0.1		
13	Passur river at Harbaria of Sundarbans	12.0	10.0	0.0	6.0	15	0	0	5.3	8.9	0	0	8.9	10.4	2.3	2.8	12.0	2.2	1.8	11.9	15.6	0.3	0.7	3.7	1.5	0.2	2.6	7.0	0.1	0.2		
14	Passur river at Akram point of Sundarbans	19.0	15.0	1.0	16.0	20	NS	5	11.3	9.4	4	3	16.3	16	3.6	13.1	19.0	2.8	9.1	16.7	22.9	0.9	6.6	8.9	4.0	1.6	7.1	10.9	1.0	2.2		
15	Passur river at Hiron point of Sundarbans	23.0	19.5	2.0	23.0	25	NS	6.2	NS	14	NS	5.8	21.4	NS	5.1	16.45	23.0	NS	13.9	22.7	NS	NS	9.2	11.0	NS	2.6	8.2		0.9	2.6		

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring, NS – Not Surveyed

Table B.4: Dissolve Oxygen (DO) in Passur River

SL	Sampling Locations	Monitoring periods																														
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct		
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	30QM		
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	5.9	6.1	5.6	5.5	6.2	5.3	6.8	5.1	7.1	6.2	6	6.1	7.1	6.3	5.19	6.575	6.0	6.4	8.7	5.9	6.0	7.7	8.4	6.1	6.4	9.2	6.5	5.8	7.8	5 or more (standard for sustaining fisheries)	
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	4.9	6.8	7.7	6.6	6.4	5	6.4	5.1	6.4	5.7	6.1	5.9	7.2	6.4	5.03	6.225	6.2	6.2	7.9	6.5	6.0	7.8	8.6	6.1	7.64	9.6	6.0	6.0	7.5		
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	5.2	6.7	7.7	6.7	6.2	5	7.1	6.2	6.9	5.6	6	6.1	6.8	6.5	5.06	6.275	6.1	6.3	7.3	6.3	6.1	7.8	7.6	6.0	6.3	7.8	6.8	6.3	6.5		
4	Left Bank of Passur River at Project Site-Jetty	5.7	6.8	7.6	5.8	6.2	6.7	6.8	5.9	5.8	6.1	6.3	6.2	6.9	6.3	5.1	6.15	5.5	6	8.7	6.1	6.5	8.6	8.1	6.0	8.2	9.0	8.4	6.6	6.7		
5	Middle of Passur River at Project Site-Jetty	5.9	6.9	7.2	5.9	6.6	6.6	7.2	5.3	6.1	6.3	5.9	5.9	7.4	6.3	5.03	6.5	6.0	6.2	7.3	6.5	6.3	8.0	8.2	6.4	8.89	8.9	8.0	6.2	5.6		
6	Right Bank of Passur River at Project Site-Jetty	5.8	6.6	8.0	6.8	6.4	6	7.6	5.4	6.6	5.8	6.1	5.9	7.5	6.5	4.9	6.575	6.5	6	7.4	6.0	6.4	8.2	7.0	6.2	7.8	9.3	8.5	6.8	6.5		
7	Left Bank of Passur River at South West corner from the Project boundary	6.6	7.3	5.6	6.1	6.3	7.5	6.4	6	6.9	6.3	5.9	6.3	6.4	6.5	5	6.55	6.8	6.1	7.8	6.1	6.2	9.9	6.9	6.6	9.7	9.6	5.4	7.2	6.7		
8	Middle of Passur River at South West corner from the Project boundary	6.5	7.1	5.6	6.9	6.5	7.4	6.1	6.1	7.1	6.4	6	6.4	7.2	7.1	4.98	6.825	6.2	6.3	7.1	6.5	6.2	10.0	7.2	6.5	9.76	7.0	6.3	6.2	6.5		
9	Right Bank of Passur River at South West corner from the Project boundary	6.5	7.2	5.8	6.6	6.4	7.3	6.3	5.8	6.8	5.6	6	6.4	6.8	6.5	5.11	6.625	6.0	6.2	6.9	6.1	6.3	10.5	7.8	6.3	9.76	6.4	5.9	6.7	6.1		
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	6.0	6.5	8.0	6.0	6.2	6	7.1	4.1	6.4	5.2	6.1	6.7	6.8	6.3	5.17	6.35	6.7	5.8	7.5	6.3	6.4	7.1	9.7	6.4	9.7	8.1	7.5	6.8	6.7		
11	Maidara river near proposed township area	6.7	6.8	8.0	6.2	6.5	6.4	7.1	5.2	5.9	5.4	6.4	6.7	7.1	6.2	5.11	6.7	6.3	6	6.0	6.2	6.0	7.7	7.5	6.1		8.0	7.0	5.5	6.2		
12	Passur river at Passur-Ghasiakhali confluence	5.3	6.2	7.0	6.5	6.3	7	6.6	5.4	5.8	5.4	5.6	5.9	6.4	6.4	5.23	5.95	5.8	6	6.9	6.5	6.2	7.9	8.6	6.0	8.14	9.2	5.9	6.2	5.8		
13	Passur river at Harbaria of Sundarbans	5.4	5.9	7.0	6.6	5.8	7.5	7.1	5.2	6.4	5.4	5.8	6.1	6.4	6.2	5.03	5.8	6.9	8.21	7.5	6.9	6.0	8.4	6.9	6.1	7.65	7.6	5.5	6.6	6.8		
14	Passur river at Akram point of Sundarbans	7.9	6.4	7.7	6.7	6	NS	7.3	6.2	6.1	6.2	6.7	6.5	7.2	6.8	5.4	6	6.8	6.9	7.7	7.0	6.6	7.7	9.7	6.5	6.61	7.2	6.8	6.1	6.5		
15	Passur river at Hiron point of Sundarbans	7.5	6.5	7.8	6.5	5.8	NS	7	NS	7.1	6.8	6.9	6.8	NS	7.3	5.4	NS	NS	7.2	8.0	NS	NS	8.6	6.7	NS	8.2	9.0	NS	6.2	6.9		

Source: CEGIS Field Survey-

Note: 1QM= First Quarterly Monitoring (April, 2014), 2QM = Second Quarterly Monitoring (July, 2014), 3QM = Third Quarterly Monitoring (October, 2014), 4QM = Fourth Quarterly Monitoring (January 2015)

Table B.5: BOD<sub>5</sub> of Passur River Water

SL	Sampling Locations	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	3.4	2.2	1.9	1.6	3.1	3	2.1	2.1	2.8	2.4	2.8	1.8	2.1	1.9	2.1	3	5 or more (standard for sustaining fisheries)
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	4.9	3.3	4.1	2.3	3.2	2.4	1.9	2.2	3.2	2.8	2.7	1.9	3.4	2.1	1.9	2	
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	2.2	2.8	3.4	2.7	3.1	2.9	3.4	1.9	3	2.5	2.8	1.9	2.5	2.7	1.9	3	
4	Left Bank of Passur River at Project Site-Jetty	3.2	3.1	4.0	0.8	3	4.4	3.2	1.1	3.6	2.1	3.1	2.1	2.4	2.8	2.0	4	
5	Middle of Passur River at Project Site-Jetty	3.0	2.5	3.5	1.4	3.5	4.3	3.7	2.4	3.3	2.2	2.5	2.2	2.6	2.4	2.0	4	
6	Right Bank of Passur River at Project Site-Jetty	5.8	3.5	3.6	2.0	3.4	3.7	2.9	1.7	3.1	3.1	2.9	2.1	3.1	2.1	2.3	4	
7	Left Bank of Passur River at South West corner from the Project boundary	3.9	2.8	2.6	1.0	3.1	5.3	2.2	1.2	3.1	2.9	2.4	2.1	3.2	2.4	2.0	5	
8	Middle of Passur River at South West corner from the Project boundary	3.8	3.3	2.8	2.6	3.2	5.2	2.3	2.3	2.6	2.7	2.7	1.9	2.5	2.7	1.9	5	
9	Right Bank of Passur River at South West corner from the Project boundary	6.5	3.8	2.9	2.1	3.4	5	3.1	2.4	3	3.1	3.1	2.1	2.6	2.3	2.1	5	
10	Maidara river of the South East corner of the Project at Ichamoti-Maidara confluence	3.2	3.3	5.5	1.5	3.2	3.9	4.2	2.7	3.3	3.4	2.8	1.8	3.4	2.4	2.1	4	
11	Maidara river near proposed township area	4.1	3.7	4.0	2.0	3.4	4.2	1.6	1.8	3.5	3.2	2.9	2.1	3.2	2.1	2.0	4	
12	Passur river at Passur-Ghasiakhali confluence	2.3	2.2	1.7	2.0	3.3	4.9	2.1	2.2	3.4	2.8	2.3	2	2.7	3.1	2.4	3.1	
13	Passur river at Harbaria of Sundarbans	2.2	2.5	2.6	1.9	2.4	3.9	2.7	2.1	3.2	2.8	2.7	2.1	2.7	3.1	2.9	2.3	
14	Passur river at Akram point of Sundarbans	3.4	2.2	1.9	1.6	3.1	3	2.1	2.1	2.8	2.4	2.8	1.8	2.1	1.9	2.1	3	
15	Passur river at Hiron point of Sundarbans	4.9	3.3	4.1	2.3	3.2	2.4	1.9	2.2	3.2	2.8	2.7	1.9	3.4	2.1	1.9	2	

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring, NS – Not Surveyed

Table B.6: COD (mg/L) of Passur River System

Sl	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	April	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	288	24	6	128	87	42	32	124	220	8	12	56	52	24	48	276	20	56	72	188	36	56	24	32	16	56	508	4
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	284	20	30	68	58	43	36	100	240	8	8	40	48	8	28	240	24	44	60	180	24	40	28	36	12	32	404	4
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	328	56	14	92	132	18	28	96	280	8	8	44	56	40	40	230	12	48	48	176	32	26	32	28	8	20	400	4
4	Left Bank of Passur River at Project Site-Jetty	376	28	18	84	102	26	36	100	280	8	12	48	40	32	36	232	30	60	44	192	20	40	24	24	28	48	304	4
5	Middle Passur River at Project Site-Jetty	400	60	14	116	110	21	36	108	240	12	16	52	36	40	32	254	16	36	56	180	28	28	40	36	16	20	412	4
6	Right Bank of Passur River at Project Site-Jetty	364	496	18	108	88	24	40	80	260	8	12	42	48	16	28	252	12	42	64	172	24	24	24	40	20	56	390	12
7	Left Bank of Passur River at South West corner from the Project boundary	364	108	10	104	96	32	42	100	240	12	8	56	42	48	40	212	10	48	88	200	28	20	26	48	8	48	408	8
8	Middle of Passur River at South West corner from the Project boundary	400	40	22	16	18	25	28	100	180	8	8	52	36	8	44	218	24	32	36	160	20	32	20	36	12	56	424	8
9	Right Bank of Passur River at South West corner from the Project boundary	408	120	10	100	106	25	48	124	200	12	12	44	52	4	36	230	16	28	68	180	32	20	28	42	20	8	448	12
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	276	32	10	116	88	51	40	100	160	8	8	36	44	16	40	180	40	36	72	160	24	24	44	32	12	12	400	16
11	Maidara river near proposed township area	284	96	26	84	94	36	42	108	210	30	8	48	40	32	32	252	20	42	68	172	20	36	36	48	28	24	380	48
12	Passur river at Passur - Ghasiakhali confluence	408	172	14	96	92	30	46	88	220	12	16	40	64	40	48	260	10	20	32	178	24	40	36	72	56	32	472	32
13	Passur river at Harbaria of Sundarbans	372	216	14	96	102	26	36	100	140	16	12	40	216	32	40	280	16	58	56	184	32	32	40	80	76	12	424	16
14	Passur river at Akram point of Sundarbans	536	520	54	316	302	NS	84	96	156	4	68	56	240	16	72	296	110	44	180	160	220	92	56	108	60	28	392	80
15	Passur river at Hiron point of Sundarbans	540	416	122	472	470	NS	96	NS	160	NS	56	196	NS	4	88	NS	NS	76	140	NS	NS	72	64	NS	40	NS	NS	32

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.7: Oil and grease (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																												
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	April	Aug	
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22 QM	23QM	25QM	26QM	27QM	28QM	29 QM	
1	Left Bank of Passur River at South West corner from the Project boundary	<5	<5	<5	>15	16.9	9	<5	39	61	5	<5	9.2	5.73	<5	16.6	<5	<1	<2.0	<2.0	<2.0	<2.0	<2.0	2.3	<2.0	<2.0	2.93	<2.0	<2.0	10
2	Passur-Ghasiakhali Confluence	<5	<5	<5	>15	13	7.63	9.87	21	30.3	13.5	<5	15.6	<5	<5	<5	<5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
3	Passur river at Harbaria of Sundarbans	<5	6.3	<5	>20	39.1	10.1	<5	14	26	5.73	<5	<5	<5	<5	<5	<1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
4	Akram Point of Sundarbans	<5	<5	<5	>20	<5	NS	10.8	ND	31	NS	10.1	13.8	7.71	<5	<5	<5	NS	<2.0	<2.0	<2.0	<2.0	<2.0	4.4	<2.0	<2.0	<2.0	<2.0	<2.0	
5	Passur river at Hiron point of Sundarbans	<5	<5	<5	>20	<5	NS	9.73	36	82	5.87	<5	14.2	ND	<5	<5	<5	<1	<2.0	<2.0	<2.0	<2.0	<2.0	2.3	<2.0	<2.0	NS	3.2	<2.0	

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.8: TDS (mg/L) of Passur River System

SL	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	13060	251	176	4360	14400	937	158	5570	13400	179	138	3100	13400	496	1913	14500	315	855	9940	15800	290	480	6800	134	122	3770	12500	58
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	12630	246	162	3950	14700	941	169	5910	13280	112	106	3140	13480	122	1919	14420	224	733	9950	15600	150	175	6950	114	96	4410	12700	105
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	12900	383	153	4330	14900	127	152	5490	13560	125	108	3330	13400	123	1915	14650	232	722	9730	15500	152	170	7300	116	94	4390	12300	106
4	Left Bank of Passur River at Project Site-Jetty	13190	445	169	4750	14600	175	172	5720	12830	162	147	3630	13560	172	2500	14300	328	824	9860	15700	205	190	6760	221	102	4150	12800	74
5	Middle Passur River at Project Site-Jetty	13330	353	156	4920	14500	132	162	5850	13100	185	110	3600	13490	125	2520	14450	235	716	9980	16000	142	175	6760	125	179	4170	13100	97
6	Right Bank of Passur River at Project Site-Jetty	13380	402	152	4870	14200	156	160	5480	13460	143	112	3520	13330	125	2500	14540	208	732	9800	16100	150	174	6900	132	105	4060	13200	110
7	Left Bank of Passur River at South West corner from the Project boundary	13180	655	162	5040	14500	336	192	5650	12820	205	113	3470	13640	160	2840	14400	205	945	10190	15640	208	325	6740	195	181	4100	13100	158
8	Middle of Passur River at South West corner from the Project boundary	13390	587	153	5050	14600	158	164	5740	12960	195	108	3790	13680	126	2710	14500	286	784	10280	16000	145	180	6450	128	98	4210	13300	110
9	Right Bank of Passur River at South West corner from the Project boundary	13240	916	154	5130	14250	160	164	5650	13590	140	146	3770	13360	127	2720	14610	296	786	10080	15800	154	172	6700	114	92	4450	13200	100
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	12400	455	214	5050	14000	2320	183	5450	13340	165	196	2920	13490	1616	2500	14160	265	992	10040	15700	940	1405	7250	229	206	4170	12500	216
11	Maidara river near proposed Township area	10970	2510	257	4390	13900	355	176	4420	11700	5170	238	3960	13110	1200	2970	14450	340	827	8860	15100	365	875	5800	2893	164	2320	11800	1270
12	Passur river at Passur - Mongla confluence	12800	6410	209	5130	14050	298	227	4540	11330	893	162	3370	12340	204	2570	14500	580	940	8350	15722	172	350	6240	740	148	3010	12100	180
13	Passur river at Harbaria of Sundarbans	12280	9360	285	4780	13900	683	205	4940	13580	1321	301	3370	13600	245	2690	15350	2190	1715	10950	15400	560	474	6430	489	2260	4060	12400	240
14	Passur river at Akram point of Sundarbans	21500	15960	3400	12350	13600	NS	4220	13330	20720	7330	2550	3580	19370	3270	11390	20600	7680	8100	17200	14800	12500	3950	16300	4188	1472	11400	18500	1700
15	Passur river at Hiron point of Sundarbans	21500	14050	5720	17900	25300	NS	5830	NS	25500	NS	4120	12210	NS	4450	14190	NS	NS	12500	21110	NS	NS	5750	20400	NS	490	14600	NS	1610

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.9: TH (mg/L) Passur River System

SL	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	2900	250	216	930	3000	245	250	1270	3130	240	255	1090	3640	200	430	3100	210	335	2050	3000	2100	215	1540	205	272	2800	4500	140
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	2500	180	218	870	3050	110	330	1380	3090	205	250	980	3420	150	510	1040	205	310	3900	5000	1950	125	1485	200	195	2700	4200	200
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	2650	170	335	870	3250	105	360	1240	3140	205	190	1030	3300	155	498	1030	185	313	4100	5000	1900	190	1530	187	225	2750	4300	180
4	Left Bank of Passur River at Project site-Jetty	2550	175	390	940	3450	118	365	1220	3010	220	265	1020	3400	160	570	1060	200	285	4600	5200	1850	175	1580	217	210	3000	4100	200
5	Middle Passur River at Project Site-Jetty	2600	275	340	990	3250	103	355	1300	3070	232	237	915	3440	145	590	1040	210	255	4200	5000	2500	178	1560	215	235	3100	4500	175
6	Right Bank of Passur River at Project site-Jetty	2625	350	355	970	3200	105	350	1260	3100	218	242	1070	3380	140	480	1085	215	275	4400	4800	2550	155	1490	202	200	2500	4000	175
7	Left Bank of Passur River at South West corner from the Project boundary	2550	325	330	1045	3600	153	345	1370	3060	235	205	935	3540	150	505	1080	205	295	4400	4400	1700	175	1530	195	240	2550	4400	140
8	Middle of Passur River at South West corner from the Project boundary	2800	350	345	1125	3670	105	390	1340	3130	242	217	1100	3480	155	530	1110	212	265	4300	5100	1850	150	1560	210	235	3200	4100	130
9	Right Bank of Passur River at South West corner from the Project boundary	2500	475	325	975	3540	165	445	1270	3110	224	238	1110	3600	175	512	1100	205	325	4600	4900	2000	115	1485	207	243	2800	4400	100
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	2500	450	350	980	3260	470	183	950	3180	220	250	1040	1960	165	505	1300	210	295	4000	5200	2000	350	1460	310	198	1400	4200	145
11	Maidara river near proposed township area	2400	725	330	970	3190	130	340	1075	3080	875	240	1170	2300	320	478	1120	220	315	4100	5000	2200	285	1440	742	217	1200	4100	400
12	Passur river at Passur - Mongla confluence	3150	1400	377	1000	3210	135	410	1090	3060	405	245	1070	2450	220	1070	1410	245	325	4000	4782	1800	200	1510	250	265	2850	4200	150
13	Passur river at Harbaria of Sundarbans	2625	2150	345	970	3080	200	430	1100	3050	415	282	1070	3560	200	610	1330	530	2550	4500	4500	1400	185	1390	280	225	2870	4400	160
14	Passur river at Akram point of Sundarbans	4500	3625	980	2380	3420	NS	1090	2850	4520	1750	670	1130	4300	640	1475	1440	2030	2750	5900	4500	4300	830	3470	1000	210	5050	4300	480
15	Passur river at Hiron point of Sundarbans	4850	3050	1440	2690	3640	NS	1460	NS	5050	NS	810	2870	NS	905	1740	NS	NS	4200	6900	NS	NS	1225	3850	NS	230	5600	NS	470

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.10: TSS (mg/L) Passur River System

SL	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	598	126	234	180	160	26	76	14	8	61	20	46	51	18	14	18	17	14	15	12	14	8	11	14	7	11	15	12
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	45	92	193	210	167	25	80	12	7	48	18	52	42	15	15	17	16	11	12	14	11	7	8	6	11	6	23	14
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	53	112	174	230	170	127	65	14	10	56	16	48	48	22	14	22	15	15	14	13	13	6	7	11	8	7	20	9
4	Left Bank of Passur River at Project Site-Jetty	54	99	227	450	160	30	92	17	10	62	20	42	52	16	13	20	18	11	12	11	12	8	8	12	7	7	13	12
5	Middle Passur River at Project Site-Jetty	60	100	232	250	165	27	85	18	8	45	24	54	43	20	13	19	16	13	13	12	13	7	9	9	6	6	12	11
6	Right Bank of Passur River at Project Site-Jetty	55	105	186	200	155	40	97	22	7	49	19	46	38	17	14	21	15	12	15	15	14	6	6	12	9	8	16	8
7	Left Bank of Passur River at South West corner from the Project boundary	24	116	185	300	150	32	104	20	12	51	20	61	32	15	15	17	16	14	16	12	13	7	7	14	15	7	14	12
8	Middle of Passur River at South West corner from the Project boundary	27	112	536	530	147	40	90	7	10	43	18	58	44	16	17	19	14	13	13	11	12	6	8	13	8	6	15	9
9	Right Bank of Passur River at South West corner from the Project boundary	67	37	459	450	155	44	82	18	11	39	16	63	40	14	12	18	20	15	14	13	13	5	6	8	6	6	13	15



SL	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	7	65	798	280	148	36	96	11	7	42	24	55	37	26	14	23	13	11	14	14	15	9	13	11	8	7	17	13
11	Maidara river near proposed township area	9	24	389	206	160	28	92	10	6	11	30	66	49	30	15	32	12	42	8	12	12	7	12	5	7	8	12	3
12	Passur river at Passur - Mongla confluence	50	310	203	280	165	24	60	15	13	47	27	61	38	25	13	14	17	27	15	13	13	15	14	9	8	6	3	7
13	Passur river at Harbaria of Sundarbans	65	90	869	400	160	42	74	22	18	31	18	61	33	27	17	15	13	22	12	11	12	11	11	17	5	8	14	9
14	Passur river at Akram point of Sundarbans	115	99	28	103	150	NS	110	16	23	16	41	34	28	22	14	18	14	15	11	10	7	7	10	18	8	11	11	16
15	Passur river at Hiron point of Sundarbans	91	72	267	200	180	NS	144	NS	15	NS	33	49	NS	16	13	NS	NS	6	9	NS	NS	5	10	NS	6	6	NS	13

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring; NS – Not Surveyed.

Table B.11: Nitrate (NO3<sup>2-</sup>) (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.9	2.89	0.32	3	33	9.1	4	6.3	3	3.9	0.25	3.62	4.35	5.8	3	6.8	0.8	2.8	3.5	0.3	0.1	3.5	1.3	3	3.2	4.3	3.3	2.1
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	0.7	2.4	1.57	1.5	13	7.5	7.1	4.3	2.9	6.2	0.39	2.89	5.05	6.8	4.2	4.9	1.7	0.1	2.6	0.3	1.1	2.7	1.7	3.3	1.3	2.2	2.1	2.2
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.1	3.2	1.84	4.3	39	6.2	5	3.9	2.5	4.3	0.42	1.87	4.55	4.5	3.6	5.1	2.1	0.11	1.9	3.7	1.2	3.4	3.2	9.5	4.7	1.2	1.3	1.3
4	Left Bank of Passur River at Project Site-Jetty	1.3	0.76	1.64	3.1	48	6.6	5.7	3.1	2	5.1	0.76	2.25	6.11	7.1	3	2.8	2.8	1.7	2.1	3.0	1.5	3.0	4.5	2.9	2.5	0.7	2.1	1.4
5	Middle Passur River at Project Site-Jetty	1.4	2.69	1.42	2.2	69	6.1	3.3	5.2	3.1	2.7	0.52	2.46	3.4	3.1	4.7	5.2	1.8	0.9	2.2	1.2	1.5	1.7	2.7	1.9	2.6	3.1	3.0	1.6
6	Right Bank of Passur River at Project Site-Jetty	1.1	2.98	1.33	8.5	8	6.6	4.7	4.1	3.6	3.9	0.31	3.01	3.16	5	7.6	5.5	3.2	0.1	3.5	4.8	2.1	2.1	5.1	1.8	1.0	2.7	1.5	1.4
7	Left Bank of Passur River at South West corner from the Project boundary	0.75	2.13	1.85	2.7	87	14.9	4.4	4.9	2.6	3.6	0.2	3.64	3.14	4.1	8.8	2.6	4	0.1	4.2	0.5	1.5	2.0	7.4	1	0.5	1.8	1.7	1.9
8	Middle of Passur River at South West corner from the Project boundary	1.1	2.43	2.09	1.8	48	4	6.2	3.7	2.9	5.1	0.41	1.93	3.34	3.4	8.5	4.5	3.7	3.4	3.0	3.4	1.7	1.3	3.9	1.5	2.1	3.0	2.0	2.1
9	Right Bank of Passur River at South West corner from the Project boundary	1.2	2.05	2.21	1.9	128	4.9	4.4	4.4	2.6	4.9	0.63	2.17	2.00	3.1	2.8	5.3	3.8	0.7	3.1	4.1	0.5	2.2	4.1	1.3	3.0	1.9	2.3	2.5
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	0.3	2.18	2.26	6	62	7	4.9	5.6	2.7	5.2	0.4	2.46	3.61	2.3	1.6	5.9	4.4	2.3	2.1	5.0	3.1	2.9	4.7	3.9	1.5	3.0	4.2	3.1
11	Maidara river near proposed township area	0.5	0.88	1.98	4	48	3.1	2.9	3.9	3.1	5.3	0.32	3.1	1.60	3.2	3.4	3.9	3.1	0.12	1.3	2.9	2.5	1.6	4.9	2.1	1.3	4.9	1.0	2.1
12	Passur river at Passur - Mongla confluence	0.6	1.52	1.64	4.5	29	7.8	3.1	3.7	3	5.2	0.27	2.78	2.49	3.5	4.5	4.7	2.4	1.6	3.7	2.7	1.8	2.0	3.3	1.5	2.6	0.5	1.7	3.8
13	Passur river at Harbaria of Sundarbans	1.4	1.75	1.67	2.7	18	4.4	4.4	5.1	3.4	5.1	0.39	2.78	2.46	4.2	4.6	5.2	2.7	0.1	4.7	4.4	1.7	2.1	3.2	5.7	2.6	0.5	2.6	3.9
14	Passur river at Akram point of Sundarbans	2.7	3.32	0.59	1.5	25	NS	3.2	4.9	2.9	5.4	0.25	3.08	3.69	2.2	1.8	5.5	4.2	0.1	1.8	2.7	1.3	1.6	2.6	4	2.6	2.9	2.8	4.1
15	Passur river at Hiron point of Sundarbans	0.8	2.84	0.4	2	28	NS	11.5	NS	3.5	NS	0.38	2.28	NS	2.6	6.1	NS	NS	0.9	2.6	NS	NS	2.5	4.1	NS	2.6	3.9	NS	3.2

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring; NS – Not Surveyed.

Table B.12: Sulphate (SO4<sup>2-</sup>) (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	1840	20	26	580	1360	67	7	570	1080	18	5	230	422	29	630	1400	24	51	760	1460	23	37.0	490	4	3	270	1	21
2	Middle of Passur River at 100m u/s of North West corner from the Project boundary	1320	23	28	450	1260	11	8	590	1040	10	3	210	460	3	370	1320	18	49	756	1380	19	6.0	510	3	6	420	5	20
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	1280	36	34	480	1240	9	11	560	1020	13	4	200	1340	5	410	1440	20	46	764	1420	21	6.0	560	5	11	460	2	24
4	Left Bank of Passur River at Project Site-Jetty	1360	45	33	550	1240	26	10	550	1060	15	4	230	1380	2	310	1260	22	52	748	1410	16	5.0	530	8	5	410	1	18
5	Middle Passur River at Project Site-Jetty	1040	32	30	520	1120	6	8	580	980	17	6	280	1280	1	310	1200	21	38	760	1440	17	4.0	640	10	3	420	3	15
6	Right Bank of Passur River at Project Site-Jetty	1320	20	27	540	820	8	9	565	1100	14	5	230	1400	2	490	1400	16	42	762	1400	19	8.0	490	13	8	430	2	18
7	Left Bank of Passur River at South West corner from the Project boundary	1640	60	40	630	880	9	12	640	1060	15	6	230	880	2	700	1300	10	56	768	1500	15	25.0	520	16	6	450	3	19
8	Middle of Passur River at South West corner from the Project boundary	1520	40	35	560	1180	19	8	560	1020	18	5	231	1440	1	340	1380	24	52	760	1450	16	9.0	470	8	4	440	1	13
9	Right Bank of Passur River at South West corner from the Project boundary	1280	80	64	620	900	12	6	550	1080	12	8	250	1340	3	340	1240	22	39	770	1460	14	6.0	510	16	12	450	2	14
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	1120	20	63	570	1220	72	11	96	1040	11	14	160	1220	120	270	1200	21	65	758	1500	18	71.0	490	16	31	420	3	17
11	Maidara river near proposed township area	1320	210	63	460	840	27	9	480	1020	480	14	200	1340	76	350	1250	18	46	760	1490	12	55.0	565	21	26	190	15	39
12	Passur river at Passur - Mongla confluence	1360	620	44	630	980	39	13	482	1100	42	14	220	1220	5	280	1260	28	30	765	1446	14	33.0	580	12	21	260	13	39
13	Passur river at Harbaria of Sundarbans	1560	860	69	590	900	51	7	500	1080	60	19	220	1300	13	220	1300	35	20	756	1500	16	38.0	470	34	540	410	5	41
14	Passur river at Akram point of Sundarbans	2600	1400	1390	850	1540	NS	84	760	1650	620	190	230	1420	30	760	1460	620	250	764	1500	980	370.0	410	60	430	580	5	410
15	Passur river at Hiron point of Sundarbans	2080	1160	2360	1500	1920	NS	97	NS	2100	NS	320	1090	NS	2	510	NS	NS	780	769	NS	NS	540.0	445	NS	30	1240	NS	598

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring; NS – Not Surveyed.

Table B.13: Phosphate (PO<sub>4</sub><sup>2-</sup>) (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.52	2.23	0.67	0.32	0.86	10	1.27	0.269	0.22	1.14	3.39	0.67	1.31	0.49	0.21	0.38	1.03	0.25	0.25	0.25	10.1	0.3	0.2	0.25	0.5	5.3	4.9	4.2
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	0.5	1.99	1.12	0.61	0.53	0.23	1.97	0.269	0.36	1.76	4.11	0.31	1.72	2.5	0.16	0.25	0.83	0.3	0.30	0.32	0.6	0.3	0.2	0.27	0.5	3.5	2	0.6
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	1.1	2.55	0.95	0.7	0.72	0.67	1.94	0.179	0.27	1.77	4.58	0.09	2.73	2.8	0.3	0.29	0.76	0.22	0.17	0.40	0.5	0.4	0.3	0.3	0.5	3.2	1.9	0.54
4	Left Bank of Passur River at Project Site-Jetty	2.1	0.45	0.92	0.43	0.49	0.27	2.53	0.357	0.31	2.31	2.76	0.07	2.77	3.3	0.19	0.38	0.88	0.24	0.20	0.30	0.6	0.2	0.3	0.35	0.7	2.9	2.3	4.5
5	Middle Passur River at Project Site-Jetty	2.2	2.13	1.11	0.41	0.68	0.59	1.3	0.536	0.3	0.98	3.2	0.12	0.66	3.9	0.17	0.34	1.07	0.4	0.35	0.27	0.6	0.3	0.2	0.29	0.5	3.0	5.7	2.1
6	Right Bank of Passur River at Project Site-Jetty	2	2.42	0.99	0.55	0.61	0.13	1.32	0.269	0.43	1.01	2.48	0.16	0.62	3.9	0.47	0.27	0.67	0.53	0.27	0.25	0.9	0.4	0.3	0.36	0.8	5.4	4	3.4
7	Left Bank of Passur River at South West corner from the Project boundary	0.57	1.25	1.18	0.76	0.65	0.1	0.99	0.536	0.63	0.87	4.16	0.09	0.65	4.6	1.31	0.29	1.16	0.32	0.20	0.41	11.1	0.5	0.4	0.4	0.7	3.0	1.2	5.4
8	Middle of Passur River at South West corner from the Project boundary	1.2	1.51	1.25	0.85	0.53	0.18	1.02	0.625	0.21	0.96	2.76	0.04	0.37	0.41	0.39	0.29	0.86	0.43	0.20	0.35	0.8	0.7	0.4	0.43	0.4	2.5	2.4	3.7
9	Right Bank of Passur River at South West corner from the Project boundary	1.5	1.1	1	0.53	0.6	0.1	1.39	0.536	0.33	1.123	2.71	0.07	0.45	0.63	0.62	0.42	1.03	0.57	0.37	0.27	0.8	0.5	0.4	0.52	1.3	3.2	6.3	2.7
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	0.55	2.1	1.27	0.59	0.7	0.5	1.27	0.351	0.19	1.06	2.836	0.07	0.61	0.51	0.38	0.24	0.83	0.27	0.40	0.28	0.5	0.6	0.5	0.25	1.2	13.1	8	3.4
11	Maidara river near proposed township area	1.1	0.53	1.04	0.64	0.55	0.29	1.28	0.269	0.13	1	5.23	0.2	0.47	15.3	0.71	0.28	1.2	0.22	0.28	0.30	0.8	0.4	0.3	0.56	0.7	4.1	0.76	0.2
12	Passur river at Passur - Mongla confluence	1.3	0.35	0.86	0.42	0.71	0.59	0.95	0.179	0.31	0.78	4.01	0.09	0.18	1.3	0.63	0.37	0.86	0.33	0.29	0.31	0.6	0.6	0.4	0.53	0.8	9.6	0.79	0.27
13	Passur river at Harbaria of Sundarbans	1.1	0.56	1.22	0.61	0.59	0.89	0.35	0.269	0.42	0.53	1.16	0.09	0.21	3.15	0.81	0.26	0.5	0.25	0.30	0.52	0.6	0.7	0.2	0.4	0.3	2.6	0.6	1.9
14	Passur river at Akram point of Sundarbans	1.3	0.29	0.8	0.42	0.61	NS	0.43	0.357	0.26	0.47	9.08	0.1	0.19	0.36	0.97	0.20	0.67	0.5	0.19	0.63	0.5	0.3	0.1	0.37	0.4	7.1	3	0.87
15	Passur river at Hiron point of Sundarbans	7.51	0.29	1.09	0.44	0.47	NS	0.45	NS	0.36	NS	5.9	0.23	NS	0.55	1.45	NS	NS	0.61	0.18	NS	NS	0.3	0.2	NS	0.4	1.1	NS	0.5

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.14: Arsenic (As) (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.002	0.003	0.004	0.003	0.002	0.002	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.004	0.003	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.002	0.003	0.003
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	0.002	0.003	0.004	0.003	0.002	0.002	0.001	0.001	0.003	0.003	0.003	0.001	0.002	0.001	0.002	0.001	0.005	0.002	0.001	0.002	0.002	0.003	0.003	0.003	0.003	0.002	0.004	0.002
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.001	0.003	0.004	0.003	0.003	0.002	0.001	0.001	0.003	0.005	0.002	0.001	0.001	0.002	0.003	0.001	0.004	0.002	0.003	0.003	0.002	0.002	0.002	0.003	0.003	0.002	0.003	0.003
4	Left Bank of Passur River at Project Site-Jetty	0.002	0.004	0.004	0.004	0.002	0.002	0.001	0.002	0.002	0.004	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.005	0.002	0.001	0.003	0.002	0.003	0.003	0.002	0.003	0.002	0.003
5	Middle Passur River at Project Site-Jetty	0.002	0.004	0.004	0.003	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.003	0.002	0.001	0.003	0.002	0.003	0.002	0.002	0.004	0.003	0.002	0.002
6	Right Bank of Passur River at Project Site-Jetty	0.002	0.003	0.003	0.003	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.003
7	Left Bank of Passur River at South West corner from the Project boundary	<0.001	0.003	0.006	0.003	0.002	0.002	0.001	0.002	0.001	0.003	0.002	0.002	0.002	0.003	0.001	0.002	0.005	0.002	0.003	0.003	0.003	0.003	0.002	0.005	0.004	0.002	0.003	0.003
8	Middle of Passur River at South West corner from the Project boundary	<0.002	0.004	0.004	0.003	0.002	0.002	0.001	0.001	0.002	0.003	0.003	0.001	0.002	0.002	0.001	0.001	0.003	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.003	0.002
9	Right Bank of Passur River at South West corner from the Project boundary	0.002	0.003	0.006	0.003	0.002	0.003	0.001	0.001	0.002	0.004	0.002	0.002	0.003	0.002	0.001	0.001	0.004	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.003	0.002
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	<0.001	0.003	0.006	0.004	0.003	0.002	0.001	0.002	0.002	0.005	0.002	0.001	0.003	0.003	0.002	0.002	0.004	0.001	0.002	0.003	0.003	0.003	0.003	0.004	0.004	0.003	0.003	0.002
11	Maidara river near proposed township area	0.002	0.002	0.003	0.003	0.003	0.002	0.001	0.001	0.002	0.002	0.002	0.001	0.003	0.001	0.001	0.001	0.003	0.001	0.005	0.003	0.004	0.004	0.003	0.002	0.004	0.002	0.004	0.002
12	Passur river at Passur - Mongla confluence	0.002	0.004	0.003	0.003	0.004	0.002	0.001	0.002	0.003	0.004	0.003	0.002	0.002	0.002	0.001	0.002	0.003	0.001	0.007	0.003	0.002	0.004	0.003	0.002	0.002	0.003	0.002	0.002
13	Passur river at Harbaria of Sundarbans	0.004	0.003	0.004	0.004	0.004	0.002	0.001	0.002	0.005	0.002	0.003	0.002	0.001	0.003	0.002	0.001	0.003	0.002	0.001	0.002	0.001	0.002	0.003	0.002	0.002	0.002	0.002	0.002
14	Passur river at Akram point of Sundarbans	0.004	0.002	0.002	0.003	0.002	NS	0.001	0.002	0.006	0.001	0.003	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.002	0.002	0.003	0.002	0.002	0.002	0.003
15	Passur river at Hiron point of Sundarbans	0.003	0.002	0.003	0.002	0.002	NS	0.001	NS	0.004	NS	0.002	0.002	NS	0.002	0.001	NS	NS	0.001	0.001	NS	NS	0.002	0.002	NS	0.009	0.002	NS	0.003

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed

Table B.15: Pb (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.053	0.004	0.002	0.104	0.098	0.0059	0.007	0.168	0.203	0.01	0.009	0.024	0.002	0.003	0.001	0.002	0.002	0.003	0.004	0.003	0.001	0.001	0.008	0.006	0.002	0.016	0.029	0.017
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	0.055	0.002	0.003	0.104	0.102	0.0038	0.006	0.092	0.302	0.009	0.007	0.034	0.001	0.003	0.001	0.001	0.001	0.007	0.005	0.002	0.003	0.002	0.007	0.004	0.005	0.017	0.029	0.019
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	0.055	0.005	0.002	0.111	0.138	0.0058	0.008	0.176	0.347	0.017	0.01	0.03	0.003	0.003	0.002	0.004	0.02	0.017	0.007	0.004	0.002	0.001	0.009	0.007	0.006	0.018	0.036	0.019
4	Left Bank of Passur River at Project Site-Jetty	0.057	0.002	0.003	0.154	0.142	0.011	0.01	0.115	0.336	0.014	0.007	0.036	0.001	0.002	0.002	0.001	0.018	0.013	0.005	0.003	0.009	0.001	0.008	0.005	0.008	0.015	0.016	0.012
5	Middle Passur River at Project Site-Jetty	0.06	0.002	0.002	0.139	0.135	0.002	0.009	0.148	0.317	0.006	0.006	0.046	0.003	0.002	0.001	0.003	0.008	0.01	0.003	0.003	0.003	0.001	0.006	0.007	0.006	0.017	0.014	0.012
6	Right Bank of Passur River at Project Site-Jetty	0.058	0.002	0.002	0.138	0.156	0.0021	0.007	0.112	0.298	0.01	0.005	0.041	0.002	0.001	0.001	0.001	0.041	0.012	0.007	0.002	0.009	0.003	0.004	0.008	0.005	0.019	0.012	0.016
7	Left Bank of Passur River at South West corner from the Project boundary	0.053	0.002	0.003	0.16	0.142	0.0076	0.01	0.134	0.396	0.007	0.006	0.048	0.003	0.001	0.001	0.007	0.012	0.011	0.003	0.002	0.120	0.001	0.006	0.019	0.018	0.019	0.0140	0.022
8	Middle of Passur River at South West corner from the Project boundary	0.054	0.003	0.004	0.153	0.148	0.002	0.011	0.099	0.323	0.006	0.007	0.044	0.009	0.002	0.001	0.003	0.015	0.014	0.004	0.003	0.006	0.002	0.008	0.009	0.008	0.017	0.003	0.015
9	Right Bank of Passur River at South West corner from the Project boundary	0.056	0.005	0.004	0.139	0.163	0.002	0.009	0.093	0.331	0.012	0.007	0.056	0.003	0.002	0.002	0.005	0.03	0.019	0.006	0.002	0.004	0.001	0.007	0.01	0.004	0.022	0.014	0.016

Sl	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	0.053	0.004	0.004	0.143	0.135	0.002	0.07	0.023	0.35	0.008	0.008	0.038	<LOQ	0.003	0.002	0.002	0.01	0.008	0.004	0.002	0.003	0.002	<b>0.008</b>	0.013	<b>0.003</b>	0.019	0.013	0.022
11	Maidara river near proposed township area	0.048	0.004	<0.002	0.133	0.14	0.002	0.008	0.067	0.275	0.015	0.007	0.056	0.001	0.011	0.001	0.003	0.016	0.017	0.005	0.003	0.004	0.003	<b>0.006</b>	0.005	<b>0.006</b>	0.007	0.015	0.002
12	Passur river at Passur - Mongla confluence	0.05	0.032	<0.002	0.141	0.14	0.002	0.009	0.078	0.258	0.098	0.011	0.05	0.0001	0.011	0.001	0.002	0.015	0.009	0.007	0.003	0.002	0.002	<b>0.005</b>	0.003	<b>0.007</b>	0.015	0.014	0.023
13	Passur river at Harbaria of Sundarbans	0.043	0.044	0.004	0.137	0.13	0.002	0.012	0.135	0.228	0.02	0.01	0.05	0.001	0.005	0.003	0.003	0.017	0.009	0.015	0.002	0.006	0.014	<b>0.007</b>	0.009	<b>0.004</b>	0.002	0.014	0.011
14	Passur river at Akram point of Sundarbans	0.194	0.071	0.032	0.309	0.297	NS	0.084	0.302	0.359	0.142	0.126	0.033	0.009	0.004	0.169	0.001	0.062	0.018	0.013	0.002	0.001	0.019	<b>0.043</b>	0.011	<b>0.020</b>	0.001	0.018	0.005
15	Passur river at Hiron point of Sundarbans	0.224	0.05	0.07	0.309	0.291	NS	0.073	NS	0.607	NS	0.151	0.129	NS	0.019	0.175	NS	NS	0.014	0.017	NS	NS	0.008	<b>0.056</b>	NS	<b>0.013</b>	0.001	NS	0.5

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Table B.16: Hg (mg/L) concentration of Passur River System

Sl	Sampling Locations	Monitoring periods																											
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Left Bank of Passur River at 100m u/s of North West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.004	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
2	Middle Passur River at 100m u/s of North West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
3	Right Bank of Passur River at 100m u/s of North West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
4	Left Bank of Passur River at Project Site-Jetty	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
5	Middle Passur River at Project Site-Jetty	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
6	Right Bank of Passur River at Project Site-Jetty	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
7	Left Bank of Passur River at South West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
8	Middle of Passur River at South West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
9	Right Bank of Passur River at South West corner from the Project boundary	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
10	Maidara river of the South East corner of the project at Ichamoti-Maidara confluence	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
11	Maidara river near proposed township area	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
12	Passur river at Passur - Mongla confluence	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
13	Passur river at Harbaria of Sundarbans	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
14	Passur river at Akram point of Sundarbans	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
15	Passur river at Hiron point of Sundarbans	< 0.00015	NS	< 0.00015	< 0.00015	< 0.00015	< 0.00015	NS	NS	< 0.00015	NS	< 0.00015	< 0.00015	< 0.001	< 0.001	< 0.001	NS	NS	< 0.001	< 0.001	NS	< 0.001	< 0.001	NS	< 0.001	< 0.001	NS	< 0.001	< 0.001

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

Parameters for ground water quality monitoring

Table B.17: pH and Temperature (°C) of Ground Water

Sl	Locations	Tube Well Type	Monitoring periods																													
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	29QM	30QM	
1	Near Proposed Township	Deep (>600 ft)	7.6	7.7	7.9	8	TC	8.1	7.49	7.6	7.8	7.8	8.4	8.1	7.4	8.2	6.9	NF	NF	NF	7.1	8.3	8.2	7.2	7.8	8.1	7.4	7.2	8.0	5.6	8.0	
2	Rajnagar	Deep (>600 ft)	7.6	7.8	8	8.2	7.8	8.3	7.93	8.1	8.3	8.1	7.9	7.5	7.8	8.1	7.4	6.9	7.9	7.3	6.9	8.4	7.9	7.6	7.3	8.0	8	7.5	8.3	6.2	8.6	
3	Kapasdanga	Deep (>600 ft)	7.6	7.7	8	8.1	7.9	8.3	7.7	7.9	8.2	7.9	7.9	7.6	7.4	7.8	7.2	7.2	7.6	7.6	6.5	8.9	8.1	7.4	7.5	8.0	8	7.5	8.2	7.4	9.1	
4	Kalekharber	Shallow (<250 ft)	6.3	6.5	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF-Not Functional.

Locations	Tube Well Type	Monitoring periods																												
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	29QM	30QM
Near Proposed Township	Deep (>600 ft)	27.3	28.5	26	24.5	TC	31	30	24	29.8	28.6	29.1	25.1	28.7	27.2	22.9	NF	NF	NF	23.8	29	31.4	27	24	31	27	22	23	31.3	28.89
Rajnagar	Deep (>600 ft)	29.6	29.9	28	22.5	28.6	28	27.8	23	29.6	29.1	30.4	24.3	27.7	26.5	23.8	30.3	29.3	30	23.7	30	30.0	27	23	30	28	25	23	30.45	27.7
Kapasdanga	Deep (>600 ft)	29.2	28.9	28	25.1	28.8	30	28.7	25	30.1	29.4	29.8	24	28.4	26.4	23.6	30.1	29.7	29	23.2	30	31.2	26	23	30	27	25	24	30.72	28.04
Kalekharber	Shallow (<250 ft)	27.5	28.7	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF=Not Functional.

\*Drinking water quality standards, The Environment Conservation Rules, 1997

Table B.18: Salinity (ppt) and DO (mg/L) in Groundwater

Sl	Locations	Tube Well Type	Monitoring periods																													
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	29QM	30QM	
1	Near Proposed Township	Deep (>600 ft)	0	0	0	1	TC	0	0	0	0	0	0	0	0	0	0	NF	NF	NF	0.1	0.1	0.1	0.0	0.1	0.18	0.1	0.1	0.1	0		
2	Rajnagar	Deep (>600 ft)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.3	0.1	0.1	0.1	0.5	0.1	0.0	0.1	0.1	0.1	0.2	0.3	0.2	0	
3	Kapashdanga	Deep (>600 ft)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0.2	0.1	0.1	0.1	0.7	0.1	0.0	0.1	0.1	0.1	0.4	0.3	0.4	0	
4	Kalekharber	Shallow (<250 ft)	0	0	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NF=Not Functional.

Sl	Locations	Tube Well Type	Monitoring periods																													
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	July	Oct	Jan	Apr	Aug	Oct	
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	2QM	26QM	27QM	28QM	29QM	30QM	
1	Near Proposed Township	Deep (>600 ft)	4.4	5.2	6.5	6.7	TC	6	5.4	4.9	6.1	5.8	6.3	4.5	5.1	6.2	5.2	NF	NF	NF	6.0	6.0	6.1	6.0	6.0	6.0	6	6.4	6.4	6.0	6.5	
2	Rajnagar	Deep (>600 ft)	6	6.2	7.7	6.3	6	5.9	6.1	5.2	5.8	6.1	5.8	4.8	5.3	5.8	4.47	6.0	6	5.9	6.1	6.5	6.0	6.2	6.1	6.1	6.2	6.7	6.3	6	7.7	
3	Kapasdanga	Deep (>600 ft)	6.4	6.5	6.1	6.5	6.6	6	5.6	4.8	5.6	5.7	6.1	4.6	5.7	6.2	4.26	5.4	5.9	6.1	6.2	6.2	6.0	6.0	6.0	6.1	6	4.9	6.3	5	6.1	
4	Kalekharber	Shallow (<250 ft)	4.4	6	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring:

NF=Non-functional \*Drinking water quality standards, The Environment Conservation Rules, 1997

Table B.19: TDS (mg/L) and TSS (mg/L) concentrations in Groundwater

SL	Locations	Type of tube wells	Monitoring periods																											
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Township near project site	Deep (>600 ft)	1113	999	-	1021	NO	881	377	447	1025	1000	617	623	395	602	405	NF	NF	NF	1315	915	25	900	3080	1196	139	200	810	890
2	Rajnagar	Deep (>600 ft)	4090	371	-	378	390	574	1007	491	384	408	382	401	617	996	602	615	390	365	376	380	602	385	660	701	335	350	450	360
3	Kapasdanga	Deep (>600 ft)	643	635	-	600	600	328	611	284	645	607	636	998	558	390	994	370	608	610	927	610	360	603	370	316	202	610	570	610
4	Kalekharber	Shallow (<250 ft)	1055	970	-	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS – Not Surveyed.

SL	Locations	Type of tube wells	Monitoring periods																											
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25QM	26QM	27QM	28QM	29QM
1	Township near project site	Deep (>600 ft)	-	6	19	40	NF**	23	4	31	3	5	7	32	4	8	12	NF	NF	NF	3	3	2	4	2	1	3	1	1	1
2	Rajnagar	Deep (>600 ft)	-	6	2	28	4	16	5	46	4	4	4	28	10	10	6	12	2	6	3	2	1	3	3	3	5	2	1	1
3	Kapasdanga	Deep (>600 ft)	-	8	6	32	6	14	4	41	3	4	5	25	9	9	7	5	3	8	4	4	4	4	2	1	2	5	1	2
4	Kalekharber	Shallow (<250 ft)	-	48	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	Nf	NF	NF	NF	NF	NF	NF

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS=Not Surveyed; NF=Non-functional;

Table B.20: TH (mg/L) concentrations in Groundwater

Sl No	Locations	Type of tubewell	Monitoring periods																											
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23 <sup>rd</sup> QM	25QM	26QM	27QM	28QM	29QM
1	Township near project site	Deep (>600 ft)	425	250	300	235	NO	225	325	295	305	320	175	550	720	145	NF	NF	NF	NF	355	235	97	145	137	625	232	160	1400	160
2	Rajnagar	Deep (>600 ft)	220	175	180	110	138	125	450	195	263	248	295	510	420	240	265	195	235	178	215	182	167	245	118	210	185	145	1600	195
3	Kapasdanga	Deep (>600 ft)	190	140	180	125	216	115	480	225	163	28	183	620	654	215	305	215	170	138	270	167	212	137	145	237	207	130	1200	140
4	Kalekarber	Shallow (<250 ft)	780	450	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF

Source: CEGIS Field Survey;

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring;

NF=Nonfunctional; \*Drinking water quality standards, The Environment Conservation Rules, 1997.

Table B.21: COD (mg/L) concentrations of monitored ground water locations

Sl	Locations	Tube-well Type	Monitoring periods																											
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23 <sup>rd</sup> QM	25QM	26QM	27QM	28QM	29QM
1	Township near project site	Deep (>600 ft)	32	32	34	20	NO	12	4	4	4	4	4	4	8	NF	NF	NF	NF	4	352	4	4	4	4	4	4	16	32	
2	Rajnagar	Deep (>600 ft)	28	28	18	16	14	10	8	4	4	4	4	4	8	4	4	4	4	3	4	4	4	4	4	4	4	32	28	
3	Kapasdanga	Deep (>600 ft)	48	32	34	20	18	14	4	4	4	2	4	4	4	16	4	4	4	4	4	4	4	4	4	4	4	8	36	
4	Kalekarber	Shallow (<250 ft)	32	36	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring; NS=Not Surveyed; NF=Non-functional; N/A=Not Availability; \*Drinking water quality standards, The Environment Conservation Rules, 1997

Table B.22: NO<sub>3</sub><sup>-</sup> (mg/L) Concentrations in Ground Water

Sl	Locations	Type of tube well	Monitoring periods *BD Standard (10 mg/L)																											
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23 <sup>rd</sup> QM	25QM	26QM	27QM	28QM	29QM
1	Township near project site	Deep (>600 ft)	0.20	0.48	<0.10	28	-	7.6	4.3	2.1	1.7	3.8	6.1	4.65	9.32	3.3	5.9	NF	NF	NF	1.7	4.4	1.4	1.8	1.9	1.7	0.5	2.4	1	1.5
2	Rajnagar	Deep (>600 ft)	0.60	0.68	0.31	26	-	2.2	4.2	1.9	2.3	3.3	7.51	7.02	14.7	2.5	7.2	5.3	8.6	0.9	4.4	2.7	2.7	3.1	1.4	7.5	3.8	2.2	1	2.1
3	Kapasdanga	Deep (>600 ft)	0.80	0.40	0.80	13	-	4.7	3.8	2.8	1.9	3.7	10.16	4.65	10.2	4.6	1.7	5.7	7.8	1.4	2.1	8.3	1.7	1.6	2.7	1.7	3.1	4.9	2	2.1
4	Kalekarber	Shallow (<250 ft)	0.40	0.56	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring; NF=Nonfunctional; \*Drinking water quality standards, The Environment Conservation Rules, 1997;

Table B.23: SO<sub>4</sub><sup>2-</sup> (mg/L) Concentrations in Ground Water

Sl	Location	Typeof Tubewell	Monitoring periods *BD Standard (400 mg/L)																												
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug	
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM	
1	Township near project site	Deep (>600 ft)	-	3	-	-	-	-	-	1	5	1	1	1	1	5	1	8	NF	NF	NF	1	4	1	2	2	4	9	1	1	1
2	Rajnagar	Deep (>600 ft)	-	2	-	-	-	-	-	2	6	2	1	1	1	1	1	2	4	1	2	1	2	2	3	3	3	1	1	4	
3	Kapasdanga	Deep (>600 ft)	-	10	-	-	-	-	-	2	2	8	1	1		3	2	6	4	6	1	1	4	1	1	2	4	3	7	1	3
4	Kalekarber	Shallow (<250 ft)	NF	3	NF	-	-	-	-	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring; NF=Non-functional; \*Drinking water quality standards, The Environment Conservation Rules, 1997

Table B.24: PO<sub>4</sub><sup>3-</sup> (mg/L) Concentrations in Ground Water

Sl	Location	Typeof Tubewell	Monitoring periods *BD Standard (6.0 mg/L)																											
			Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23QM	25QM	26QM	27QM	28QM	29QM
1	Township near project site	Deep (>600 ft)	NF	2.2	-	0.74	NO	1.4	0.31	0.267	1.08	0.17	0.167	1.18	2.18	1.68	0.13	NF	NF	NF	2.1	2.3	0.3	1	1.1	0.3	0.7	2.0	1.4	1.7
2	Rajnagar	Deep (>600 ft)	-	2.5	-	0.44	1.98	1.6	0.27	0.179	1.53	0.29	0.67	1.21	1.8	3.5	0.17	4.5	2.9	0.15	1.3	2.5	4.0	0.5	0.4	1.5	6.3	1.8	0.98	1.2
3	Kapasdanga	Deep (>600 ft)	-	6.2	-	0.48	4.54	4.1	0.48	0.179	3.26	0.31	0.6	1.18	2.1	4.7	0.18	0.27	4.8	0.26	3.6	3.2	2.0	1.5	0.9	1.7	2.3	2.3	4	5
4	Kalekarber	Shallow (<250 ft)	NF	1.2	NF	NF	NF	NF	NF	NF	NF	NF	NF	1.23	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring;

NF=Nonfunctional; \*Drinking water quality standards, The Environment Conservation Rules, 1997

Table B.25: As concentrations (mg/L) of monitored ground water locations

Sl	Locations	Monitoring periods																												
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	21QM	22QM	23 <sup>rd</sup> QM	25QM	26QM	27QM	28QM	29QM
1	Township near project site	0.013	0.020	0.012	0.014	NO	0.015	0.002	0.008	0.018	0.012	0.033	0.028	0.012	0.014	0.002	0.001	NF	NF	0.014	0.012	0.014	0.001	0.018	0.020	0.022	0.003	0.002	0.002	0.012
2	Rajnagar	0.006	0.009	0.006	0.008	0.01	0.014	0.012	0.002	0.007	0.018	0.011	0.005	0.022	0.004	0.012	0.022	0.012	0.007	0.003	0.012	0.006	0.027	0.006	0.068	0.045	0.053	0.004	0.003	0.003
3	Kalekarber	0.376	0.407	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	0.061
4	Kapasdanga	0.036	0.033	0.020	0.017	0.034	0.024	0.011	0.002	0.047	0.005	0.016	0.028	0.010	0.027	0.002	0.001	0.004	0.050	0.004	0.012	0.022	0.001	0.033	0.003	0.004	0.006	0.049	0.008	NF

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS=Not Surveyed; NF=Non-functional; N/A=Not Availability; TC=temporarily closed, D=Damaged

\*Drinking water quality standards, The Environment Conservation Rules, 1997.

Table B.26: Pb concentrations (mg/L) of monitored ground water locations

Sl	Locations	Monitoring periods																												
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	22QM	23 <sup>rd</sup> QM	25QM	26QM	27QM	28QM	29QM
1	Township near project site	0.002	<0.002	0.004	0.023	NO	0.002	0.006	0.026	0.019	0.002	0.001	0.01	0.001	0.003	0.001	0.001	0.001	NF	NF	0.008	0.004	0.018	0.002	0.001	0.001	0.004	0.048	0.003	0.009
2	Rajnagar	<0.002	<0.002	<0.002	0.016	0.013	0.0027	0.021	0.011	0.007	0.002	0.001	0.009	0.001	0.007	0.002	0.001	0.001	0.001	0.004	0.003	0.004	0.002	0.008	0.001	0.001	0.006	0.016	0.008	0.002
3	Kalekarber	0.002	0.008	NF	NF	D	D	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
4	Kapasdanga	<0.002	0.004	<0.002	0.013	0.017	0.002	0.005	0.012	0.008	0.002	0.001	0.016	0.001	0.002	0.001	0.001	0.001	0.001	0.056	0.004	0.006	0.001	0.001	0.002	0.001	0.002	0.056	0.002	0.001

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS=Not Surveyed; NF=Non-functional; N/A=Not Availability; TC=temporarily closed, D=Damaged

\*Drinking water quality standards, The Environment Conservation Rules, 1997

Table B.27: Hg concentrations (mg/L) of monitored ground water locations

Sl	Locations	Monitoring periods*BD Standard (0.001 mg/L)																												
		Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Nov	Feb	Apr	July	Nov	Feb	Jul	Oct	Jan	Apr	Aug
		1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	21QM	22QM	23 <sup>rd</sup> QM	25QM	26QM	27QM	28QM	29QM
1	Township near project site	<0.00015	<0.00015	<0.0005	<0.0005	<0.0005	0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2	Rajnagar	<0.00015	<0.00015	<0.0005	<0.0005	<0.00015	0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3	Kalekarber	<0.00015	<0.00015	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF	NF
4	Kapasdanga	<0.00015	<0.00015	<0.0005	<0.0005	<0.00015	0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	0.001	<0.0001	<0.001		<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Source: CEGIS Field Survey

Note: 1QM= First Quarterly Monitoring, 2QM = Second Quarterly Monitoring, 3QM = Third Quarterly Monitoring, 4QM = Fourth Quarterly Monitoring: NS=Not Surveyed; NF=Non-functional; N/A=Not Availability; TC=temporarily closed, D=Damaged

\*Drinking water quality standards, The Environment Conservation Rules, 1997.



Table B.28: PAH (mg/L) concentrations of monitored locations

PAH	July, 2018			January, 2019			July, 2019			February, 2020			July, 2020			January, 2021			August, 2021		
	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point	Project Jetty	Majhar point	Hiron point
Acenaphthylene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzol (A) Anthracene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzol (A) Pyrene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzol (B) Fluoranthene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzol (G, H, I) Perilene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzol (K) Fluoranthene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzol (A, H) Anthracene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table B.29: TOC (mg/L) and TC (mg/L) concentrations of monitored locations

Monitoring sites	July, 2018		January, 2019		July, 2019		February, 2020		July, 2020		January, 2021		August, 2021	
	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon
Project jetty site	26.4	19.5	20.7	14.3	17.2	13.6	37.5	26.4	152	9.17	1302	<5	250	<5
Majhar point or Harbaria area	21.9	25.1	24.8	18.8	21.7	18.1	21.7	18.1	200	9.48	1568	<5	200	20.2
Hiron point	NM	NM	6.8	5.7	NM	NM	8.1	6.7	NM	NM	9241	<5	544	<5

## (C) Noise Level monitoring data

Table C.1: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM1 (Noise Level in dB (A)) Mar-14				QM2 (Noise Level in dB (A)) Jul-14				QM3 (Noise Level in dB (A)) Oct-14				QM4 (Noise Level in dB (A)) Jan-15				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	80.32	60.86	63.22	68.13	52.71	55.62	50.27	52.87	53.37	53.52	57	54.63	51.92	53.7	54.21	53.28	70
2	NW Corner of the Project area	55.23	53	47.43	51.89	NM	NM	NM	NM	42.67	41.73	41.37	41.92	33.87	36.42	35.46	35.25	50
3	Chunkuri-2, Bajua	62.69	57.19	53.39	57.76	54.61	51.14	51.9	52.55	52.26	51.14	50.76	51.39	55.08	46.29	46.49	49.29	50
4	SW corner of the Project area	49.2	NM	NM	49.2	44.55	48.94	49.33	47.6	45.56	45.1	47.18	45.95	36.57	34.24	37.27	36.03	50
5	Proposed Township area, Project site	47.8	49.7	NM	48.75	46.15	47.21	NM	46.68	42.67	41.73	41.37	41.92	41.49	39.55	43.37	41.47	50
6	Barni, Gaurambha	64.95	50.93	60.65	58.84	48.73	50.37	50.75	49.95	50.18	50.89	48.27	49.78	43.36	38.56	48.86	43.6	50
7	Khan Jahan Ali Bridge, Khulna	76.12	66.72	72.25	71.7	55.97	64.68	61.75	60.8	72.24	58.3	68.3	66.28	61.34	63.4	60.41	61.72	70
8	Mongla Port area	69.38	54.55	59.79	61.24	54.75	54.2	52.58	53.84	66.8	55.2	59.5	60.5	40.26	35.04	40.76	38.69	75
9	Harbaria, Sundarbans	39.24	NM	42.51	40.88	59.25	60.52	48.62	56.13	54.08	56.51	NM	55.3	36.36	32.4	NM	34.38	45
10	Akram Point, Sundarbans	40.95	41.98	39.9	40.94	48.95	46.86	NM	47.9	45.27	42.69	NM	43.98	37.9	30.75	NM	34.32	45
11	Hiron Point, Sundarbans	35.99	40.75	39.16	38.63	51.29	NM	NM	51.29	47.98	39.42	NM	47.98	42.82	31.93	NM	37.37	45

Note(s): NM – Not Monitored, \*Std- Standard as defined in National Noise Control Rules 2006

Table C.2: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM 5 (Noise Level in dB (A)) Apr-15				QM 6 (Noise Level in dB (A)) Jul-15				QM 7 (Noise Level in dB (A)) Oct-15				QM 8 (Noise Level in dB (A)) Jan-16				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	57.27	54.31	59.65	57.08	43.52	54.23	51.56	49.77	68.32	66.09	60.96	65.12	67.84	61.25	66.31	66.07	70
2	NW Corner of the Project area	45.05	42.15	46.8	44.67	37.58	40.91	46.18	41.56	41.51	39.58	44.74	41.94	53.91	49.02	49.95	50.96	50
3	Chunkuri-2, Bajua	45.9	48.19	NM	47.05	40.57	42.23	39.17	40.66	47.53	45.48	49.28	47.43	56.84	48.12	55.90	53.62	50
4	SW corner of the Project area	40.6	43.25	46.89	43.58	44.57	44.30	42.36	43.75	36.15	48.26	43.68	42.70	60.32	55.30	63.70	60.44	50
5	Proposed Township area, Project site	41.49	39.55	43.37	41.47	43.41	50.86	45.99	46.75	46.89	49.47	55.20	50.52	54.79	52.22	54.29	53.77	50
6	Barni, Gaurambha	58.23	50.11	NM	54.17	46.76	44.83	46.95	46.18	56.40	54.19	54.88	55.16	60.62	60.00	56.86	59.16	50
7	Khan Jahan Ali Bridge, Khulna	75.2	72.75	72.42	73.45	52.95	52.18	53.34	52.82	64.43	61.65	66.65	64.25	69.96	64.81	70.56	68.45	70
8	Mongla Port area	46.02	49.29	49.15	48.15	36.72	38.56	43.54	39.61	45.39	NM	48.63	47.01	54.15	51.82	52.14	52.70	75
9	Harbaria, Sundarbans	67.06	64.05	64.99	65.37	39.33	30.74	NM	35.03	54.97	46.54	NM	50.75	45.72	44.69	NM	45.20	45
10	Akram Point, Sundarbans	53.35	56.37	NM	54.86	NM	NM	NM	NM	45.28	53.92	NM	49.60	45.60	40.29	NM	42.95	45
11	Hiron Point, Sundarbans	47.48	48.2	NM	47.84	NM	NM	NM	NM	54.44	37.69	NM	46.06	NM	NM	NM	NM	45

Note(s): NM – Not Monitored, \*Std- Standard as defined in National Noise Control Rules 2006.

Table C.3: Ambient noise monitoring status at the monitored locations

Sl No	Location	QM9 (Noise Level in dB (A)) Apr-16				QM 10 (Noise Level in dB (A)) Jul-16				QM 11 (Noise Level in dB (A)) Oct-16				QM 12 (Noise Level in dB (A)) Jan-17				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	67.71	61.23	66.31	65.08	50.92	50.04	52.3	51.42	60.1	68.6	67.8	65.5	54.4	61	61.46	58.95	70
2	NW Corner of the Project area	53.81	48.66	49.90	50.79	54.40	53.19	50.36	52.65	54.7	54.8	57.0	55.5	44.52	44.52	NM	44.52	50
3	Chunkuri-2, Bajua	43.30	43.35	46.84	44.49	56.29	49.4	54.51	53.4	50.4	47.7	56.6	51.6	55.73	56.2	NM	55.31	50
4	SW corner of the Project area	56.81	54.73	51.97	54.50	67.38	74.12	54.61	65.37	47.8	49.0	50.8	49.2	44.41	45.96	NM	45.19	50

Sl No	Location	QM9 (Noise Level in dB (A)) Apr-16				QM 10 (Noise Level in dB (A)) Jul-16				QM 11 (Noise Level in dB (A)) Oct-16				QM 12 (Noise Level in dB (A)) Jan-17				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
5	Proposed Township area, Project site	55.02	52.41	52.69	53.37	62.71	52.98	51.67	55.79	45.8	41.6	48.7	45.4	NM	43.4	41.85	42.63	50
6	Barni, Gaurambha	50.63	54.19	57.09	53.97	51.2	59.54	59.53	56.75	52.4	57.3	55.0	54.9	49.75	48.35	NM	49.05	50
7	Khan Jahan Ali Bridge, Khulna	66.40	64.82	66.34	65.85	63.52	62.15	65.73	63.80	61.9	59.6	61.3	60.9	51.69	60.05	54.97	55.57	70
8	Mongla Port area	49.89	48.67	51.07	49.88	53.87	52.04	52.7	52.87	49.5	50.0	50.2	49.9	47.82	48.67	50.33	48.94	75
9	Harbaria, Sundarbans	44.40	44.69	NM	44.55	53.87	53.04	52.79	52.9	57.2	53.5	49.3	53.3	41.13	38.4	37.98	39.17	45
10	Akram Point, Sundarbans	45.60	40.29	NM	42.95	47.16	46.48	50.24	47.96	40.5	43.0	42.5	42.0	38.74	38.45	37.06	38.08	45
11	Hiron Point, Sundarbans	48.53	37.69	NM	43.11	NM	NM	NM	NM	46.1	42.08	41.9	44.0	43.62	40.96	42.29	42.29	45

Note(s): NM – Not Monitored, \*Std- Standard as defined in National Noise Control Rules 2006.

**Table C.4: Ambient noise monitoring status at the monitored locations**

Sl No	Location	QM13 (Noise Level in dB (A)) Apr-17				QM 14 (Noise Level in dB (A)) Oct-17				QM 15 (Noise Level in dB (A)) Jan-18				QM 16 (Noise Level in dB (A)) April-18				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	58.21	59.00	66.57	61.62	47.65	51.06	50.27	49.66	60.2	60.2	60.5	60.3	64.09	59.30	65.43	62.94	70
2	NW Corner of the Project area	44.97	49.30	47.31	47.19	47.65	45.12	46.65	46.47	47.8	48.1	49.2	48.37	47.92	54.32	61.14	54.46	55
3	Chunkuri-2, Bajua	45.60	52.29	53.42	50.44	39.82	45.60	41.73	42.38	51.1	51.2	52.1	51.47	44.77	46	63.14	51.30333	55
4	SW corner of the Project area	39.62	42.64	47.48	43.25	60.80	64.08	62.52	62.47	43.5	43.5	45.7	44.23	64.45	63.49	66.63	64.85667	55
5	Project site near Shapmari area	41.40	43.09	43.45	42.65	43.05	48.52	45.01	45.53	53.2	54	52.82	53.34	51.95	59.66	56.8	56.13667	55
6	Barni, Gaurambha	43.05	46.45	45.01	44.83	45.60	52.29	53.42	50.44	56.5	54.2	56.1	55.6	55.6	51.80	51.39	52.93	60
7	Khan Jahan Ali Bridge, Khulna	54.01	57.50	58.66	56.72	40.60	42.64	46.55	43.26	60.2	62.1	62.2	61.5	49.4	45.25	47.98	47.54333	70
8	Mongla Port area	47.78	47.45	45.25	47.61	41.40	44.68	45.71	43.93	60.2	60.2	58.4	59.6	50.84	48.33	53.25	50.80667	75

Sl No	Location	QM13 (Noise Level in dB (A)) Apr-17				QM 14 (Noise Level in dB (A)) Oct-17				QM 15 (Noise Level in dB (A)) Jan-18				QM 16 (Noise Level in dB (A)) April-18				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
9	Harbaria, Sundarbans	50.79	53.67	57.84	54.10	44.25	46.67	47.31	46.08	45.8	44.7	43.8	44.7	50.23	45.55	65.43	53.73667	50
10	Akram Point, Sundarbans	43.41	45.60	43.89	44.30	58.21	58.59	58.70	58.50	39.4	40.5	41.1	40.3	58.31	60.93	64.87	61.37	50
11	Hiron Point, Sundarbans	NM	NM	NM	NM	39.92	39.79	33.5	37.74	37.2	39	38.4	38.2					50

Source: CEGIS field Survey; NM-Not measured; \*Std- Standard as defined in National Noise Control Rules 2006.

**Table C.5 Ambient noise monitoring status at the monitored locations**

Sl No	Location	QM 17 (Noise Level in dB (A)) July-18				QM 18 (Noise Level in dB (A)) Nov-18				QM 19 (Noise Level in dB (A)) Feb-19				QM 20 (Noise Level in dB (A)) Apr-19				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	57.64	56.94	58.03	57.54	61.3	56.3	57.1	70	56.14	59.28	53.95	56.45	62.02	61.91	61.08	61.67	70
2	NW Corner of the Project area	42.80	47.51	46.57	45.63	56.5	60.1	59.85	55	45.15	54.11	53	50.75	53.70	58.92	57.92	56.85	55
3	Chunkuri-2, Bajua	46.23	49.02	47.34	47.53	45.8	48.9	51.3	55	50.19	49.35	51	50.18	49.66	54.02	51.35	51.68	55
4	SW corner of the Project area	58.84	48.00	51.03	52.63	64.5	60.6	60.2	55	53.50	58.01	55.88	55.79	58.08	54.79	55.27	56.05	55
5	Project site near Shapmari area	42.66	45.82	48.78	45.75	45.1	51.2	55.8	55	58.48	61.21	54.70	58.13	61.35	58.97	56.16	58.83	55
6	Barni, Gaurambha	42.67	47.95	45.90	45.51	58.3	50.6	50.2	60	54.32	57.65	45.75	52.57	58.58	51.05	49.92	53.18	60
7	Khan Jahan Ali Bridge, Khulna	64.1	64.06	61.90	63.35	64.6	60.9	60.9	70	65.72	69.04	66.03	66.93	67.95	63.09	69.82	66.95	70
8	Mongla Port area	63.12	59.00	60.77	60.96	55.8	53.1	59.0	75	64.33	63.37	70.85	66.18	64.12	62.41	65.45	63.99	75
9	Harbaria, Sundarbans	51.98	48.58	50.28	50.28	49.9	47.6	NM	50	51.43	47.90	NM	49.67	49.42	47.45	NM	48.43	50
10	Akram Point, Sundarbans	46.52	43.88	45.2	45.20	41.9	40.1	NM	50	47.35	45.55	NM	46.45	46.16	38.49	NM	42.33	50
11	Hiron Point, Sundarbans	NM	NM	NM	57.54	39.7	39.1	NM	50	33.8	44.62	NM	39.21	NM	NM	NM	-	50

Source: CEGIS field Survey; NM-Not measured; \*Std- Standard as defined in National Noise Control Rules 2006.

Table C.6 Ambient noise monitoring status at the monitored locations

Sl No	Location	QM 21 (Noise Level in dB (A)) July-19				QM 22 (Noise Level in dB (A)) November-19				QM 23 (Noise Level in dB (A)) February 20				QM 25 (Noise Level in dB (A)) July, 20				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	55.92	60.88	61.23	59.34	70	61.03	55.78	58.60	56.24	54.09	53.45	54.59	52.00	51.11	50.56	51.28	70
2	NW Corner of the Project area	56.44	53.21	55.88	55.18	55	53.45	50.97	51.11	40.96	43.33	51.98	45.42	43.9	42.95	43.26	43.37	55
3	Chunkuri-2, Bajua	56.15	63.34	58.60	59.36	55	52.92	54.51	55.27	59.78	51.59	54.96	55.44	49.42	48.52	48.32	48.75	55
4	SW corner of the Project area	66.94	58.41	65.65	63.66	55	49.98	42.05	46.57	56.35	54.05	56.40	55.60	49.91	49.78	50.85	50.18	55
5	Project site near Shapmari area	53.14	55.40	55.05	54.53	55	55.80	54.77	54.86	51.02	47.91	47.93	48.95	54.55	53.21	52.88	53.72	55
6	Barni, Gaurambha	51.36	57.98	NM	54.67	60	49.37	48.53	50.53	57.37	60.48	68.05	61.97	56.53	40.65	49.21	48.80	60
7	Khan Jahan Ali Bridge, Khulna	63.38	60.55	66.44	63.46	70	67.65	65.32	66.05	60.75	62.81	63.05	62.20	65.55	66.86	66.52	66.31	70
8	Mongla Port area	60.49	62.10	63.43	62.01	75	55.66	55.85	57.25	59.74	62.38	61.07	61.06	64.92	67.90	63.71	66.41	75
9	Harbaria, Sundarbans	47.62	42.18	NM	44.90	50	44.71	NM	44.10	45.59	42.29	41.35	43.94	47.80	52.15	41.2	49.97	50
10	Akram Point, Sundarbans	44.05	45.62	NM	44.84	50	42.60	NM	44.86	NM	36.59	40.46	36.59	51.04	45.11	43.1	51.04	50
11	Hiron Point, Sundarbans	NM	NM	NM	NM	50	41.34	NM	40.28	41.3	39.41	NM	40.34	NM	NM	NM	NM	50

Source: CEGIS field Survey; Note: NM-Not measured; \*Std- Standard as defined in National Noise Control Rules 2006.

Table C.7 Ambient noise monitoring status at the monitored locations

Sl No	Location	QM 26 (Noise Level in dB (A)) Oct, 2020				QM 27 (Noise Level in dB (A)) Jan, 2021				QM 28 (Noise Level in dB (A)) Apr, 2021				QM 29 (Noise Level in dB (A)) Jul, 2021				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	65.91	51.62	56.93	58.15	58.33	NM	62.68	60.50	61.35	61.74	61.22	61.44	50.96	51.08	51.57	51.21	70
2	NW Corner of the Project area	47.82	50.15	47.45	48.48	45.00	52.75	56.51	51.42	50.65	48.34	NM	49.50	49.60	51.64	49.09	50.11	55
3	Chunkuri-2, Bajua	43.58	47.68	46.45	45.91	48.75	45.45	46.96	47.05	50.22	52.90	50.81	51.31	49.93	51.65	49.52	50.36	55
4	SW corner of the Project area	49.50	48.83	49.22	49.18	NM	50.88	53.84	52.36	55.41	54.85	55.45	55.24	49.82	54.82	51.07	51.90	55



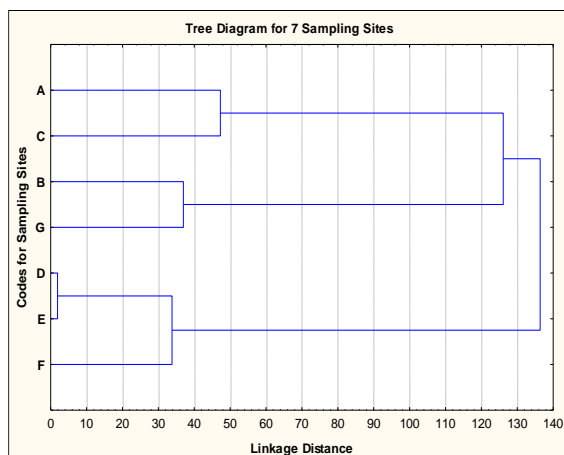
Sl No	Location	QM 26 (Noise Level in dB (A)) Oct, 2020				QM 27 (Noise Level in dB (A)) Jan, 2021				QM 28 (Noise Level in dB (A)) Apr, 2021				QM 29 (Noise Level in dB (A)) Jul, 2021				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time
5	Project site near Shapmari area	50.23	41.71	41.43	44.45	49.19	47.07	51.00	49.09	52.23	51.24	52.67	52.05	53.45	54.35	53.71	53.84	55
6	Barni, Gaurambha	67.71	51.76	55.51	58.33	51.69	51.99	55.60	53.09	54.16	51.69	51.15	52.34	52.73	NM	49.28	51.00	60
7	Khan Jahan Ali Bridge, Khulna	81.72	81.45	82.25	81.81	61.95	NM	61.93	61.94	56.08	54.09	53.79	54.65	52.78	51.29	53.05	52.38	70
8	Mongla Port area	74.72	75.67	80.37	76.92	55.16	56.85	57.53	56.52	54.01	52.41	54.48	53.63	55.26	55.54	55.68	54.49	75
9	Harbaria, Sundarbans	59.01	NM	50.06	54.54	46.98	41.82	NM	44.40	48.54	47.54	NM	48.04	NM	NM	NM	NM	50
10	Akram Point, Sundarbans	NM	42.23	NM	42.23	40.34	35.35	NM	37.85	45.95	40.89	NM	43.42	46.31	42.94	NM	44.62	50
11	Hiron Point, Sundarbans	52.40	49.01	NM	50.70	42.50	35.23	NM	38.85	NM	NM	NM	NM	49.70	51.2	NM	50.94	50

Source: CEGIS field Survey; Note: NM-Not measured; \*Std- Standard as defined in National Noise Control Rules 2006.

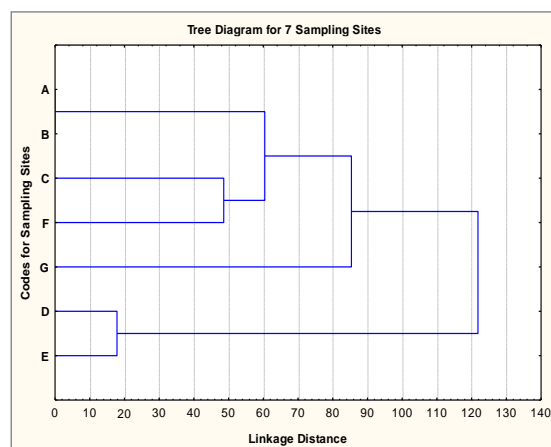
**Table C.8 Ambient noise monitoring status at the monitored locations**

Sl No	Location	QM 30 (Noise Level in dB (A)) Oct, 2021																Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG													Day time
1	Chalna, Dacope	68.9	52.08	58.3	64.57													70
2	NW Corner of the Project area	47.99	51.61	48.17	49.59													55
3	Chunkuri-2, Bajua	45.31	48.07	46.8	46.87													55
4	SW corner of the Project area	49.66	49.49	48.95	49.37													55
5	Project site near Shapmari area	50.94	42.29	41.88	47.17													55
6	Barni, Gaurambha	68.37	51.5	56.61	63.96													60
7	Khan Jahan Ali Bridge, Khulna	77.75	80.58	81.43	80.18													70
8	Mongla Port area	73.94	75.15	79.45	76.86													75
9	Harbaria, Sundarbans	59.51	50.62	NM	57.02													50
10	Akram Point, Sundarbans	44.22	42.12	NM	43.29													50
11	Hiron Point, Sundarbans	53.99	49.41	NM	52.27													50

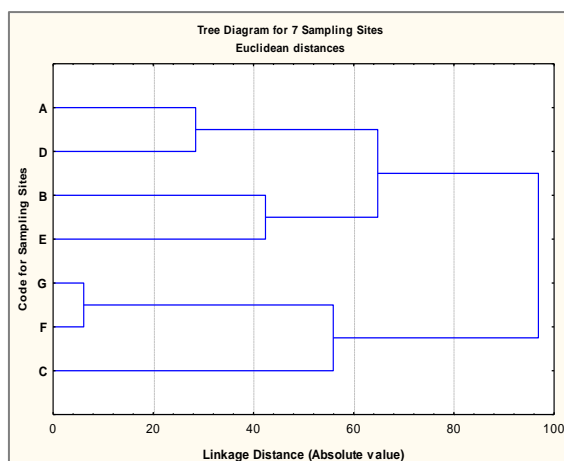
Source: CEGIS field Survey; Note: NM-Not measured; \*Std- Standard as defined in National Noise Control Rules 2006.

**(D) Fisheries resources monitoring data****D1: Classification of functional habitat**

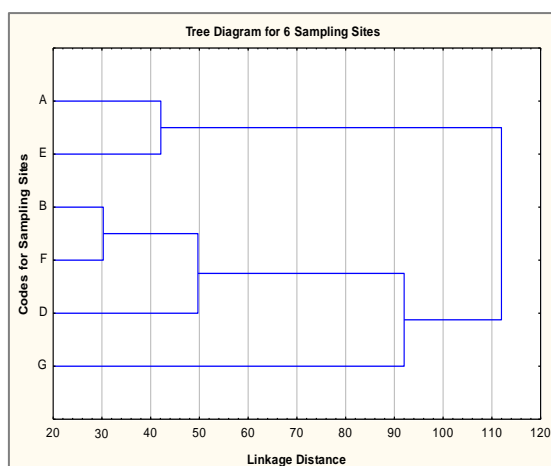
1st Monitoring, April, 2014



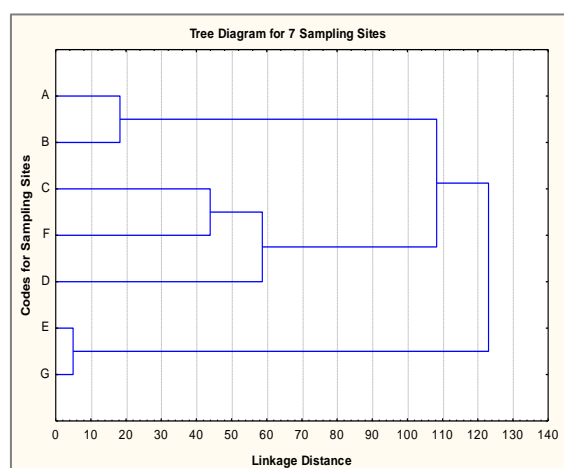
2nd Monitoring, July 2014



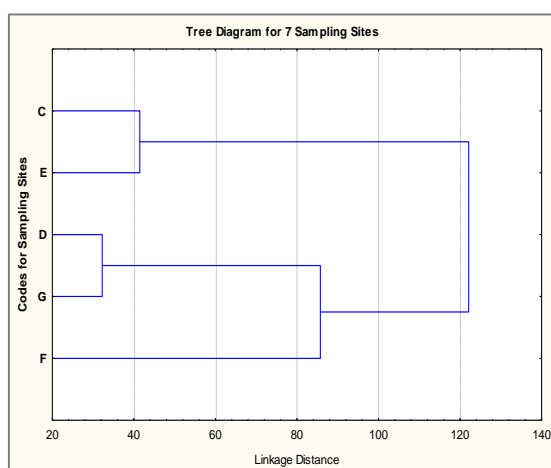
3rd Monitoring, October, 2014



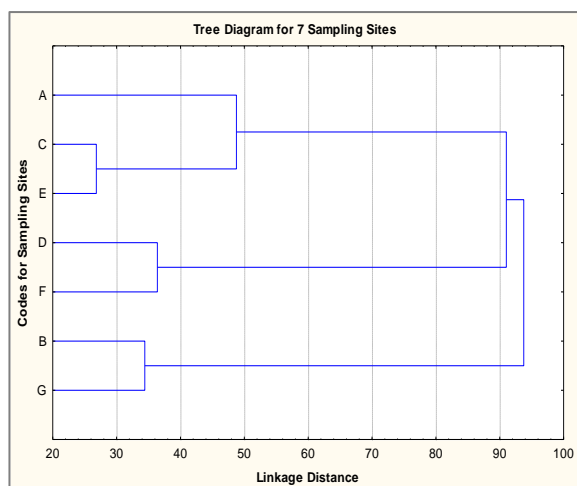
4th Monitoring, January 2015



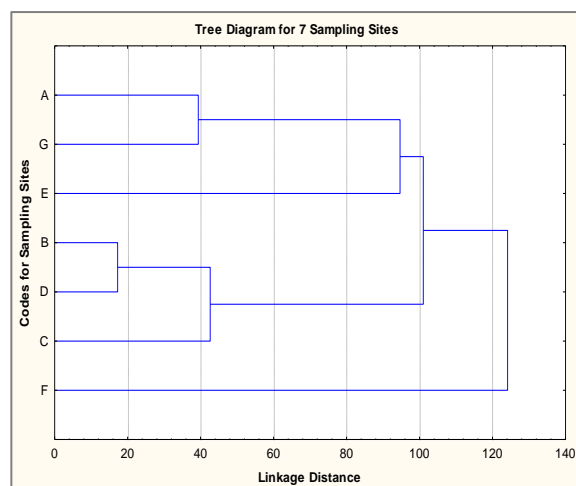
5th Monitoring, April, 2015



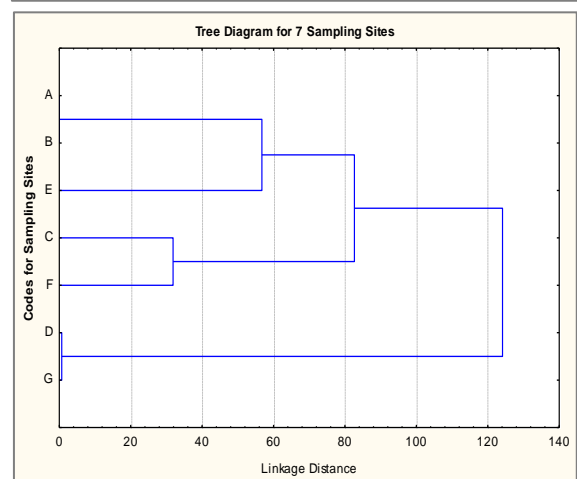
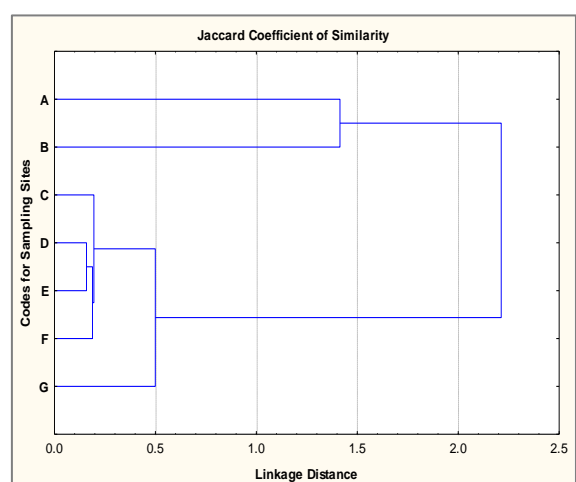
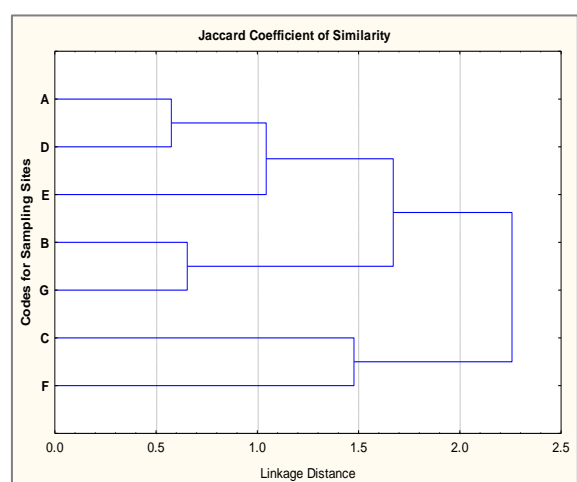
6th Monitoring, August, 2015



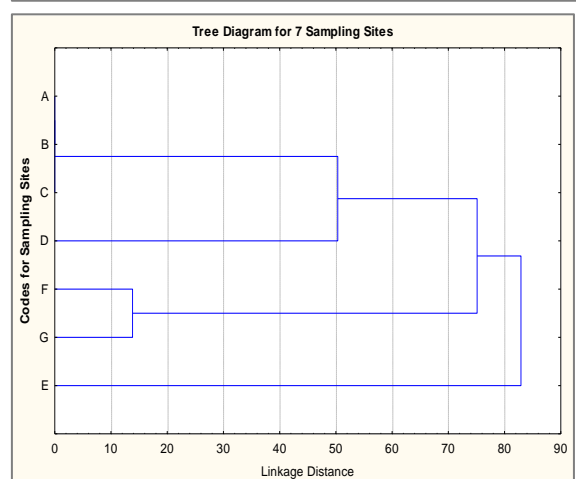
7th Monitoring, October, 2015



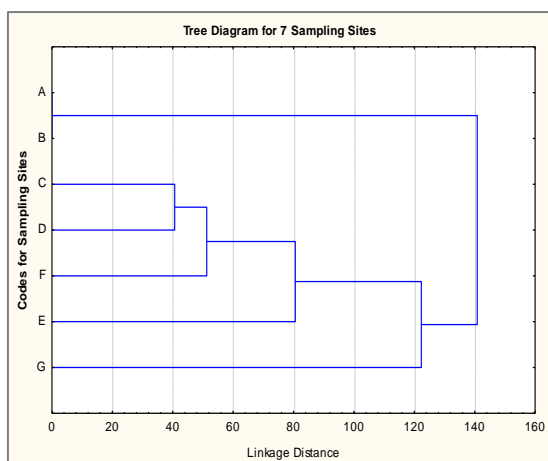
8th Monitoring, January, 2016



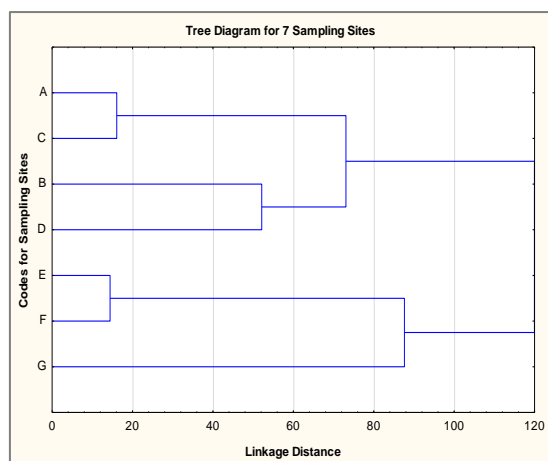
9th Monitoring, April, 2016



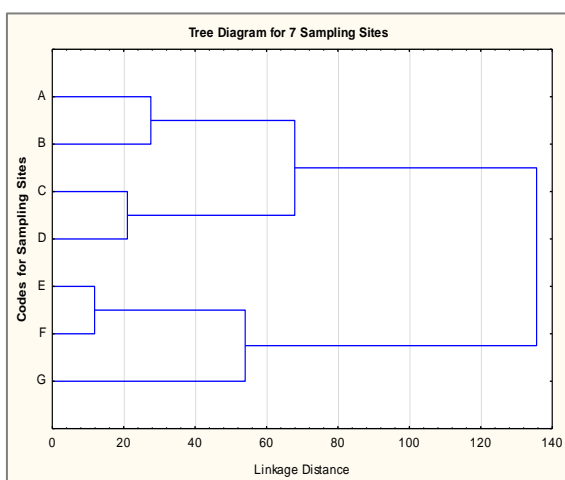
10th Monitoring, July, 2016



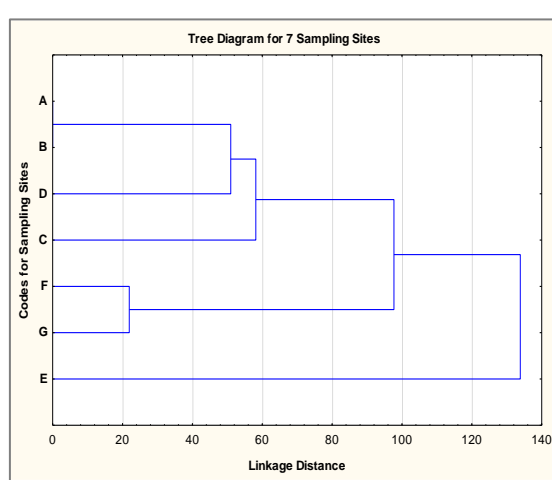
11th Monitoring, October, 2016



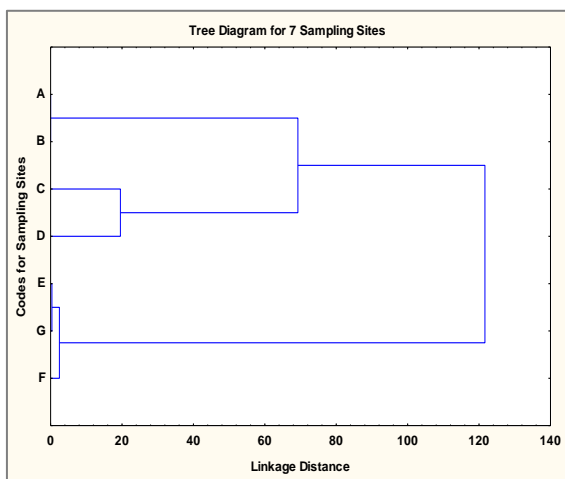
12th Monitoring, January, 2017



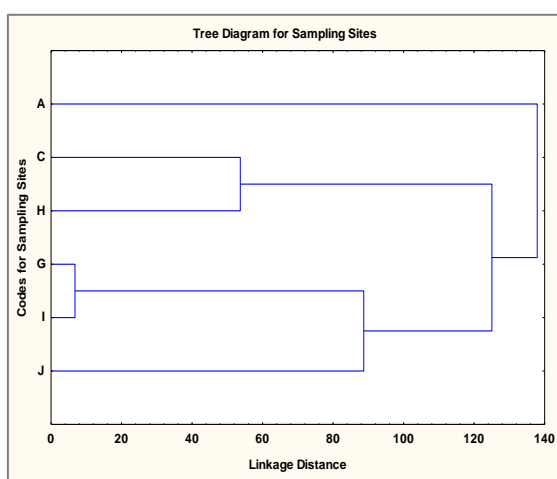
13th Monitoring, April, 2017



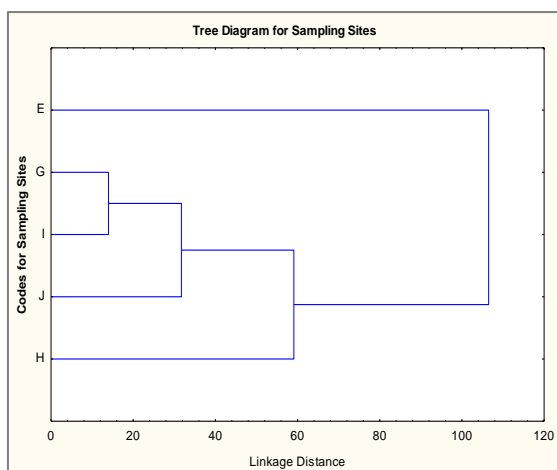
14th Monitoring, October, 2017



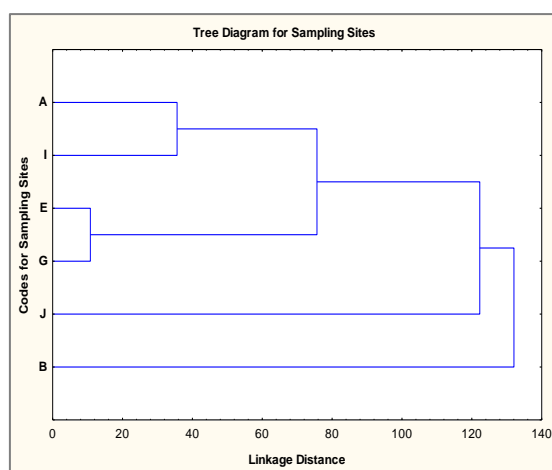
15th Monitoring, January, 2018



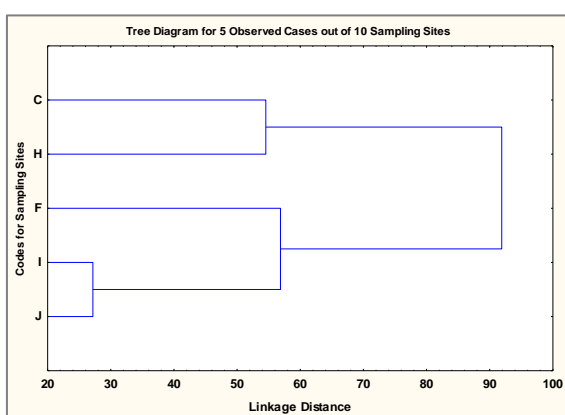
16th Monitoring, April, 2018



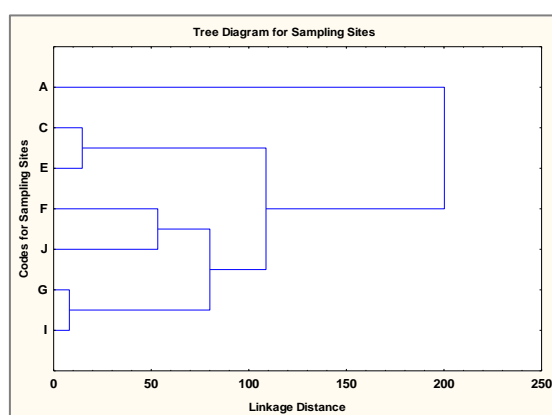
17th Monitoring, July, 2018



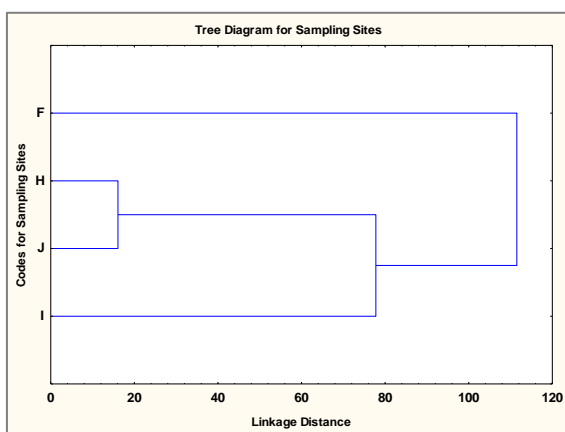
18th Monitoring, November, 2018



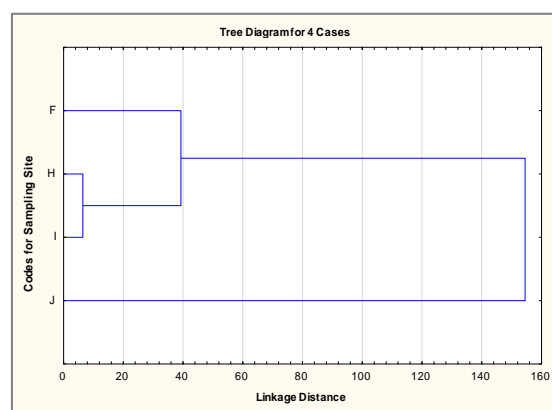
19th Monitoring, February, 2019



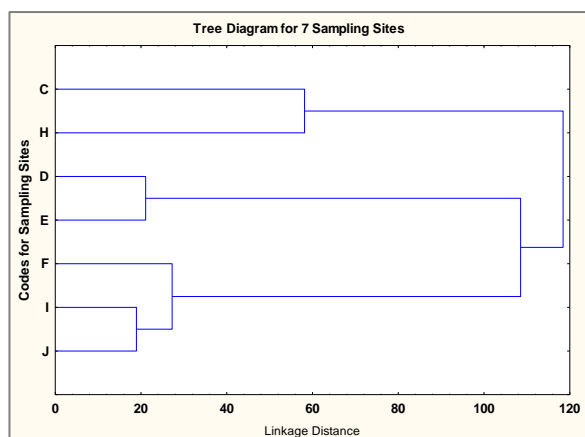
20th Monitoring, April, 2019



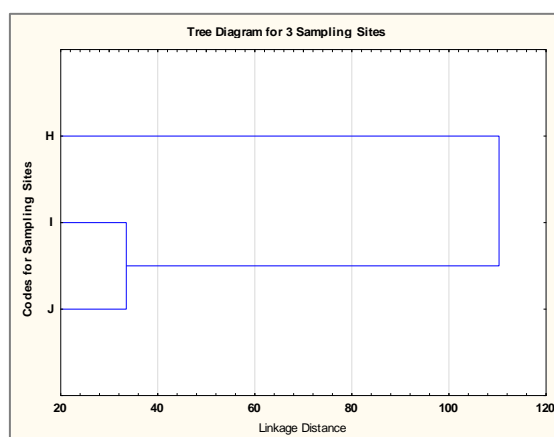
21st Monitoring, July 2019



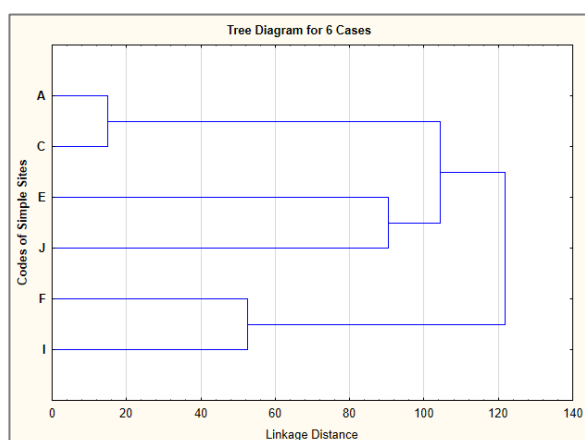
22nd Monitoring, November, 2019



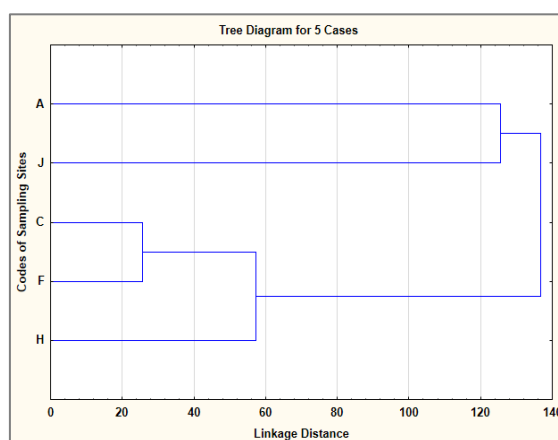
23rd Monitoring, February 2020



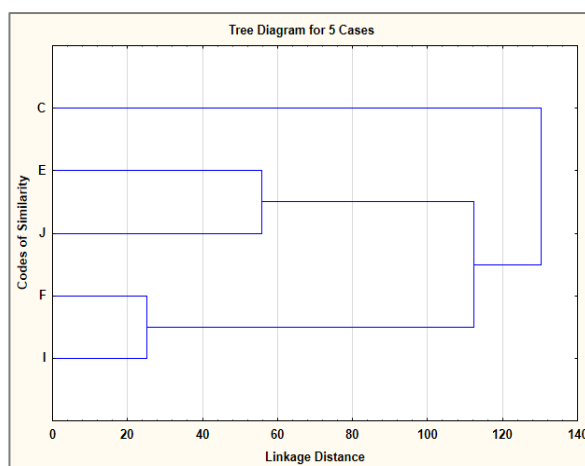
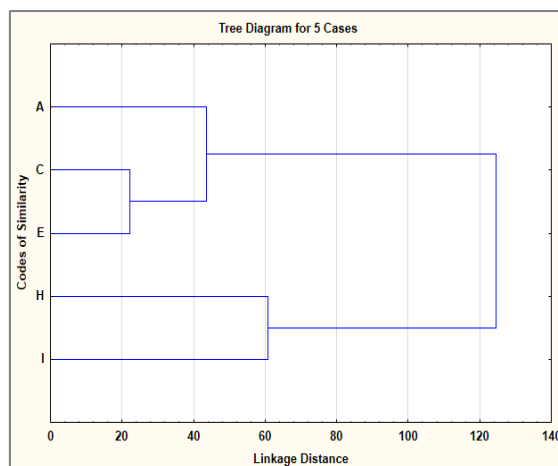
25th Monitoring, July 2020



26th Monitoring, November 2020

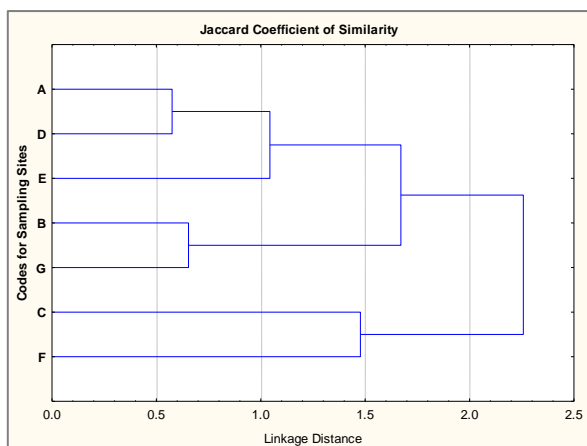
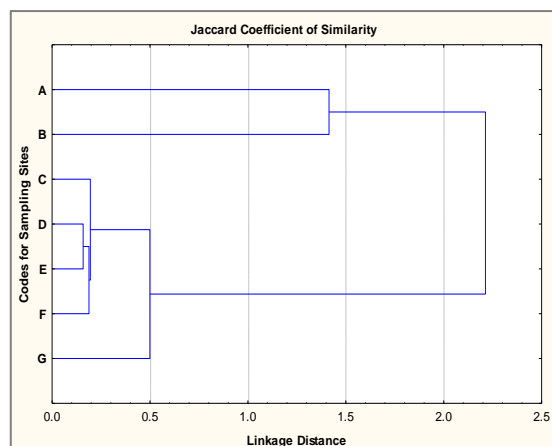
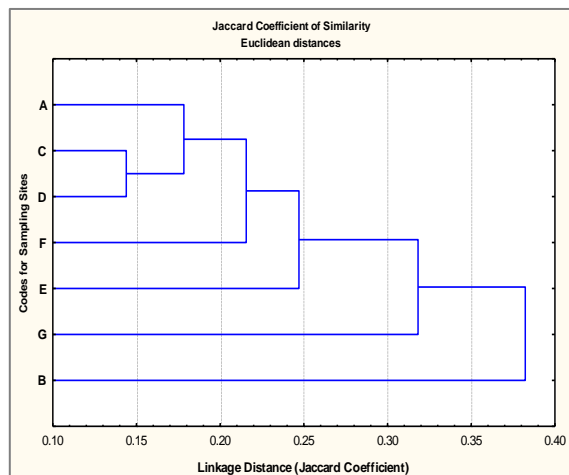
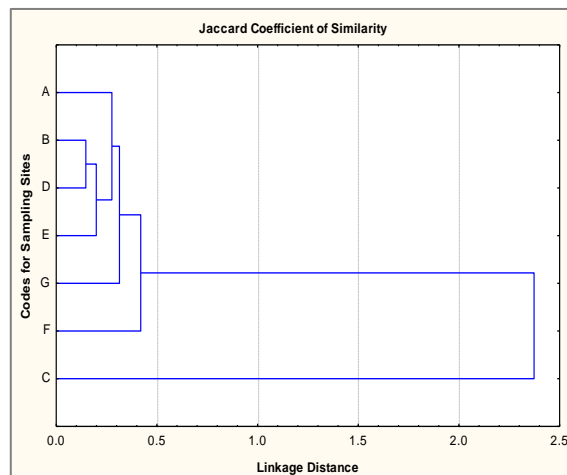
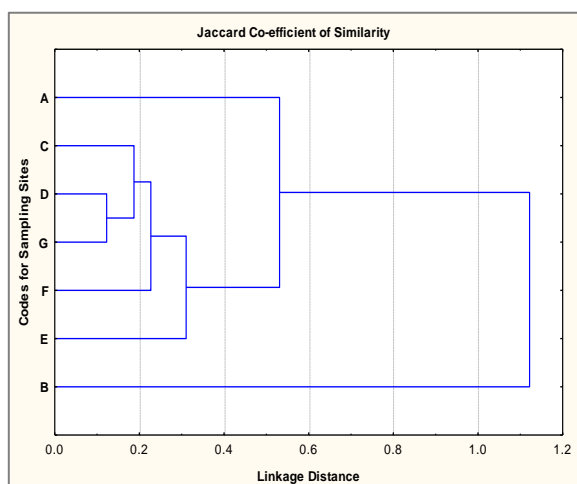
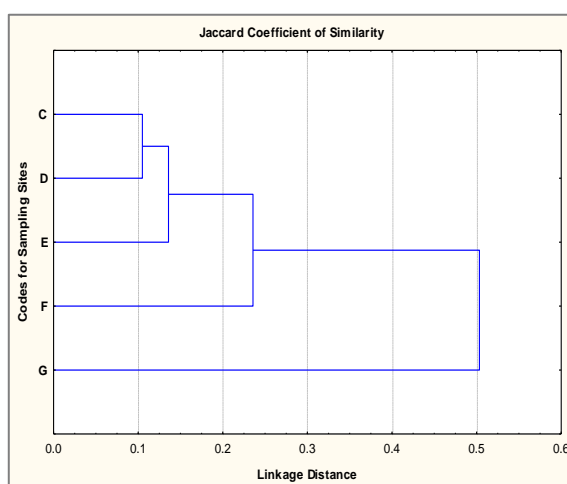


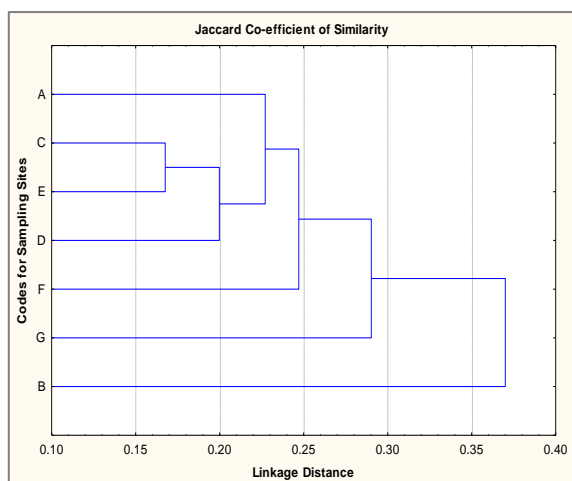
27th Monitoring, January 2021

28<sup>th</sup> monitoring, April 202129<sup>th</sup> Monitoring, August 2021

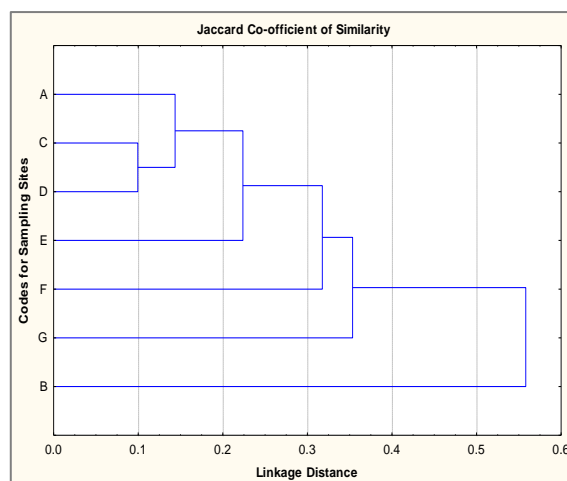


## D2: Jaccard Co-efficient of Similarity of Habitats respecting fish species occurrence

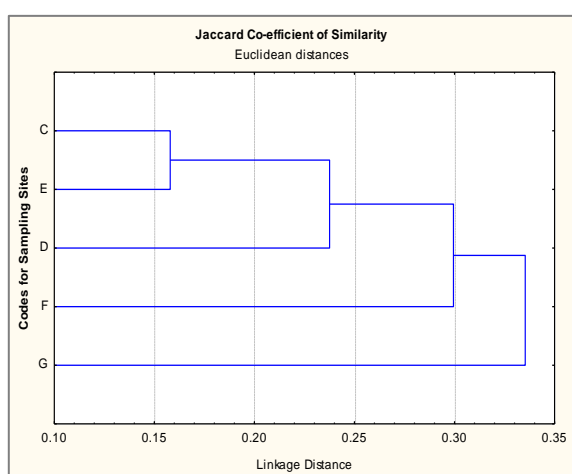
1<sup>st</sup> Monitoring, April, 20142<sup>nd</sup> Monitoring, July 20143<sup>rd</sup> Monitoring, October, 20144<sup>th</sup> Monitoring, January 20155<sup>th</sup> Monitoring, April, 20156<sup>th</sup> Monitoring, August, 2015



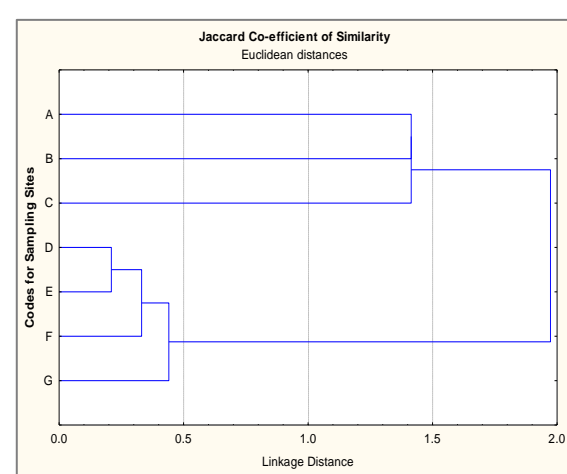
7th Monitoring, October, 2015



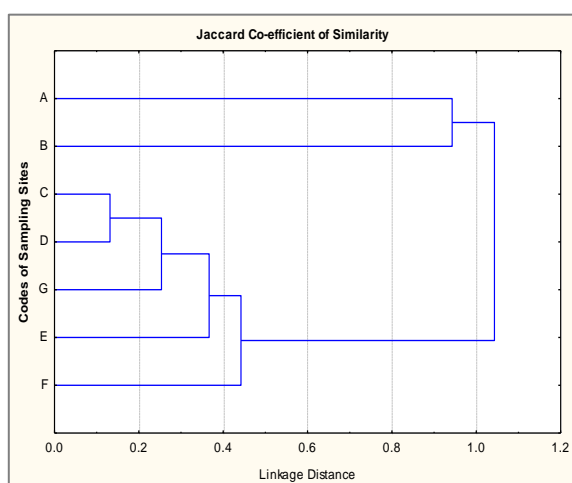
8th Monitoring, January, 2016



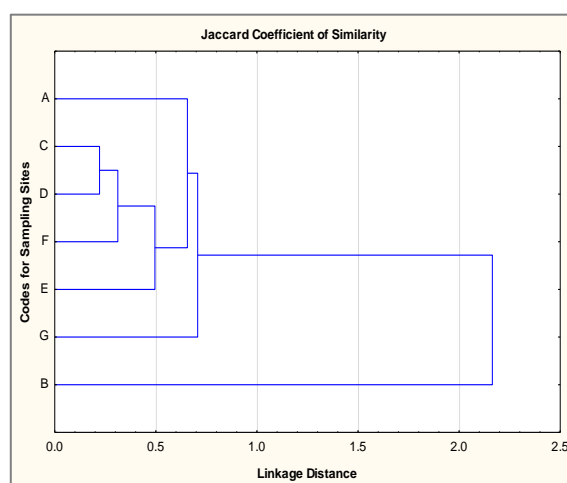
9th Monitoring, April, 2016



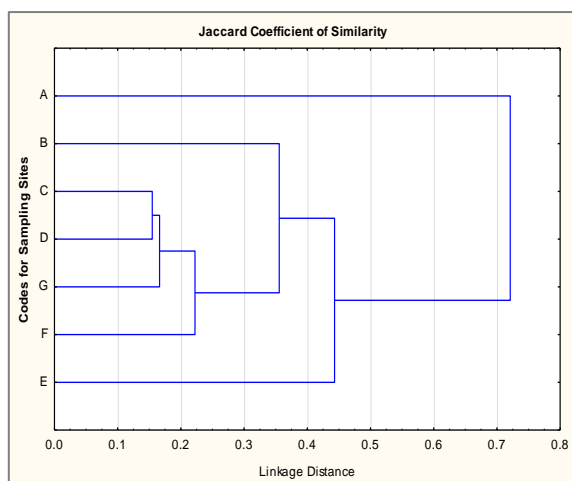
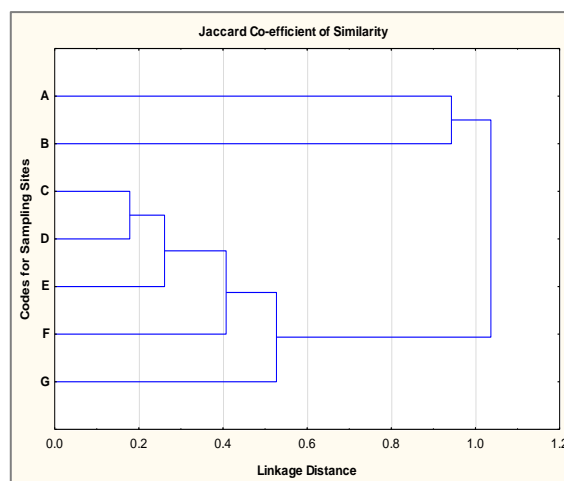
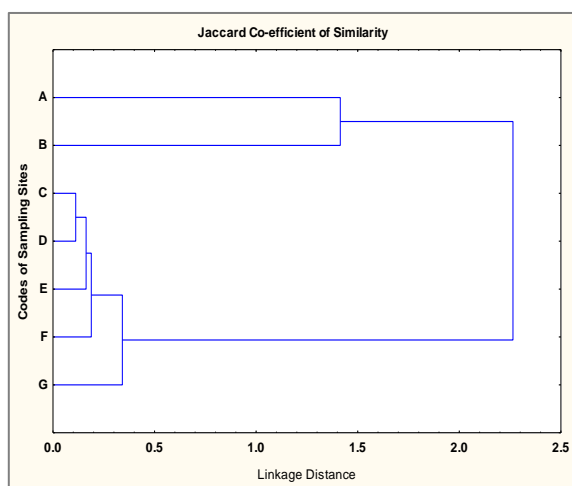
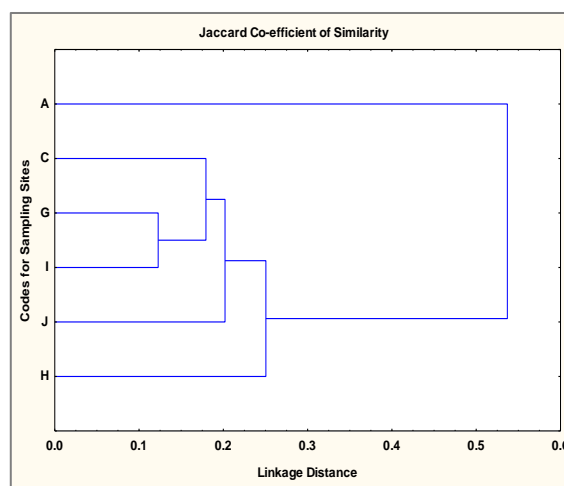
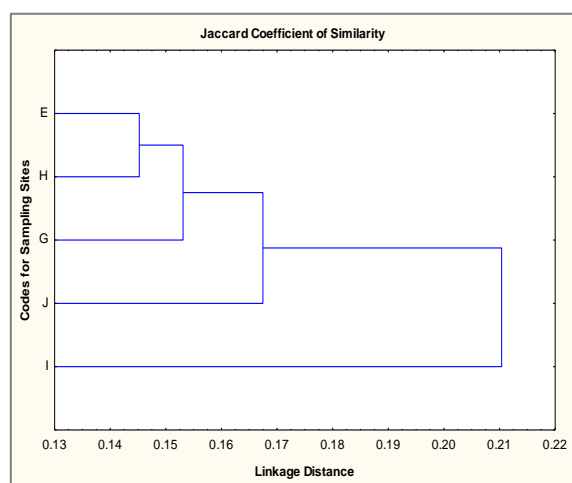
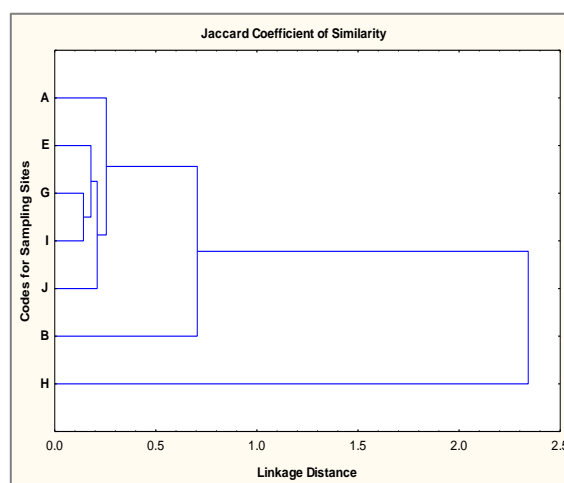
10th Monitoring, July, 2016

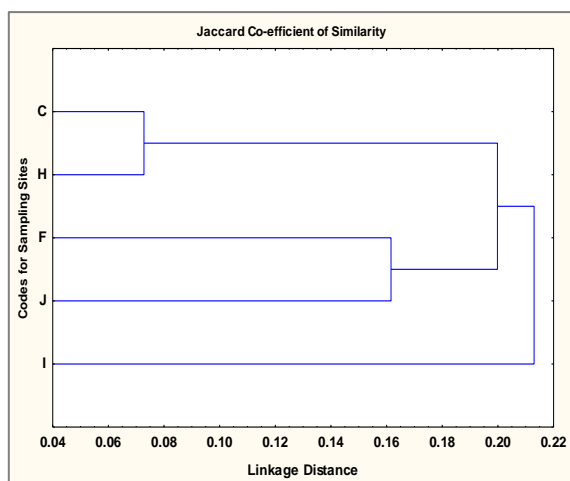
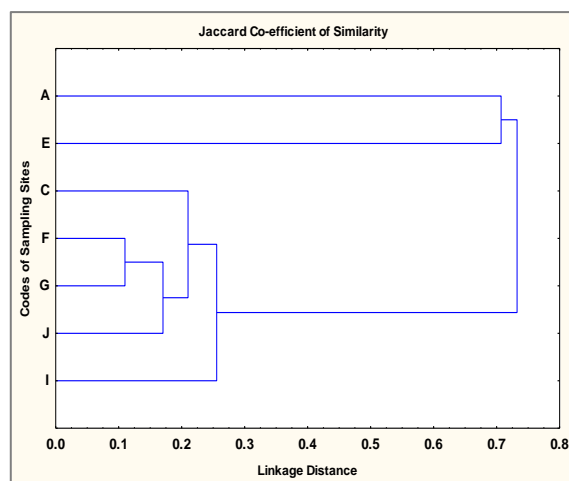
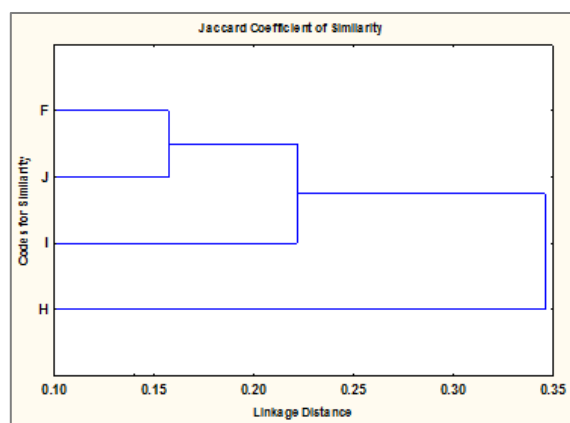
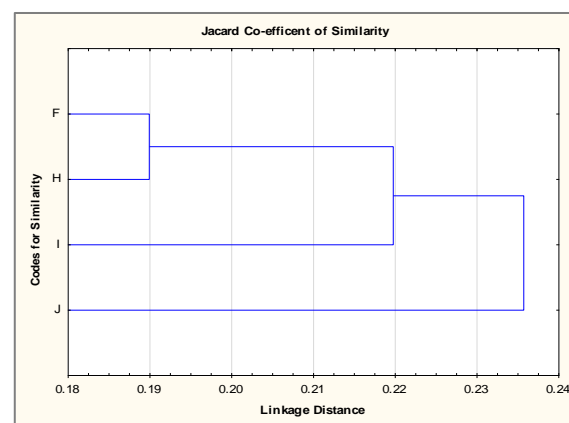
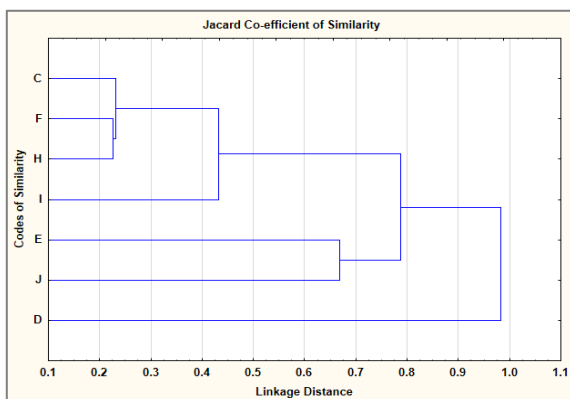
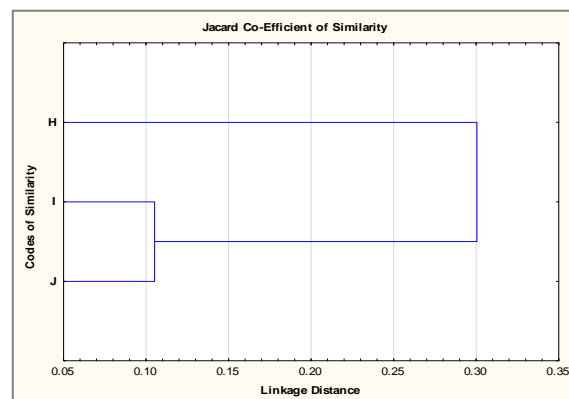


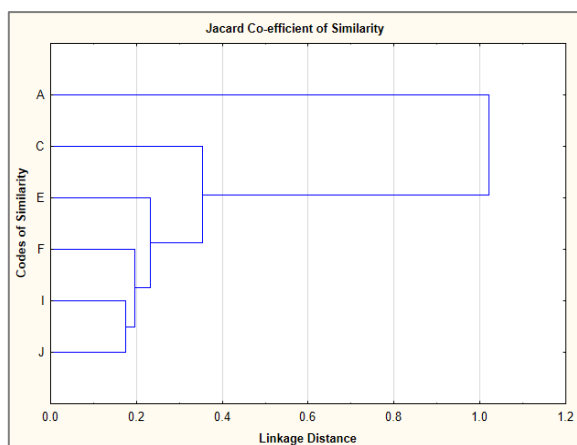
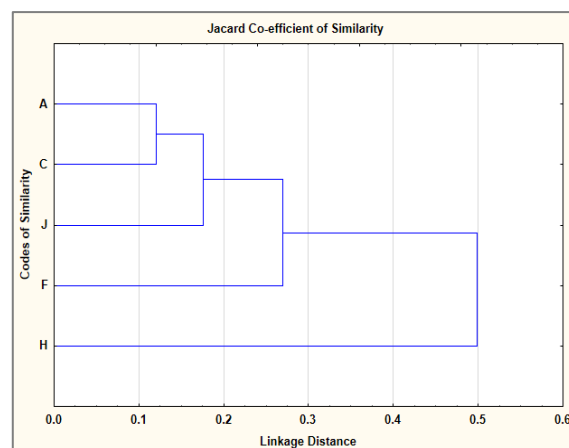
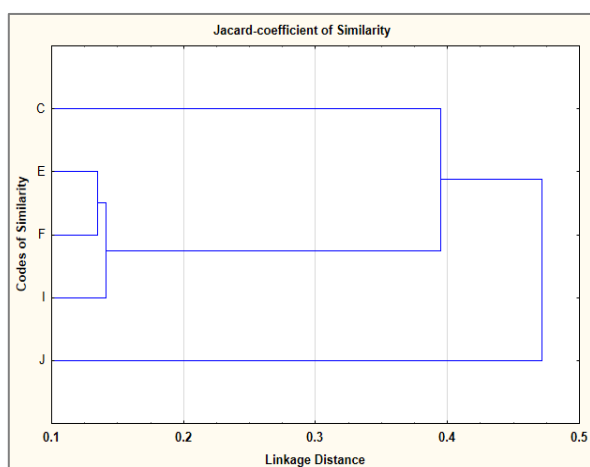
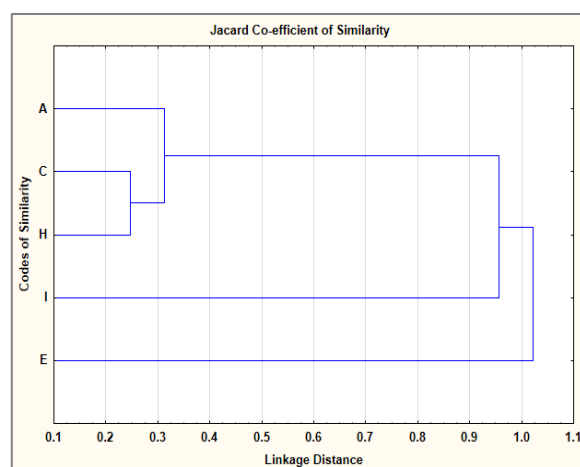
11th Monitoring, October, 2016



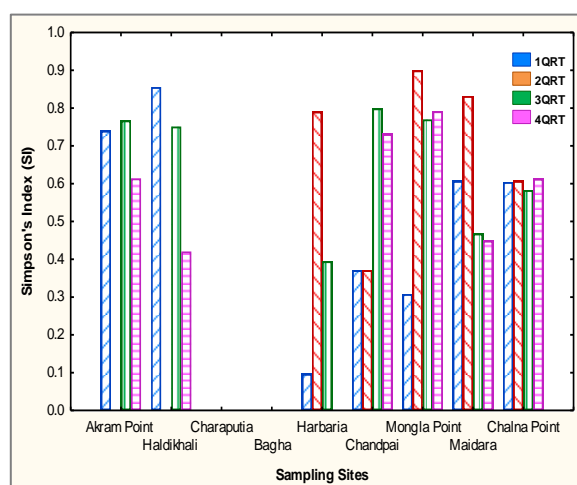
12th Monitoring, January, 2017

13<sup>th</sup> Monitoring, April, 201714<sup>th</sup> Monitoring, October, 201715<sup>th</sup> Monitoring, January, 201816<sup>th</sup> Monitoring, April, 201817<sup>th</sup> Monitoring, July, 201818<sup>th</sup> Monitoring, November, 2018

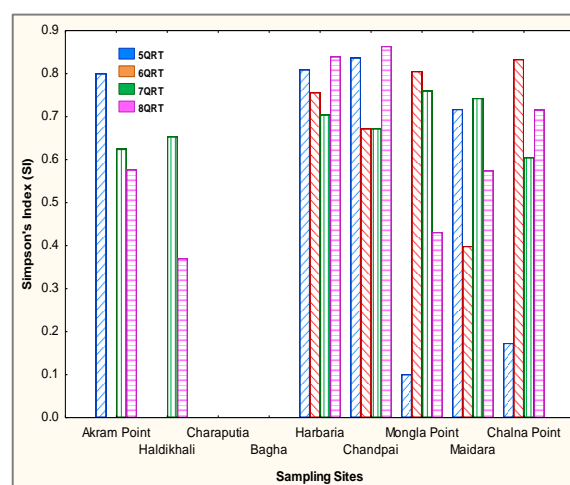
19<sup>th</sup> Monitoring, February, 201920<sup>th</sup> Monitoring, April, 201921<sup>st</sup> Monitoring, July 201922<sup>nd</sup> Monitoring, November 201923<sup>rd</sup> Monitoring, February 202025<sup>th</sup> Monitoring, July 2020

26<sup>th</sup> Monitoring, November, 202027<sup>th</sup> Monitoring, January, 202128<sup>th</sup> monitoring, April, 202129<sup>th</sup> monitoring, August, 2021

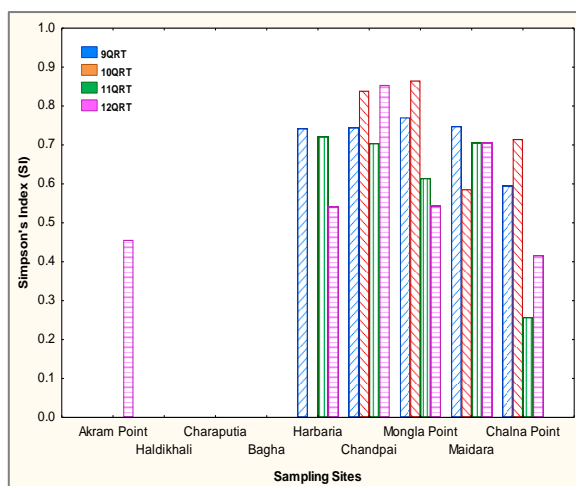
### D.3: Site-wise fish species richness (FSR) in the Passur River System



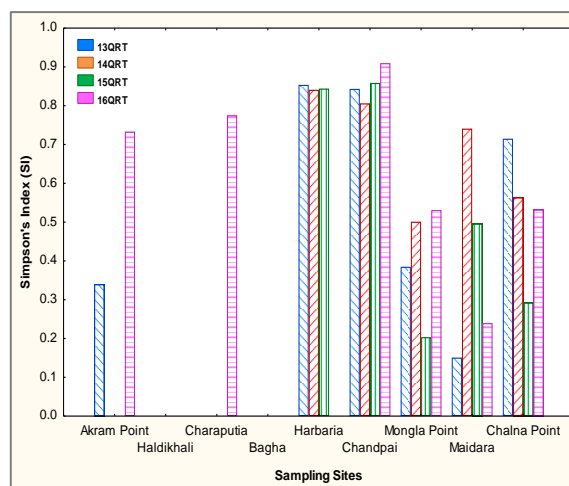
2014-2015



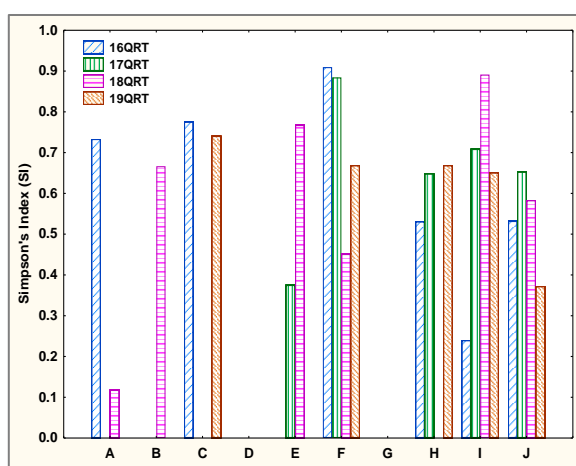
2015-2016



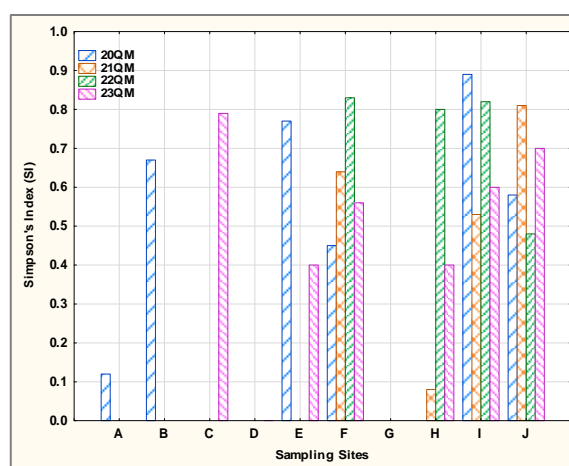
2016-2017



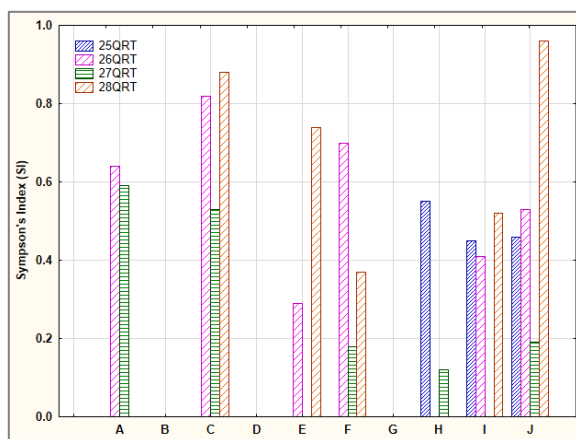
2017-18



2018-19

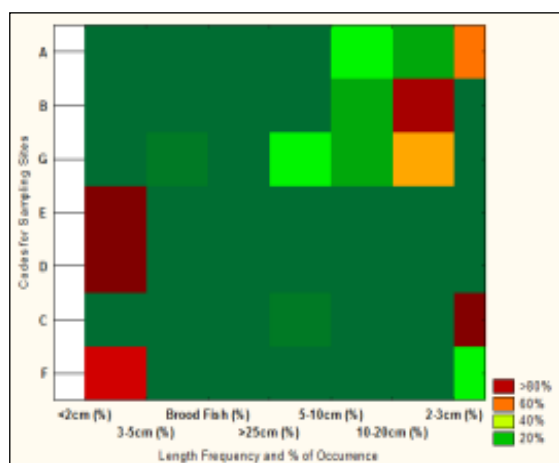


2019-20

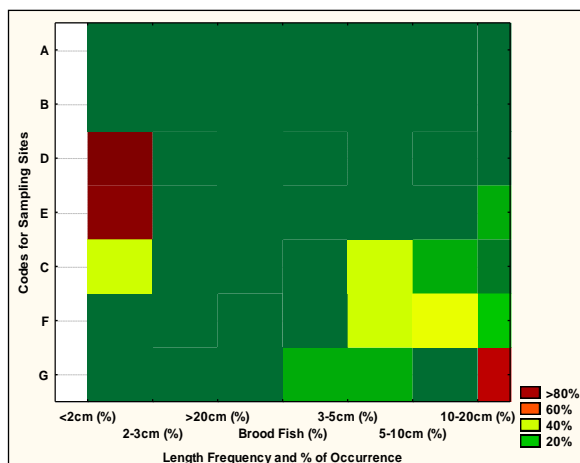


2020-21

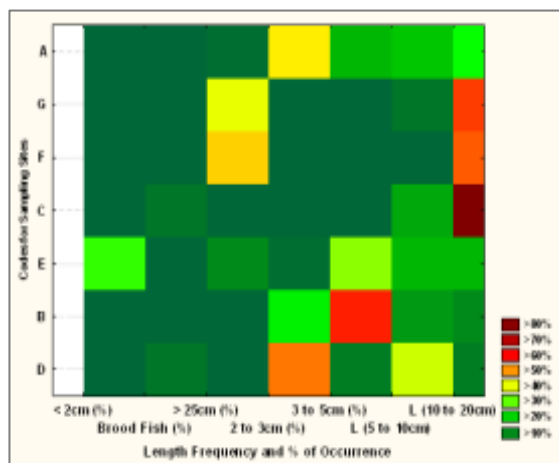
## D4: Fish Community Structure



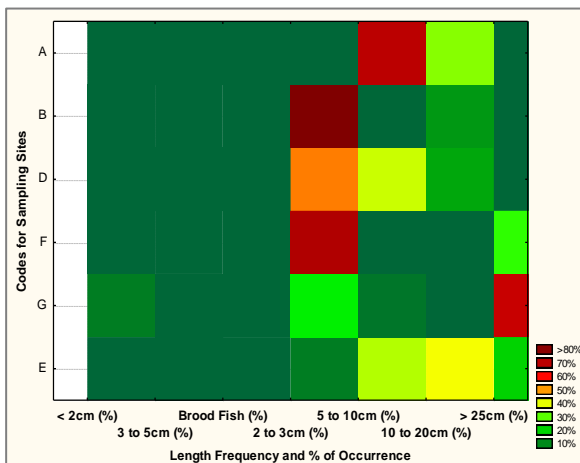
1st Monitoring, April, 2014



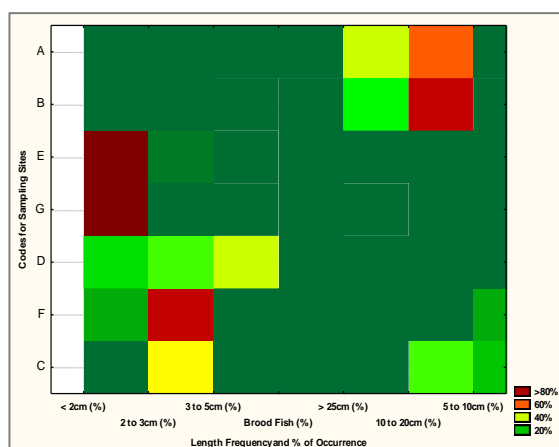
2nd Monitoring, July 2014



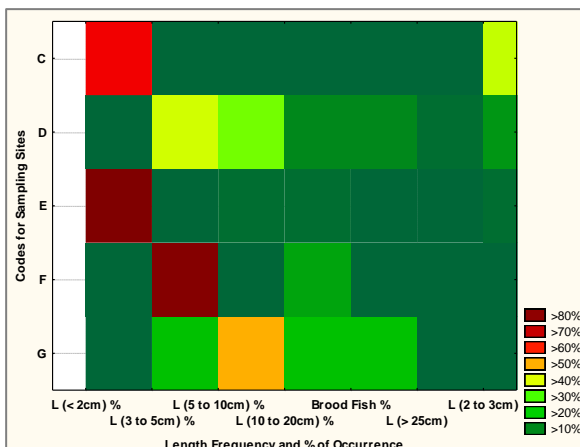
3rd Monitoring, October, 2014



4th Monitoring, January 2015

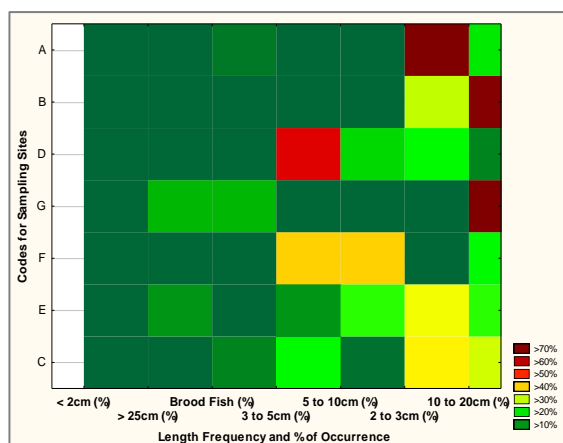


5th Monitoring, April, 2015

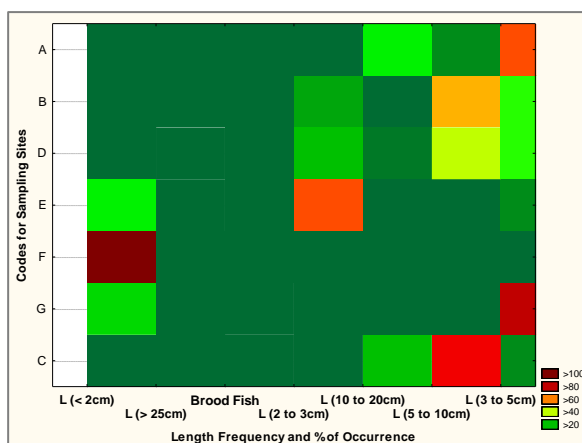


6th Monitoring, August, 2015

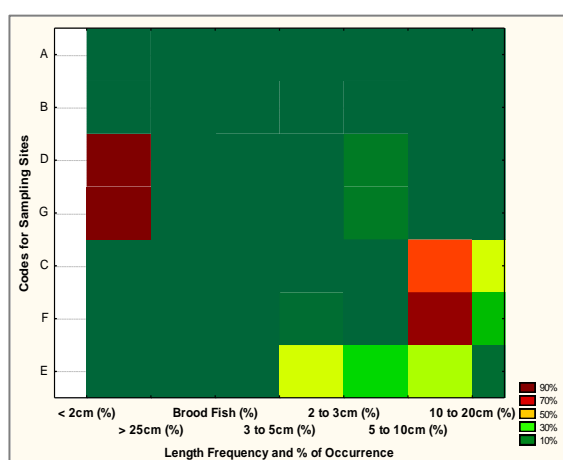




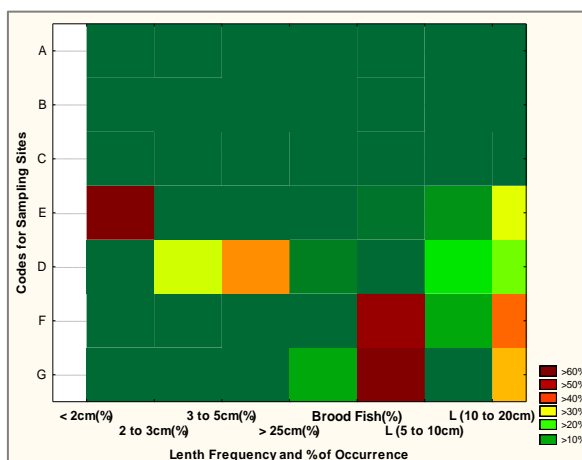
7th Monitoring, October, 2015



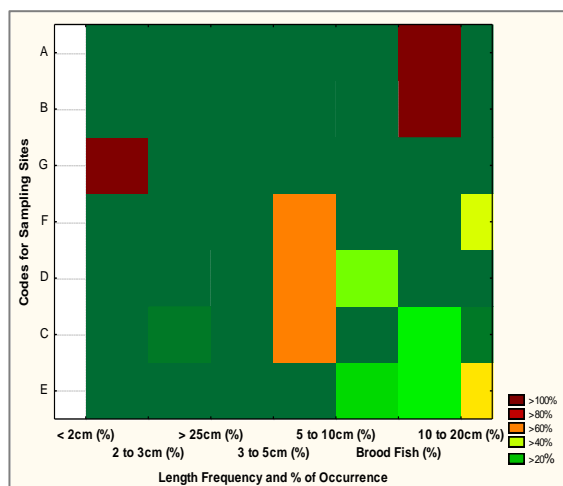
8th Monitoring, January, 2016



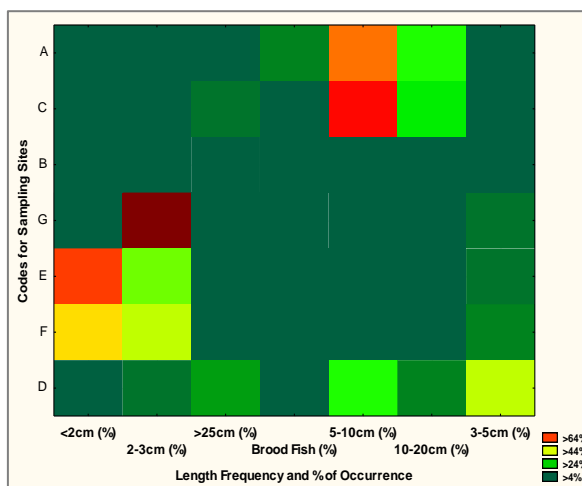
9th Monitoring, April, 2016



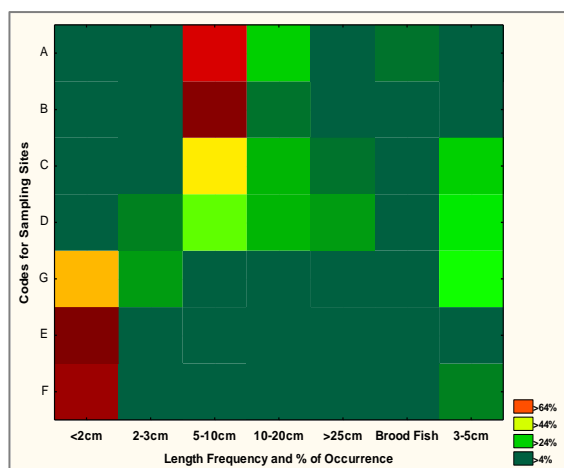
10th Monitoring, July, 2016



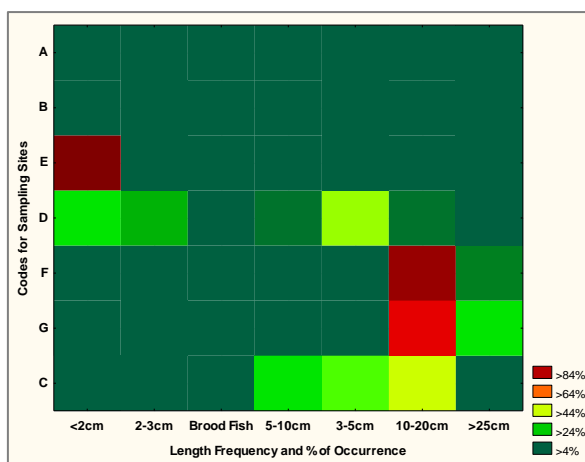
11th Monitoring, October, 2016



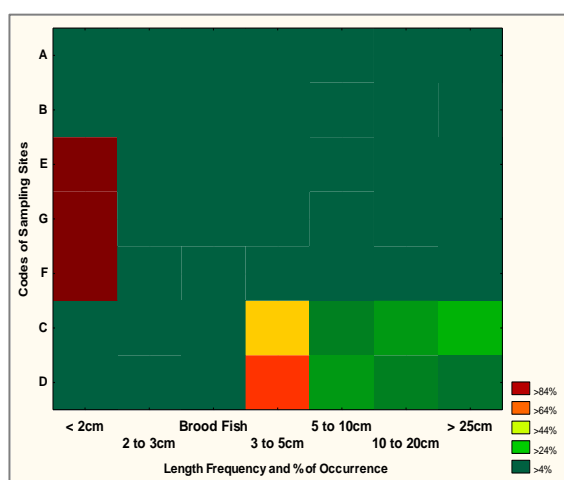
12th Monitoring, January, 2017



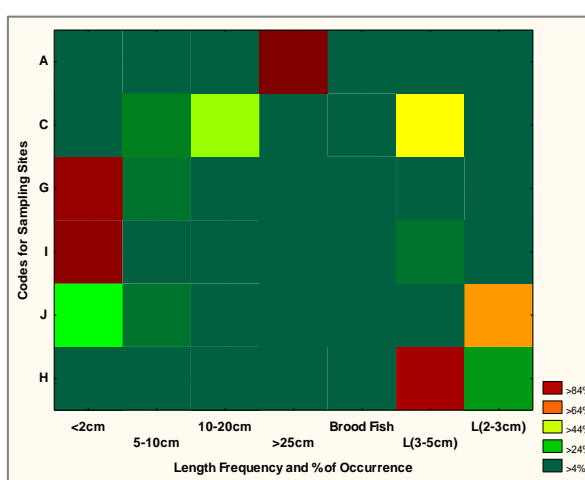
13th Monitoring, April, 2017



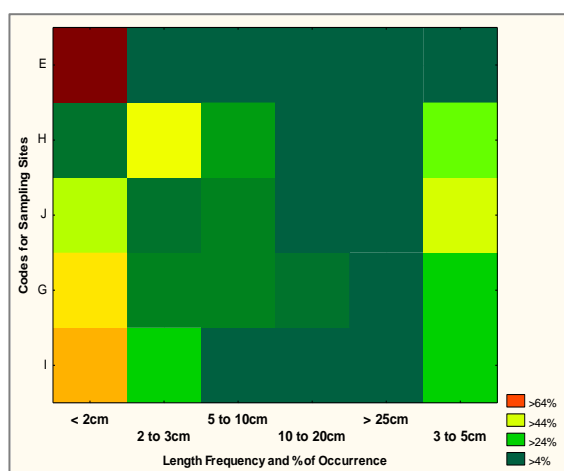
14th Monitoring, October, 2017



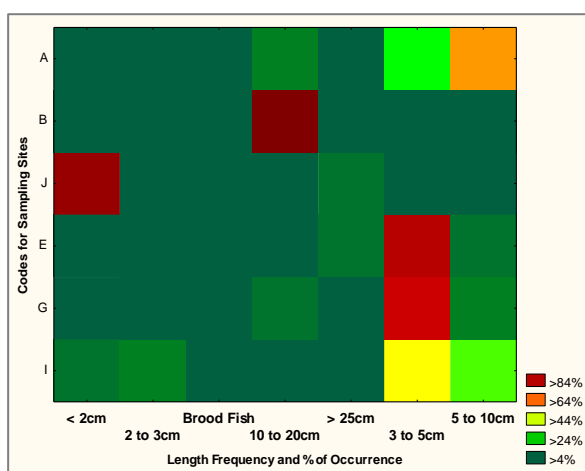
15th Monitoring, January, 2018



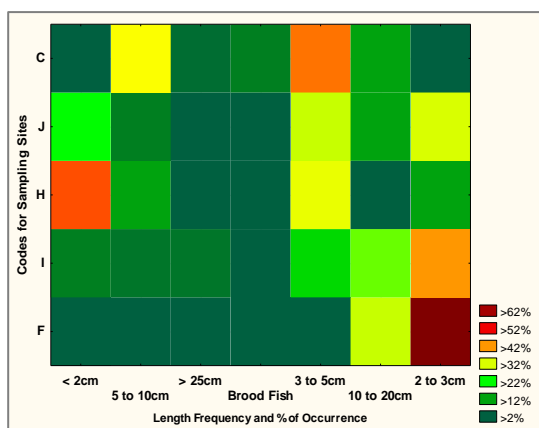
16th Monitoring, April, 2018



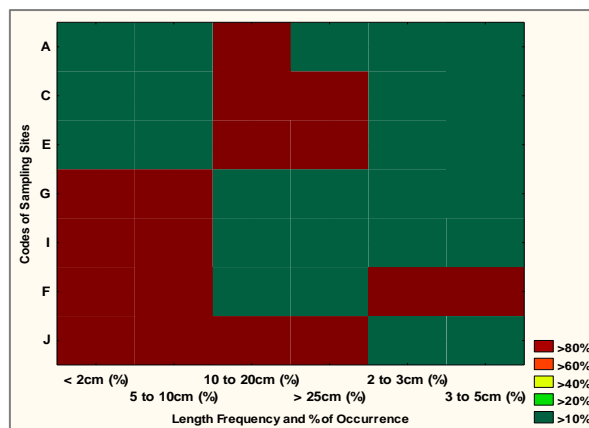
17th Monitoring, July, 2018



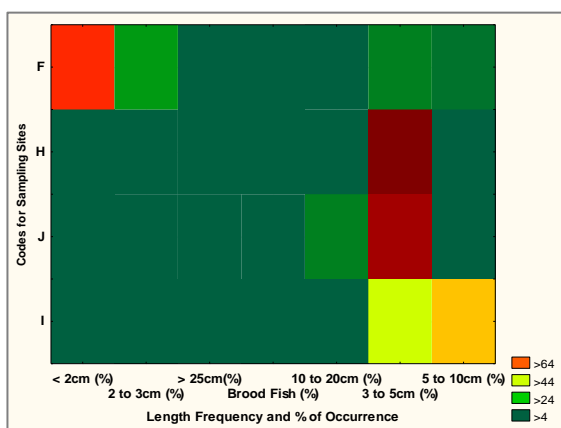
18th Monitoring, November, 2018



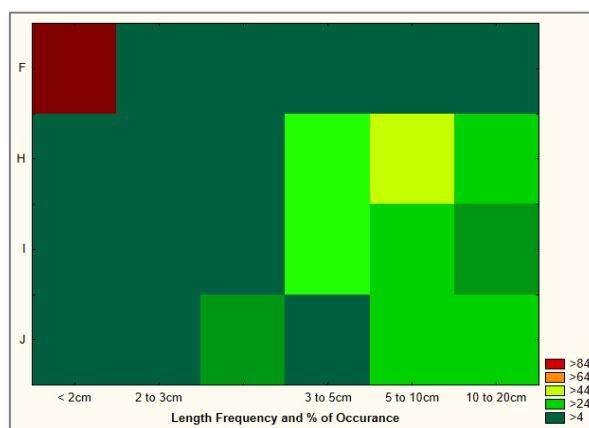
19th Monitoring, February, 2019



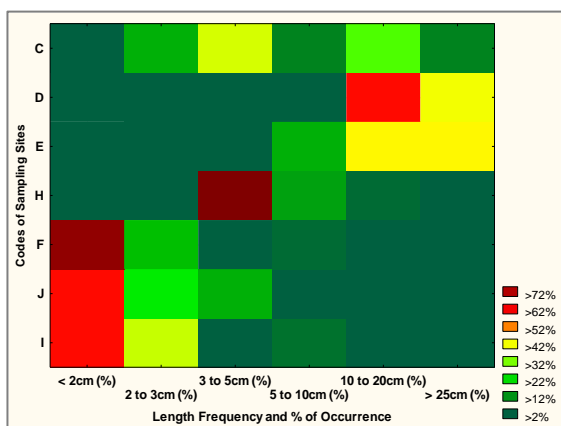
20th Monitoring, April, 2019



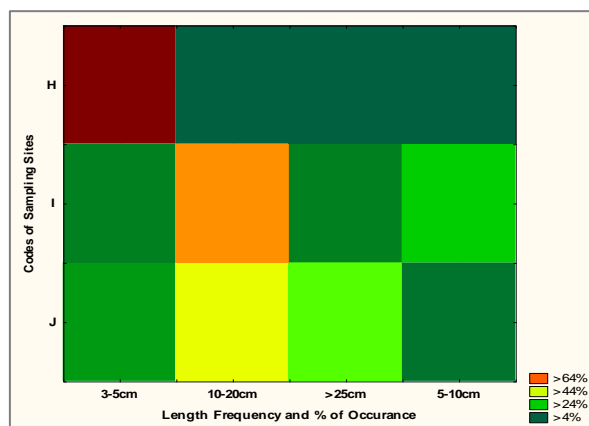
21st Monitoring, July, 2019



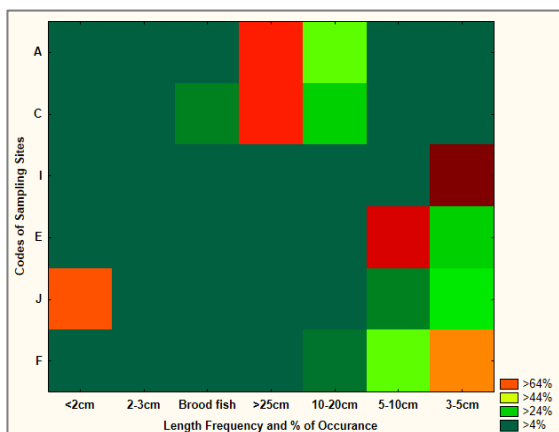
22nd Monitoring, November, 2019



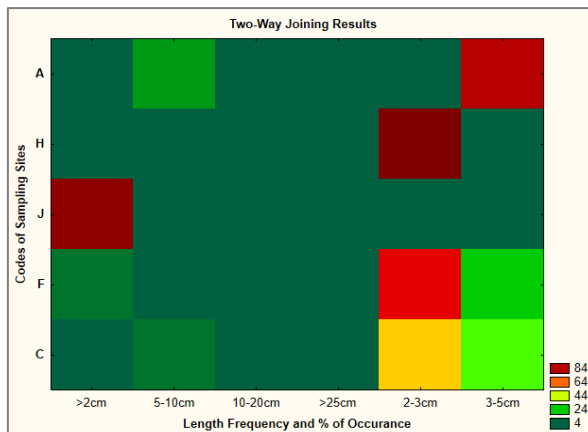
23rd Monitoring, February, 2020



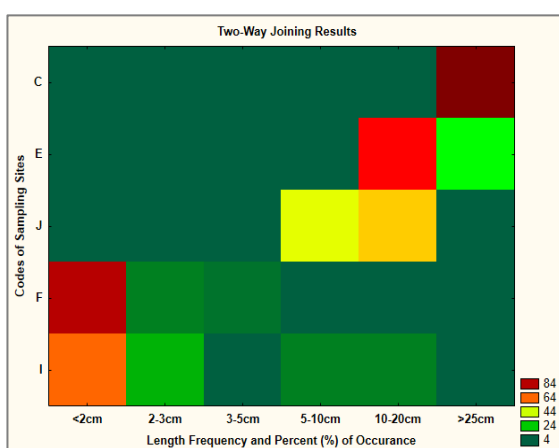
25th Monitoring, July, 2020



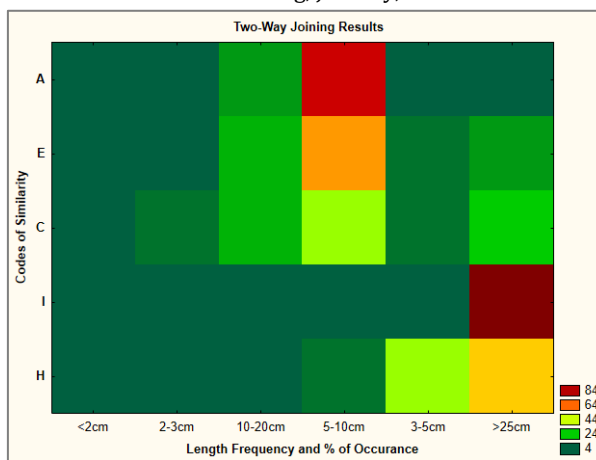
26th Monitoring, November 2021



27th Monitoring, January, 2021



28th monitoring, April, 2021



29th monitoring, August, 2021

## D.4: Occurrence of Species

Local Name	Scientific Name	Local Status*	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
			‘-’ = No; ‘+’ = Occurrence											
Hilsa	<i>Tenualosa ilisha</i>	NO	-	-	+	-	-	+	+	-	-	-	+	-
Sagor Baim	<i>Anguilla bengalensis</i>	NT	+	-	-	-	-	+	-	-	-	-	-	-
Bacha	<i>Eutropiichthys vacha</i>	CR	+	-	-	-	-	-	-	-	-	+	-	-
Bagda Chingri	<i>Penaeus monodon</i>	DD	+	+	+	+	+	+	+	+	+	+	-	+
Banspata	<i>Brachypleura novae-zeelandiae</i>	NO	+	+	+	+	-	+	+	+	+	-	+	+
Kukurjib	<i>Cynoglossus lingua</i>	NO	+	-	-	-	-	-	-	+	+	+	-	+
Bele	<i>Glossogobius giuris</i>	NO	+	+	+	+	+	+	+	+	+	-	+	+
Aswine Bele	<i>Butis butis</i>	NO	-	-	-	-	-	-	+	+	+	+	+	+
Bairagi	<i>Coilia dussumieri</i>	NO	+	+	+	+	+	+	-	+	-	-	-	+
Boishakhi Chingri	<i>Macrobrachium</i> sp.	NO	-	+	-	-	+	+	+	+	+	-	-	-
Chammu Chingri	<i>Metapenaeus brevicornis</i>	DD	+	+	+	-	+	+	+	+	+	+	+	-
Chaka Chingri	<i>Penaeus indicus</i>	DD	+	+	-	+	+	+	+	+	+	-	+	-
Ghora Chela	<i>Securicula gora</i>	-	+	-	-	-	-	-	-	-	-	-	-	-
Chanda Chela	<i>Securicula</i> sp.		-	+	+	-	-	-	-	-	+	+	-	-
Sada Chewa	<i>Trepauchen vagina</i>	NO	+	-	+	-	-	+	-	-	-	+	-	-
Lal Chewa	<i>Taenioides cirratus</i>	NO	+	+	+	+	+	+	+	+	+	-	-	-
Chhuri	<i>Trichiurus muticus</i>	NO	+	-	+	-	-	-	-	-	-	-	-	-
Sagor Chela	<i>Megalops cyprinoids</i>	NO	+	-	-	-	-	-	-	-	-	-	-	-
Purabi Chela	<i>Thyrssa purava</i>	NO	+	-	-	-	-	-	-	-	-	-	-	-
Kabashi Tengra	<i>Mystus cavasius</i>	DD	+	-	-	-	-	-	-	-	-	-	-	-
Gagra Tengra	<i>Nemapteryx nenga</i>	DD	-	+	+	-	+	-	+	-	+	+	+	+
Gulsha Tengra	<i>Mystus bleekery</i>	DD	+	+	-	+	-	+	+	+	+	+	+	+
Harina Chingri	<i>Metapenaeus ensis</i>	DD	+	+	+	+	+	+	+	+	+	-	+	-
Ekthuto	<i>Hyporhamphus limbatus</i>	NO	+	-	+	+	-	-	-	+	+	-	+	-
Kakila	<i>Xenentodon cancila</i>	NO	+	-	-	-	-	-	-	-	-	-	+	-
Chapila	<i>Gudusia chapra</i>	NO	+	+	-	-	-	-	-	-	-	+	-	-
Kuchia	<i>Monopterusuchia</i>	DD	+	+	-	+	+	+	+	+	+	+	+	+
Loitta	<i>Harpodon nehereus</i>	NO	+	+	+	-	+	-	-	-	+	+	-	-
Motka Chingri	<i>Macrobrachium villosimanusless</i>	DD	+	+	+	+	+	+	+	+	+	+	+	-
Mud Crab	<i>Scylla serrata</i>	NO	+	-	+	+	+	+	+	+	+	-	+	+
Tular Dandi	<i>Sillaginopsis panijus</i>	NO	+	-	+	-	+	-	+	-	-	-	+	-
Paira Chanda	<i>Scatophagus argus</i>	DD	+	-	-	-	-	-	-	-	-	+	-	-
Paissa	<i>Liza parsia</i>	NO	+	+	+	+	+	+	+	+	+	+	+	+
Pangas	<i>Pangasius pangasius</i>	CR	+	-	+	-	-	-	-	+	-	-	-	+
Tak Chanda	<i>Leiognathus equulus</i>	NO	+	-	-	-	-	-	+	-	-	+	-	-

Local Name	Scientific Name	Local Status*	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
			'-' = No; '+' = Occurrence											
Phessa	<i>Setipinna phasa</i>	NO	+	+	+	+	+	+	+	+	+	-	+	-
Teli Phessa	<i>Setipinna phasa</i>	DD	-	-	+	-	-	-	-	-	-	+	-	-
Poma	<i>Poma poma</i>	NO	+	+	+	+	+	+	+	+	+	+	+	+
Potka	<i>Chelonodon patoca</i>	NO	+	+	-	+	+	+	-	+	+	-	+	+
Shilong	<i>Silonia silondia</i>	EN	+	-	+	-	-	-	-	-	-	-	+	-
Tailla	<i>Eleutheronema tetradactylum</i>	DD	+	-	-	-	-	-	-	-	-	+	-	-
Tapse	<i>Polynemus paradiseus</i>	DD	+	+	+	-	-	+	+	+	-	-	+	+
Daitna	<i>Acanthopagrus latus</i>	DD	-	-	-	+	-	-	-	+	+	-	+	+
Shole	<i>Channa striatus</i>	DD	-	-	-	+	-	-	-	+	-	-	-	-
Magur	<i>Clarias batrachus</i>	DD	-	-	-	+	-	-	-	+	-	-	-	+
Koi	<i>Anabas testudineus</i>	DD	-	-	-	+	-	-	-	+	-	+	-	-
Vetki	<i>Lates calcarifer</i>	DD	-	-	-	+	+	+	+	+	+	-	+	+

Local Name	Scientific Name	Local Status*	13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
			'-' = No; '+' = Occurrence																
Hilsa	<i>Tenualosa ilisha</i>	NO	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	+	
Sagor Baim	<i>Anguilla bengalensis</i>	NT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bacha	<i>Eutropiichthys vacha</i>	CR	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	
Bagda Chingri	<i>Penaeus monodon</i>	DD	+	-	+	+	+	+	+	+	+	+	+	-	-	+	+	+	
Banspata	<i>Brachypleura novae-zeelandiae</i>	NO	+	+	+	+	+	+	+	+	+	-	-	+	+	+	-	+	
Kukurjib	<i>Cynoglossus lingua</i>	NO	-	-	+	-	-	-	+	-	+	+	-	+	-	+	-	+	
Bele	<i>Glossogobius giuris</i>	NO	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Aswine Bele	<i>Butis butis</i>	NO	+	+	+	+	+	-	+	+	-	-	-	-	-	-	-	-	
Bairagi	<i>Coilia dussumieri</i>	NO	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	
Boishakhi Chingri	<i>Macrobrachium sp.</i>	NO	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	
Chammu Chingri	<i>Metapenaeus brevicornis</i>	DD	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-	
Chaka Chingri	<i>Penaeus indicus</i>	DD	+	-	+	+	+	+	+	+	+	+	+	-	+	+	+	-	
Ghora Chela	<i>Securicula gora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chanda Chela	<i>Securicula sp.</i>	-	-	-	+	+	+	+	-	-	-	+	+	-	-	-	-	-	
Sada Chewa	<i>Trepachen vagina</i>	NO	-	-	-	+	-	-	-	+	-	+	-	-	-	-	-	+	
Lal Chewa	<i>Taenioides cirratus</i>	NO	+	+	-	+	+	-	+	+	-	-	+	-	-	-	+	+	
Chhuri	<i>Trichiurus muticus</i>	NO	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	
Sagor Chela	<i>Megalops cyprinoids</i>	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Purabi Chela	<i>Thryssa purava</i>	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Kabashi Tengra	<i>Mystus cavasius</i>	DD	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+
Gagra Tengra	<i>Nemapteryx nenga</i>	DD	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	-

Local Name	Scientific Name	Local Status*	13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
'-' = No; '+' = Occurrence																			
Gulsha Tengra	<i>Mystus bleekery</i>	DD	+	+	+	+	+	-	+	+	+	-	+	-	-	+	-	-	-
Harina Chingri	<i>Metapenaeus ensis</i>	DD	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
Ekthuto	<i>Hyporhamphus limbatus</i>	NO	+	+	-	-	+	+	+	+	+	+	-	-	-	+	-	-	+
Kakila	<i>Xenentodon cancila</i>	NO	-	+	-	-	+	-	-	-	-	+	-	-	+	-	-	-	+
Chapila	<i>Gudusia chapra</i>	NO	-	-	-	-	+	+	+	-	+	+	-	+	+	+	+	-	+
Kuchia	<i>Monopterusuchia</i>	DD	+	+	+	+	+	+	-	+	+	-	+	+	-	+	+	+	-
Loitta	<i>Harpodon nehereus</i>	NO	+	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	+
Motka Chingri	<i>Macrobrachium villosimanusless</i>	DD	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	-
Mud Crab	<i>Scylla serrata</i>	NO	+	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	+
Tular Dandi	<i>Sillaginopsis panijus</i>	NO	-	+	-	-	-	+	+	+	+	-	-	-	+	-	+	-	+
Pairst Chanda	<i>Scatophagus argus</i>	DD	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-
Paissa	<i>Liza parsia</i>	NO	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	-
Pangas	<i>Pangasius pangasius</i>	CR	-	-	-	-	-	+	+	+	+	+	-	-	-	-	-	+	+
Tak Chanda	<i>Leiognathus equulus</i>	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pheksa	<i>Setipinna phasa</i>	NO	+	+	-	+	-	-	+	+	+	+	+	-	+	-	+	+	-
Teli Pheksa	<i>Setipinna phasa</i>	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Poma	<i>Poma poma</i>	NO	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
Potka	<i>Chelonodon patoca</i>	NO	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	+	-
Shilong	<i>Silonia silondia</i>	EN	+	+	-	-	-	-	-	-	-	+	-	+	-	-	-	+	+
Tailla	<i>Eleutheronema tetradactylum</i>	DD	-	-	-	-	-	+	-	+	+	-	-	-	+	+	-	+	+
Tapse	<i>Polynemus paradiseus</i>	DD	-	+	+	+	+	+	+	+	+	-	+	+	+	-	-	+	+
Daitna	<i>Acanthopagrus latus</i>	DD	-	+	+	+	-	+	+	+	-	-	+	-	+	+	-	-	-
Shole	<i>Channa striatus</i>	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	+	-	-	+
Magur	<i>Clarias batrachus</i>	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Koi	<i>Anabas testudineus</i>	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Vetki	<i>Lates calcarifer</i>	DD	+	+	+	+	-	+	+	-	+	-	-	-	+	-	-	+	-



D.5: Length-wise species distribution (%) in sampling sites

Fish Species	Sampling	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Amadi Chingri	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	E	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
Bagda	A	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	E	0.00	0.00	0.00	50.00	50.00	0.00	0.00
Baila	A	0.00	0.00	0.00	50.00	50.00	0.00	0.00
	C	0.00	0.00	25.00	25.00	50.00	0.00	0.00
	E	0.00	0.00	0.00	28.57	57.14	14.29	0.00
	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
	J	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Banspata	A	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	66.67	33.33	0.00
	E	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Bhola	A	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	C	0.00	0.00	0.00	25.00	75.00	0.00	0.00
	E	0.00	0.00	0.00	50.00	50.00	0.00	0.00
	J	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Bhut Bele	C	0.00	0.00	0.00	33.33	66.67	0.00	0.00
Boiragi	A	0.00	0.00	0.00	33.33	66.67	0.00	0.00
Chaka Chingri	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Chali Chingri	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Chamua Chigri	C	0.00	0.00	0.00	0.00	0.00	100.00	0.00
Chata Bele	C	0.00	0.00	0.00	25.00	50.00	25.00	0.00
	E	0.00	0.00	0.00	0.00	0.00	100.00	0.00
Chela	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
Chewa	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
Chhati Icha	A	0.00	0.00	0.00	0.00	50.00	50.00	0.00

Fish Species	Sampling	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Chitra	E	0.00	0.00	16.67	66.67	16.67	0.00	0.00
Datina	A	0.00	0.00	0.00	0.00	50.00	50.00	0.00
	B	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Gagra	B	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	66.67	33.33	0.00
	E	0.00	0.00	0.00	50.00	50.00	0.00	0.00
Gangania	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	E	0.00	0.00	0.00	50.00	50.00	0.00	0.00
Goda Chingri	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	E	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Golda	A	0.00	0.00	0.00	0.00	50.00	50.00	0.00
	B	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	66.67	33.33	0.00
	E	0.00	0.00	0.00	0.00	50.00	50.00	0.00
Gulsha	B	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	E	0.00	0.00	0.00	33.33	66.67	0.00	0.00
	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
Harina	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
	J	0.00	0.00	50.00	50.00	0.00	0.00	0.00
Ilish	H	0.00	0.00	0.00	0.00	0.00	100.00	0.00
	I	0.00	0.00	0.00	0.00	0.00	100.00	0.00
	J	0.00	0.00	0.00	0.00	0.00	100.00	0.00
Java	C	0.00	0.00	0.00	50.00	0.00	50.00	0.00
Kaikka	A	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Kain	A	0.00	0.00	0.00	0.00	0.00	100.00	0.00

Fish Species	Sampling	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
	C	0.00	0.00	0.00	0.00	0.00	100.00	0.00
	E	0.00	0.00	0.00	0.00	50.00	50.00	0.00
Khorkul	E	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Kuchia	C	0.00	0.00	0.00	0.00	0.00	100.00	0.00
Menua	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Mochon	E	0.00	0.00	0.00	0.00	50.00	50.00	0.00
Motka	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	E	0.00	0.00	33.33	66.67	0.00	0.00	0.00
	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Mutkura	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
Nandi Bele	C	0.00	0.00	0.00	33.33	66.67	0.00	0.00
	E	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Paira	A	0.00	0.00	50.00	50.00	0.00	0.00	0.00
	C	0.00	0.00	28.57	57.14	14.29	0.00	0.00
Paissa	A	0.00	0.00	0.00	50.00	50.00	0.00	0.00
	B	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	66.67	33.33	0.00	0.00
	E	0.00	0.00	0.00	66.67	33.33	0.00	0.00
	J	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Pangas	C	0.00	0.00	0.00	50.00	0.00	50.00	0.00
Pankhali	E	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Phesa	A	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	J	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Poikka	C	0.00	0.00	33.33	66.67	0.00	0.00	0.00
	E	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Poma	C	0.00	0.00	0.00	0.00	75.00	25.00	0.00
	E	0.00	0.00	0.00	50.00	50.00	0.00	0.00
	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
Potka	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00

Fish Species	Sampling	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Ramchos	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	E	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Silonda	J	0.00	0.00	0.00	50.00	50.00	0.00	0.00
Telkumra	A	0.00	0.00	0.00	0.00	0.00	100.00	0.00
	E	0.00	0.00	0.00	0.00	50.00	50.00	0.00
Tengra	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Tiger Chingri	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Tirel	A	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Tit Punti	F	33.33	33.33	33.33	0.00	0.00	0.00	0.00
Vetki	E	0.00	0.00	0.00	33.33	66.67	0.00	0.00

Source: CEGIS field survey, November 2020

#### D.6: Purpose, timing and extent of migration for different year-class of migratory fish species

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
Tapsi	Haldikhali	Juvenile and Age-1 adult	Feeding and Growing	-	Feeding and Growing	-	-	-		-	-		-	-
	Akram Point	Juvenile and Age-1 adult	Feeding and Growing	-	-	-	-	-	Feeding	-	-		-	-
		Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Chalna Point	Age-1 adult and Brood fish	Feeding and Growing	Spawning	-	-	-	Feeding	Feeding and Spawning	-	-		Feeding and Growing	-
		Adult	-	-	Feeding and Growing	-	-	Feeding	Feeding	-	-			-
	Harbaria	Juvenile and Age-1 adult	Feeding and Growing	Feeding and Growing		-	-	-	-	-	-		-	Feeding
		Adult and Brood Fish	-	-	Breeding and Spawning	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Chandpai	Juvenile	-	-	Feeding and Growing	-	-	-	Feeding	-	-		Feeding	-
	Mongla Point	Adult	-	-	-	-	-	-	-	-	-			-
	South-west of the Project	Age-1 adult	Feeding and Growing	Feeding and Growing	Feeding and Growing	-	-	Feeding	-	-	-		-	-
		Brood Fish	-	-	-	-	-	Breeding and Spawning	-	-	-		-	-
Bairagi	Haldikhali	Juvenile and Age-1 adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Age-1 adult	Feeding and Growing	-	-	-	Feeding and Growing	-	-	-	-		-	-
		Juvenile and Adult	-	-	-	-	-	-	-	Growing and Feeding	-		-	-
	Chandpai	Fry	Breeding and Spawning	Breeding and Spawning	Feeding and Growing	Feeding	-	Feeding	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-
	Chalna Point	Juvenile and Age-1 adult	Feeding and Growing	-	-	-	Feeding and Growing	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	-		-	Nursing
	Harbaria	Juvenile	Feeding and Growing	-	-	-	-	Feeding	-	-	-		-	-
	Mongla Point	Fry	-	Nursing	-	Feeding	-	-	-	-	-		-	Nursing
		Juvenile	-	-	-	-	-	-	-	Feeding	-		-	-
	South-west of the Project	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	-		-	Nursing
Chapila	Haldikhali	Juvenile	Feeding and	-	-	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
			Growing											
	Akram Point	Juvenile	Feeding and Growing	-	-	-	-	-	-	-	-		-	-
	Mongla Point	Fry	-	Nursing	-	-	-	-	-	-	-		-	-
	South-west of the Project	Age-1 adult	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
Loitta	Haldikhali	Juvenile and Age-1 adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Akram Point	Juvenile	Feeding and Growing	-	-	-	Feeding and Growing	-	-	-	-		-	-
	Akram Point	Age-1 adult	-	-	Feeding and Growing	-	Feeding and Growing	-	-	-	-		-	-
	Chandpai	Juvenile	Feeding and Growing	-	-	-	-	-	-	-	-		-	-
	Harbaria	Fry, Juvenile and Age-1 adult	-	Nursing, Feeding and Growing	-	-	-	-	-	-	-		-	-
	Chalna Point	Age-1 adult	-	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	Nursing		-	-
Poma	Haldikhali	Juvenile	Feeding and Growing	-	-	Feeding	-	-	-		-		-	-
	Akram Point	Juvenile	Feeding and Growing	-	-	-	-	-	-	Growing and Feeding	-		-	-
		Age-1 adult	-	-	Feeding and Growing	-	-	-	Feeding	Feeding	-		-	-
		Adult	-	-	-	-	-	-			-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Chandpai	Fry and Juvenile	Breeding and Spawning	Nursing	-	-	-	Feeding	-	-	-		-	-
		Juvenile	-	-	Feeding and Growing	Feeding	Feeding and Growing	-	Feeding and Growing		-		Feeding and Growing	
		Adult	-	-	-	-	-	-	Feeding		-			
		Brood Fish	-	-	-	-	-	-	-		-		Spawning	-
	Haldikhali	Fry and Juvenile	-	-	Nursing	-	-	-	-	-	-		-	-
	Harbaria	Adult and Brood Fish	-	-	Breeding and Spawning	-	-	-	-	-	-		Feeding and Spawning	-
		Adult	-	-	-	-	-	-	Feeding		-		-	Feeding
		Fry and Juvenile						Spawning and Nursery	-	-	Feeding and Growing		-	-
	Mongla Point	Fry, Juvenile and Age-1 adult	-	-	Spawning, Feeding and Growing	-	-	-	-	Nursing	-		-	Nursing
		Juvenile	-	-	-	-	-	-	Feeding and Growing		-		-	-
		Age-1 Adult	-	-	-	-	-	-	Feeding	Feeding	-		-	-
		Adult	-	-		Feeding	-	Feeding	-	-	-		Feeding	-
		Brood Fish	-	-	-	-	-	-	-	-	-		Spawning	-
	South-west of the Project	Adult	-	-	Feeding	Feeding	-	Feeding	-	-	-		-	-
	Chalna Point	Juvenile, Adult and Brood Fish	Breeding and Spawning	-	-	-	-	-	-	-	-		Feeding, Growing and Spawning	-
		Juvenile and Adult	-	-	Feeding and Growing	Feeding	Feeding and Growing	-	Feeding and Growing	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	Nursery		-	Nursing
Chhuri	Haldikhali	Adult	Feeding	-	Feeding	-	-	-	-	-	-		-	-
	Akram Point		Feeding	-	Feeding	-	-	-	-	-	-		-	-
Chela	Haldikhali	Adult	Feeding	-	Feeding	-	-	-	-	-	-		-	-
	Akram Point	Juvenile	Feeding	-	-	-	-	-	-	-	-		-	-



Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
		and Adult	and Growing											
	Harbaria	Fry and Juvenile	-	Feeding and Growing	-	-	-	Nursery	-	-	-		-	-
	Chandpai		-	-	-	-	-	-	-	Growing and Feeding	Nursery		-	-
Gang Tengra	Haldikhali	Adult	Feeding	-	Feeding	Feeding	-	-	-	-	-		-	-
	Akram Point	Adult	Feeding And Breeding	-	-	Feeding	-	-	-	-	-		-	-
	Harbaria	Adult	-	-	Feeding	-	-	-	-	-	-		-	-
	Chandpai	Adult	-	-	Feeding	Feeding	-	-	-	-	-		-	-
Gagra Tengra	Chandpai	Juvenile and Age-1 adult	-	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-		-	-
	Chalna Point	Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-
	Mongla Point	Age-1 adult	-	Feeding And Growing	-	-	-	-	-	-	-		-	-
	Akram Point	Juvenile and Adult	-	-	Feeding and Growing	-	-	-	-	-	-		-	Feeding
		Adult	-	-	-	-	-	-	Feeding	-	-		-	-
	Haldikhali	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-
	Harbaria	Adult	-	-	Feeding	-	Feeding and Growing	-	-	-	Feeding		Feeding	
Gulsha Tengra	Haldikhali	Adult	Feeding and Breeding	-	-	-	-	-	-	-	-		-	-
	Akram Point	Adult		-	-	-	-	-	-	-	-		-	-
	Chandpai	Age-1 adult	-	-	-	Feeding	-	Feeding	Feeding and	-	-		-	Feeding

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
									Growing					
		Juvenile	-	-	-	-	-	-	Feeding and Growing		-		Feeding and Growing	-
	Mongla Point	Age-1 adult	-	Feeding and Growing	-	Feeding and Growing	-	Feeding and Growing		-	Feeding and Growing		-	-
		Juvenile	-	-	-	-	-	-	Feeding and Growing		-		Feeding and Growing	-
	Harbaria	Juvenile	-	-	-	-	-	-	Feeding and Growing		-		Feeding and Growing	-
		Age-1 adult	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-		Feeding and Growing	-
Potka	Haldikhali	Adult	Feeding and Breeding	-	-	-	-	-	-	-	-		-	-
	Chandpai	Fry	Spawning	Spawning and Nursing	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	Feeding
		Adult	-	-	-	Feeding	-	-	-	-	-		Feeding	-
	Mongla Point	Fry	Spawning	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Harbaria	Fry	-	-	-	-	-	Nursery	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	-
Paira Chanda	Akram Point	Adult	Feeding	-	-	-	-	-	-	-	-		-	-
	Chandpai	Fry	Breeding and	-	-	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
			Spawning											
Chewa	Akram Point	Juvenile and Adult	Feeding	-	Feeding and Growing	-	-	-	-	-			-	-
	Chandpai	Fry and Juvenile	Spawning	-	Feeding and Growing	-	Nursing and Grazing	Nursery	Feeding and Growing	-	Nursing		-	-
		Adult	-	-	-	Feeding	-	Feeding	-	Feeding	-		-	-
	Haldikhali	Juvenile and Adult	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Juvenile and Adult	-	-	Feeding and Growing	-	-	Feeding and Nursery	-	Feeding	-		-	-
	Mongla Point	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
	South-west of the Project	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	-	-	-		-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
Bele	Akram Point	Adult	Feeding	-	Feeding	Feeding	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	-
	Haldikhali	Juvenile-1, Juvenile and Adult	-	-	Nursing and Growing	Feeding	-	-	-	-	-		-	-
	Harbaria	Juvenile and Adult	-	-	Feeding and Growing	-	Feeding and Growing	Nursery and Feeding	Feeding and Growing	-	-		-	-
	Chandpai	Fry	Breeding and Spawning	Nursing	-	-	Nursing	Nursery	-	-	Nursery		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Chandpai	Juvenile and Adult	-	-	Feeding and Growing	Feeding	-	Feeding	-	Feeding	-		Feeding and Growing	
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing				-	-
	Mongla Point	Fry	Breeding and Spawning	-	-	-	-	Nursery	-	-	-		-	-
	Mongla Point	Fry, Juvenile-1 and Juvenile			Nursing and Growing	-	-	-	-	-	-		-	-
	Mongla Point	Juvenile and Adult	-	-	-	Feeding	Feeding and Growing	Feeding	Feeding and Growing	-	-		-	-
	Chalna Point	Fry	Breeding and Spawning	Nursing	-	-	Nursing	-	-	Nursing	-		-	-
	Chalna Point	Adult	-	-	-	Feeding	-	-	-	-	-		-	-
	Maidara	Juvenile and Age-1 adult	-	Feeding and Growing	Feeding and Growing	Feeding	Feeding and Growing	-	-	-	Feeding and Growing		-	-
		Fry	-	-	-	-	-	-	-	Nursing	-		-	Nursing
Tular Dandi (Nona bele)	Akram Point	Adult	Feeding	-	-	-	-	-	-	-	-		-	-
	South-west of the Project	Adult	-	-	Feeding	-	-	-	-	-	-		Feeding	-
	Chalna Point	Adult	Feeding	-	Feeding	-	Feeding	-	Feeding	-	-		-	-
Tairel	Akram Point	Adult	Feeding	-	-	-	-	-	-	Feeding	-		-	-
	Harbaria	Age-1 Adult	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Mongla Point	Juvenile	Feeding	-	-	-	-	-	-	-	-		-	-
Pheksa	Akram Point	Adult	Feeding	-	-	-	-	-	-	Feeding	-		-	-
		Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Haldikhali	Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Haldikhali	Adult	-	-	-	Feeding	-	-	-	-	-		-	-
	Harbaria	Juvenile	-	-	-	-	-	-	-	-	Feeding And Growing		-	-
	Chalna Point	Juvenile and Adult	Feeding	Feeding and Growing	-	-	-	-	Feeding and Growing	-		-	-	-
		Adult	-	-	Feeding	Feeding	Feeding	-	Feeding	-		-		-
	Mongla Point	Adult	-	-	Feeding	Feeding	-	-	Feeding and Growing	-	-		Feeding	-
	Chandpai	Juvenile and Adult	Feeding	Feeding and Growing	-	-	Feeding and Growing	-		-	-		-	-
	Maidara	Juvenile and Adult	Feeding	Feeding and Growing	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-
			Adult	-	-	Feeding	Feeding	-	Feeding	-	-	-		-
		Paissa	Akram Point	Juvenile and Adult	Feeding	-	Feeding and Growing	Feeding	-	-	-	Feeding and Growing	-	
Brood	-			-	-	-	-	-	-	-	-		-	Spawning
Juvenile	-			-	-	-	-	-	Feeding and Growing			-	-	-
Haldikhali	Juvenile and Adult		Feeding	-	Feeding And Growing	Feeding	-	-	-	-	-		-	-
	Juvenile		-	-	-	-	-	-	Feeding and Growing	-	-		-	-
Harbaria	Juvenile-1 and Juvenile		-	-	Feeding	-	Feeding and Growing	-	Feeding and Growing	-	-		-	-
	Adult		-	-	-	-	-	-	-	Feeding	-		-	-
Chandpai	Fry		Breeding and Spawning	-	-	-	-	Nursing	-	-	Nursery		-	-
Chandpai	Juvenile and Adult		-	-	Feeding and Growing	-	-	Nursery and Feeding	-	-	-		Feeding and Growing	Feeding

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Harbaria	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-			-
	Mongla Point	Fry	Breeding and Spawning	-	-	-	-	Nursery	-	-	Nursery		-	-
		Age-1 Juvenile	-	-	-	-	-	-	Nursing, Feeding and Growing	-	Feeding and Growing		-	-
		Age-1 Adult	-	-	-	-	Feeding and Growing	Feeding	-	-			-	-
	Maidara	Fry, Juvenile and Age-1 adult	Breeding and Spawning	Feeding and Growing	-	-	Feeding and Growing	-	-	-			-	-
		Age-1 Juvenile, Juvenile and Age-1 Adult	-	-	-	-	-	-	Nursing, Feeding and Growing	-	-		Feeding and Growing	-
		Adult	-	-	-	-	-	Feeding	-	-	-		-	-
	Banshpata	Chandpai	Juvenile	Feeding	-	-	-	-	-	-	-		-	-
		Adult	-	-	-	Feeding	-	Feeding	-	-	-		-	-
		Akram Point	Juvenile	-	-	-	-	-	Feeding and Growing	-	-		-	-
			Adult	-	-	-	-	-	-	Feeding	-		-	-
		Haldikhali	Juvnile and adult	-	-	Feeding and Growing	Feeding	-	Feeding and Growing	-	-		-	-
		Harbaria	Adult	-	-	-	-	-	-	Feeding	Feeding		Feeding	-
		Mongla Point	Fry and Adult	Feeding	Nursing	-	-	-	-	-	-		-	-
		Adult	-	-	-	Feeding	-	-	-	-	Feeding		-	-
		Maidara	Adult	-	-	Feeding	Feeding	-	Breeding and Spawning	-	-		-	-
	Chalna Point	Adult	-	-	Feeding	Feeding	-	-	-	-	-		-	-
Hilsa	Akram Point	Brood Fish	-	-	-	-	-	-	-	-	-			-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Haldikhali	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
		Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
	Chandpai	Adult and Brood Fish	-	-	-	-	-	-	Feeding and Breeding	-	-		-	-
	Mongla Point	Adult	-	-	Feeding	-	-	-	-	-	-		-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
	Maidara	Age-1 Adult	-	-	-	-	-	-	-	-	-		Feeding	-
	Chalna Point	Brood fish	-	-	-	-	-	Breeding and Spawning	-	-	-		-	-
Pangas	Haldikhali	Juvenile	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Adult	-	-	-	-	-	-	-	Feeding	-		-	-
	Mongla Point	Juvenile and Adult	-	-	Feeding	-	-	-	-	-	-		-	-



Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
			13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
Tapsi	Haldikhali	Juvenile and Age-1 adult	-	-	Grazing	-	-	-	-	-	-		-	-	-	-	-	-	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Chalna Point	Age-1 adult and Brood fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
		Adult	-	Feeding	-	-	Feeding	-	-	Feeding	Feeding		-	-	-	-	-	-	-
	Harbaria	Juvenile and Age-1 adult	Feeding	-	-	-	-	-	-	-	-		-	-	-	-	-	Feeding	Feeding
		Adult and Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Chandpai	Juvenile	-	Feeding and Growing	-	Feeding and Growing	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-		-	-	-	-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-		Feeding	-	-	-	-	-	-
		Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-
		Fry	-	-	Nursing	-	-	-	-	-	-		-	Nursing	-	-	-	-	-
	Maidara	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	Maturation	-	-	-		-	-	-	-	-	-	-
		Adult	-	-	-	-	Feeding	-	-	-	-		-	-	-	-	-	-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
Bairagi / Amadi	Haldikhali	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	Feeding	Feeding
		Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Chandpai	Fry	-	Nursing	-	Nursing	-	-	-	Nursing	-		-	-	-	-	-	-	-
		Juvenile	-	Feeding and Growing	Feeding and Growing	Feeding and Growing	-	Maturation	Feeding and Growing	-	Nursing		-	-	-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
			13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
	Chalna Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	Feeding	-		-	-	-	-	-		-
		Fry	Nursing	-	-	-	-	Nursing	-	Nursing	-		-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	Feeding and Growing	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-
	Mongla Point	Fry	Nursing	-	Nursing	-	-	-	-	-	-		Nursing	Nursing	-	-	-	-	-
		Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-
	Maidara	Juvenile	-	-	-	-	-	Maturation	-	-	-	Feeding and Growing	-	-	-	-	Feeding and Growing	-	-
		Fry	Nursing	-	Nursing	-	-	Nursing	-	Nursing	-		-	-	-	-	-	-	-
	Charaputia	Adult	-	-	-	-	-	-	-	Feeding	-		-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-
	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
Chapila	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	Feeding and Growing	-	-	-	-	-
		Adult	-	-	-	-	Feeding	-	Maturation	-	-		-	-	-	-	-	-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	Maturation	-	Maturation	Feeding	-	-	-	-	-	-	-
		Fry	-	-	-	-	-	Nursing	-	-	-		-	-	-	-	-	-	-
	Maidara	Juvenile to Age-1 adult	-	-	-	-	-	Growing and Maturation	-	-	-		-	-	-	-	-	-	-
Loitta	Haldikhali	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Akram Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Chandpai	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-
	Harbaria	Fry, Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
			13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
		and Age-1 adult																	
	Mongla Point	Fry	-	-	Nursing	-	-	-	-	-	-		-	-	-	-	-	-	-
	Chalna Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
		Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
Poma	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Akram Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	Maturation	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Charaputia	Brood Fish	-	-	-	Spawning	-	-		-	-		-	-	-	-	-	-	Maturation
		Juvenile and Adult	-	-	-	Feeding	-	-	Growing and Maturation	Feeding	-		Growing and Maturation	-	-	Growing and Maturation	Maturation		Nursing
	Chandpai	Fry and Juvenile	-	-	-	Nursing	-	-	-	-	-		-	-	-	-	-	-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	-	-	-
		Juvenile	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-	-		-	-	-	-	-	-	-
		Adult		Feeding	Feeding	Feeding	-	-	-	-	-		-	-	-	-	Feeding	-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-
	Haldikhali	Fry and Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Harbaria	Adult and Brood Fish	-	-	-	-	-	-	-	-	-			-	-	-	-	Maturation	-
		Adult	Feeding	-	-	-	-	Feeding	-	-	-		-	-	-	-	-	-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-		Nursing	-	-	-	-	-	-
	Mongla Point	Fry, Juvenile and Age-1 adult	Nursing	-	-	-	Nursing	-	Feeding and Growing	-	-		Nursing and Maturation	-	-	-	-	-	-
		Fry	-	Nursing	-	-	-	-	-	-	-		-	Nursing	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	Nursing		-	-	-	-	-	Maturation	-
		Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
			13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
	Maidara	Adult	-	Feeding	-	-	-	-	Maturation and Feeding	-	-	-	Feeding	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	-	-	-
		Fry	-	-	-	-	-	Nursing	-	-	-	Nursing	-	-	-	-	-	-	-
	Chalna Point	Juvenile and Adult	-	Feeding and Growing	-	-	-	Maturation and Feeding	Maturation and Feeding	-	Maturation and Feeding	-	-	Maturation and Feeding	-	-	-	-	-
		Fry	Nursing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Feeding	-
Chhuri	Haldikhali	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Akram Point		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chela	Haldikhali	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	-
	Harbaria	Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	-	-	Nursing and Maturation	-	-	-	Feeding and Growing
	Chalna Point		-	-	-	Nursing and Feeding	-	-	-	-	-	Nursing and Maturation	-	Nursing and Maturation	-	-	-	-	-
	Chandpai		-	-	Feeding and Growing	-	-	-	-	Nursing	Nursing	-	-	Nursing and Maturation	-	-	Feeding and Growing	-	-
	Mongla Point		-	Nursing	-	-	-	-	-	-	-	Nursing and Maturation	-	-	-	-	-	-	-
Gang Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chandpai	Adult	-	-	-	-	Feeding	-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Fingerling	-	-	-	-	Nursing	-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Fingerling	-	-	-	-	Nursing	-	-	-	-	-	-	-	-	-	-	-	-
		Age-1 Adult	-	-	-	-	Feeding and Growing	-	-	-	-	-	-	-	-	-	-	-	-
Ghagra Tengra	Chandpai	Juvenile and Age-1 adult	-	-	-	-	-	Maturation	-	-	-	-	-	-	Maturation	-	Maturation	-	-
		Brood Fish	-	-	Breeding	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
			13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
		Fry	-	-	-	-	Nursing	-	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Nursing	-
	Mongla Point	Age-1 adult	-	-	-	-	-	-	Maturation and Feeding	-	Maturation and Feeding	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	Feeding and Growing	-	-	-	-	-
	Akram Point	Juvenile and Adult	Feeding	-	-	-	-	-	-	Feeding and Growing	-	-	-	-	Maturation	-	-	-	Feeding and Growing
		Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Feeding	Maturation
	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Adult	Feeding	Breeding	-	-	-	-	Feeding	-	-	-	-	-	Maturation	-	Maturation	-	Maturation
		Juvenile	-	-	-	-	Maturation	-	Maturation	-	-	-	-	-	-	-	-	-	-
	Charaputia	Juvenile and Age-1 adult	-	-	-	-	-	Maturation	-	-	-	Maturation	-	-	Maturation	-	Maturation	-	-
Gulsha Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Feeding and Growing
	Chandpai	Age-1 adult	Feeding	-	Feeding and Growing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-	-	-	-	-	-	-	-	Maturation
	Charaputia	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-	-	-	-	-	-	-	-	-
		Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Maturation	-	-	-
	Mongla Point	Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-	-	-	-	-	-	-	-	-
		Age-1 adult	-	-	-	-	Feeding and Growing	-	-	-	-	-	-	-	-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
			13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-		-	Feeding and Growing		-	-	-	-
Potka	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Chalna Point	Fry	-	-	-	-	-	Nursing	-	-	-		-	-	-	-	-	-	-
	Chandpai	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-
		Juvenile	Feeding	-	-	-	-	-	Feeding and Growing	-	-		-	-	-	-	Feeding and Growing	-	-
		Adult	-	Feeding and Growing	Feeding	-	-	-	-	-	-		-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	-	-
	Mongla Point	Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Maidara	Fry	-	-	-	Nursing	-	Nursing	-	Nursing	-		-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	Maturation	-	-	-		-	-	-	-	-	-	Feeding and Growing
	Harbaria	Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Charaputia	Juvenile and adult	-	-	-	-	-	-	Feeding and Growing	-	-		-	-	-	Feeding and Growing	-	-	Feeding and Growing
Paira Chanda	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
Chewa	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Feeding and Growing
	Chandpai	Fry and Juvenile	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	Feeding and Growing	-	-
		Juvenile	-	Feeding and Growing	-	-	-	-	-	-	Feeding and Growing		-	-	-	-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-	-	Feeding	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	Nursing	-	-	-	-	-	-
	Chandpai	Juvenile-1	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	-	-	Nursing	Maturation	Maturation	-	-	-	-	-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-	Maturation	-	-
	Maidara	Juvenile	-	-	-	-	-	-	-	-	-	Maturation	-	-	-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
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	Chalna Point	Fry	-	-	Nursing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Adult	-	-	-	-	Feeding	-	-	-	-	Feeding	-	Feeding	-	-	-	-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-	-	-	Maturation	-	-	-	-	-	Feeding and Maturation
Bele	Akram Point	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	-	-	Feeding	Maturation	-	-
	Chandpai	Fry	-	-	-	Nursing	Nursing	-	-	Nursing	-	Nursing	-	-	-	-	-	-	-
		Juvenile and Adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	Feeding and Growing	-	-	-	-	Maturation and Feeding	-	-	-	Feeding and Maturation
	Jongra	Fry	-	-	-	-	-	-	Nursing	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Fry	-	Nursing	-	-	Nursing	-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Juvenile and Adult	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	-	-	-	-	-	-
		Fry	-	-	Nursing	Nursing	-	-	-	-	-	-	-	-	-	-	-	-	Feeding and Maturation
	Chalna Point	Fingerling	-	-	-	-	Nursing	-	-	-	-	-	Nursing	Nursing	-	-	-	-	-
		Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	Feeding and Growing	Maturation	-
		Juvenile and Age-1 adult	-	-	Feeding and Growing	-	Feeding and Growing	Feeding and Growing	-	-	Maturation and Feeding	Maturation and Feeding	Maturation and Feeding	-	-	-	-	-	-
	Maidara	Fry	Nursing	-	Nursing	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile and Age-1 adult	-	-	-	-	-	Maturation	-	-	-	-	-	-	-	-	-	-	-
Tular Dandi (Nona bele)	Akram Point	Adult	-	-	-	-	-	-	-	Feeding and Maturation	-	-	-	-	-	-	-	-	-
	Chandpai	Age-1 Adult	-	-	Feeding	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	Growing	-	-	-	-	-	-	-	-	-	-	-
		Fry	-	-	-	-	-	-	-	Nursing	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-	-	-	-	-	-	-	-	-
	Maidara	Adult	-	Feeding	-	-	-	-	Maturation	-	-	-	-	-	-	-	Maturation and Feeding	-	-



Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
			13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
	Chalna Point	Adult	-	-	-	-	-	-	Maturation	Maturation	Maturation and Feeding	-	-	-	Maturation and Feeding	-	-	-	Maturation
Tairel	Akram Point	Adult	-	-	-	Feeding	-	-	-	-	-	-	-	-	-	-	-	-	Maturation
		Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Maturation	-	-	-
	Charaputia	Juvenile	-	-	-	-	-	-	-	Maturation	-	-	-	-	-	-	-	-	-
	Harbaria	Age-1 Adult	-	Feeding and Growing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chandpai	Juvenile	-	-	-	-	-	Growing	-	-	Feeding and Growing	-	-	-	-	-	-	Maturation	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	Growing	-	-	-	-	-	-	-	Maturing
	Maidara	Juvenile	-	-	-	-	-	Growing	-	-	-	-	-	-	-	-	-	-	-
Pheksha	Akram Point	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Charaputia	Juvenile and Adult	-	-	-	-	-	-	-	Feeding and Maturation	-	-	-	-	-	-	Maturation	-	Maturing
	Chalna Point	Juvenile and Adult	-	-	-	Feeding and Growing	-	-	-	Maturation	Maturation	-	-	-	Maturation	-	-	-	-
		Adult	-	Feeding	-	-	-	-	Maturation	-	-	Feeding	-	-	-	-	-	-	-
	Mongla Point	Adult	-	-	-	-	-	-	Maturation	-	-	-	Feeding	-	-	-	-	-	-
		Juvenile	-	-	-	Growing	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chandpai	Juvenile and Adult	-	-	-	Feeding and Growing	-	-	Maturation	-	-	-	-	-	-	-	-	-	Growing and Maturation
Paissa	Akram Point	Juvenile and Adult	Feeding	-	-	-	-	Growing and Maturation	-	-	-	-	-	-	-	Growing and Maturation	-	-	-
		Brood	Spawning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Growing and Maturation
	Charaputia	Brood Fish	-	-	-	Spawning	-	-	-	-	-	-	-	-	-	-	-	Feeding	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Feeding	-	-	Growing and Maturation
		Fry	-	-	-	-	-	-	-	-	-	-	Nursing	-	-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
			13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
	Harbaria	Juvenile-1 and Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-	Feeding and Growing	-	-	-	-
		Adult	-	Feeding	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Chalna	Fry	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		Nursing	Nursing	-	Feeding	Feeding and Growing	-	-
	Chandpai	Fry	-	-	-	Nursing	-	-	Feeding and Growing	Nursing	Nursing	Nursing	Nursing	-	Feeding and Growing	Feeding	-	-	-
		Juvenile and Adult	Feeding	Feeding and Growing	-	Feeding and Growing	-	Maturation	-	-			-	-	-	-	-	-	Feeding and Growing
	Jongra	Fry	-	-	-	-	-	-	-	Nursing			-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	Feeding and Growing	-	-	Maturation	-	-			-	-	Feeding and Growing	-	-	-	-
	Mongla Point	Fry	-	-	Nursing	-	-	-	-	-			-	-	-	-	-	-	-
		Age-1 Adult	-	-	-	-	-	-	-	-		Maturation	-	-	-	-	-	-	-
	Maidara	Fry, Juvenile and Age-1 adult	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-	Feeding and Growing	-	-	-	-
		Juvenile	-	-	-	-	-	Growing	-	-	-		Maturation	-	-	-	-	-	-
Banshpata	Chandpai	Juvenile	-	-	-	Growing	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-
		Adult	-	Feeding	Feeding	-	-	-	-	-	-		-	-	-	-	-	-	Growing and Maturation
	Jongra	Juvenile	-	-	-	-	-	-	-	Maturation	-		-	-	-	-	-	-	-
	Charaputia	Juvenile and Age-1 Adult	-	-	-	Feeding	-	-	Growing and Maturation	-	-		-	-	-	Growing and Maturation	-	-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Feeding and growing
	Haldikhali	Juvenile and adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																
			13 <sup>th</sup> QM	14 <sup>th</sup> QM	15 <sup>th</sup> QM	16 <sup>th</sup> QM	17 <sup>th</sup> QM	18 <sup>th</sup> QM	19 <sup>th</sup> QM	20 <sup>th</sup> QM	21 <sup>st</sup> QM	22 <sup>nd</sup> QM	23 <sup>rd</sup> QM	25 <sup>th</sup> QM	26 <sup>th</sup> QM	27 <sup>th</sup> QM	28 <sup>th</sup> QM	29 <sup>th</sup> QM	30 <sup>th</sup> QM
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	Growing and Maturation	Growing and Maturation	-	-		-	-	Maturation	-	-	Maturation	-
		Adult	-	Feeding	-	-	-	Feeding	-	-	-		-	-	-	-	-	Maturation	-
	Chalna Point	Juvenile and Age-1 Adult	-	-	-	-	-	-	Growing and Maturation	Feeding	Growing and Maturation		-	Growing and Maturation	-	-	-	-	Maturation
Hilsa	Akram Point	Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Maturation
	Maidara	Age-1 Adult	-	-	-	-	-	-	-	-	-	Maturation	-	-	-	-	-	-	Maturation
	Chalna Point	Adult	-	-	-	-	-	Maturation	-	-	-	Feeding	-	-	-	-	-	Nursining	-
Pangas	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Maturation
	Charaputia	Adult	-	-	-	-	-	-	-	Feeding	-		-	-	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-	-	-	-	-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-	Feeding and Growing	-	-	-	-		-	-

Source: Field findings at different times

\*Only Age-1 to Brood fish was allowed to interpret the migration purpose; F = Feeding; Sp = Spawning

## D.7: The Present Catch in Three Sampling Ghers

Sampling Site	Total Catch (ton): 2014-2015							
	1st QM (April, 2014)		2nd QM (July, 2014)		3rd QM		4th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
1	Bagda	5	Bagda	6.42	Bagda	4.8	-	-
	Vetki	1.57	Bele	0	Gusha Chingri	-	-	-
	Bele	0.98	Cheng	0	Harina Chingri	-	-	-
	Harina Chingri	0.78	Bhangan	0	Rui (kg)	-	-	-
	Chali Chingri	0.11	Chali Chingri	0	Catla (kg)	-	-	-
	Chaka Chingri	0.08	-	-	-	-	-	-
Sub-total =		8.52		6.42		4.8	-	-
2	Bagda	4	Bagda	1	Bagda	7	-	-
	Harina Chingri	2	Harina Chingri	0.33	Vetki	1	-	-
	Chali Chingri	0.18	Chali Chingri	0.08	Paissa	10	-	-
	-	-	Golda Chingri	0.01	Phessa	2.4	-	-
	-	-	Bele	0.08	Bhangan	1.7	-	-
	-	-	Tengra&Paissa	0.04	Golda Chingri	0.9	-	-
	-	-	-		Gulsha Tengra	0.2	-	-
Sub-total =		6.00		2.00		23		-
3	Bagda	1.38	Bagda	2.4	Bagda	1.5	-	-
	Harina Chingri	0.34	Harina Chingri	0.34	Paissa	10	-	-
	Chali Chingri	0.17	Chali Chingri	0.17	Tengra	10	-	-
	-	-	-	-	Bele	20	-	-
	-	-	-	-	Tilapia	22	-	-
	-	-	-	-	Rui	28	-	-
	-	-	-	-	Vetki	-	-	-
	-	-	-	-	Harina Chingri	-	-	-
	-	-	-	-	Chami Chingri	-	-	-
	-	-	-	-	Catla	56	-	-
	-	-	-	-	Mrigel	50	-	-
Sub-total =		1.89		2.91		197.5	-	-
Grand-total =		17.00		11.33		226.5	-	-

Source: CEGIS Field Survey, 2014-2015

Sampling Site	Total Catch (ton): 2015-2016							
	5th QM		6th QM		7th QM		8th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
1	Bagda	-	Bagda	1.6	Bagda	2	Catla	2
	Horina Chingri	1	Horina Chingri	1	Horina Chingri	3.2	Glass Carp	0.1
	Tengra	-	Chali Chingri	0.5	Gusha Chingri	0.8	Horina Chingri	0.8
	Paissa	-	Paissa	0.25	Paissa	24	Minar Carp	0.1
	Chela	-	Bele	0.25	Vetki	0.2	Nilotica	1.6
	Vetki	-	-	-	Kailla	0.4	Paissa	0.6
	-	-	-	-	Bele	0	Rui	3
	-	-	-	-	Tilapia	0	Vetki	0.8
	-	-	-	-	Catla	0	-	0
	-	-	-	-	Minar Carp	0	-	0
	-	-	-	-	Glass Carp	0	-	0
	-	-	-	-	Kakra	0.4	-	0
Sub-total=	-	1	-	3.06	-	31	-	9
2	Bagda	-	Bagda	1.67	Bagda	0	-	0
	-	-	Chali Chingri	0.30	Horina Chingri	0	-	0
	-	-	Horina Chingri	0.50	Chali Chingri	0	-	0
	-	-	Bele	0.30	Tilapia	0	-	0
	-	-	Paissa	0.25	Vetki	0	-	0
	-	-	-	-	Tengra	0	-	0
	-	-	-	-	Paissa	0	-	0
Sub-total=	-	0	-	3.02	-	0	-	0
3	Bagda	-	Bagda	3.5	Bagda	0.4	-	0
	-	-	-	-	Paissa	3.2	-	0
	-	-	-	-	Vetki	0.4	-	0
	-	-	-	-	Tilapia	0.06	-	0
	-	-	-	-	Horina Chingri	0.35	-	0
	-	-	-	-	Chali Chingri	0.6	-	0
	-	-	-	-	Chaka Chingri	0.1	-	0
	-	-	-	-	Tengra	0	-	0
	-	-	-	-	Bele	0	-	0
	-	-	-	-	Tairel	0.06	-	0
	-	-	-	-	Bhangan	0	-	0
Sub-total =	-	-	-	-	-	5.17	-	0
Grand-total =	-	1	-	3.5	-	36.17	-	9

Source: CEGIS Field Survey, 2015-2016

Sampling Site	Total Catch (ton): 2016-2017							
	9th QM		10th QM		11th QM		12th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
1	-	0	-	-	Bagda	3	-	0
	-	0	-	-	Tengra	0.1	-	0
	-	0	-	-	Horina Chingri	0.8	-	0
	-	0	-	-	Paissa	0.1	-	0
	-	0	-	-	Vetki	2	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
<b>Sub-total =</b>	-	<b>0</b>	-	-	-	<b>6</b>	-	<b>0</b>
2	Bagda	1	-	-	Bagda	2	Bagda	0.0035
	Horina	0.14	-	-	Bele	1.6	Horina Chingri	0.288
	-	0	-	-	Chali Chingri	4	Paissa	0.22
	-	0	-	-	Horina Chingri	8	Tengra	0.305
	-	0	-	-	Paissa	0.28	Chela	0.45
	-	0	-	-	Tengra	0.8	Tilapia	0.53
	-	0	-	-	Tilapia	8	Vetki	0.06
	-	-	-	-	Vetki	2.4	Bele	0.15
<b>Sub-total =</b>		<b>1.14</b>	-	-	-	<b>9</b>	-	<b>0</b>
3	Bagda	2	-	-	Bagda	0.4	-	0
	-	0	-	-	Horina Chingri	0.35	-	0
	-	0	-	-	Paissa	0.06	-	0
	-	0	-	-	Tengra	0.4	-	0
	-	0	-	-	Tilapia	3.2	-	0
	-	0	-	-	-	-	-	-
<b>Sub-total =</b>	-	<b>2</b>	-	-	-	<b>4</b>	-	<b>2.01</b>
<b>Grand-total =</b>	-	<b>3.14</b>	-	-	-	<b>19</b>	-	<b>2.01</b>

Source: CEGIS Field Survey, 2016-2017

Sampling Site	Total Catch (ton): 2017-2018 and 2018-19													
	13th QM		14th QM		15th QM		16th QM		17th QM		18th QM		19th QM	
	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton
1	Bagda	0	Bagda	3	-	-	Bagda	2.00	Bagda	0.76	Bagda	0	Bagda	-
	Horina Chingri	1	Rui (kg)	1.3	-	-	Golda	0.10	Bele	0.20	Catla	1.2	Paissa	-
	Tengra	0	Catla (kg)	1	-	-	Rui	0.12	Chali	1.20	Common Carp	0.3	-	-
	Paissa	0	-	-	-	-	Grass Carp	0.20	Golda	0.00	Grass Carp	0.3	-	-
	Chela	0	-	-	-	-	Catla	0.30	Horina	1.60	Rui	4.2	-	-
	Vetki	0	-	-	-	-	Tilapia	0.45	Paissa	0.00			-	-
							Horina	0.10	Tilapia	12.80			-	-
							Gusha	0.00					-	-
							Paissa	0.00					-	-
							Khorulla	0.00					-	-
							Vetki	0.00					-	-
							Gulsha	0.00					-	-
							Bele	0.00					-	-
Sub-total =	-	1	-	3.6	-	-	=	3.27	=	16.56	=	6	-	-
2	Bagda	0	Bagda	5	-	-	Bagda	3.93	Bagda	1.48	Bagda	5	Bagda	-
	-	-	Vetki	0.5	-	-	Golda	0.13	Bele	0.06	Bhangan	0.05	Paissa	-
	-	-	Paissa	7	-	-	Rui	8.41	Bhangan	0.01	Catla	3	Datina	-
	-	-	Phessa	1	-	-	Tilapia	5.90	Catla	0.00	Chali	0.4		
	-	-	Bhangan	0.7	-	-	Nilotica	0.00	Chali	0.04	Golda	0.08		
							Khorulla	0.00	Chel	0.01	Horina	1.8		
							Mrigel	0.00	Golda	0.00	Paissa	0.8		
							Catla	0.00	Horina	0.50	Rui	3		
							Grass Carp	0.11	Motka	0.05	Tengra	0.8		
							Common Carp	5.55	Paissa	0.03	Tilapia	8		
							Sarpunti	0.53	Rui	0.00	Vetki	2		
							Horina	1.91	Tengra	0.13				



Sampling Site	Total Catch (ton): 2017-2018 and 2018-19													
	13th QM		14th QM		15th QM		16th QM		17th QM		18th QM		19th QM	
	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton
							Chali Chingri	1.16	Tilapia	0.41				
							Bele	0.43	Vetki	0.01				
							Vetki	1.96						
							Tengra	4.20						
							Paissa	0.14						
							Tairel	0.003						
							Pheksa	0.001						
<b>Sub-total =</b>		<b>0</b>		<b>14.2</b>	-	-	=	<b>34.38</b>	=	<b>2.75</b>	=	<b>25</b>		
<b>3</b>	Bagda	0	Bagda	2	-	-	Bagda	0.50	Bagda	0.10	-	0	Bagda	-
	-	-	Paissa	8	-	-	Tilapia	1.50	Horina Chingri	0.00			Golda	-
	-	-	Tengra	2	-	-	Tengra	0.12	Paissa	0.00			Paissa	-
	-	-	Tilapia	5	-	-	Paissa	0.00	Tengra	0.00			Nilotica	-
	-	-	Rui	3	-	-	Horina Chingri	0.60	Tilapia	0.20			Khorsul	-
	-	-	Vetki	2	-	-								
	-	-	Catla	10	-	-								
<b>Sub-total =</b>	-	<b>0</b>	-	<b>32</b>	-	-								
<b>Grand-total =</b>	-	<b>1</b>	-	<b>49.8</b>	-	-	=	<b>2.72</b>	=	<b>0.30</b>	=	<b>0</b>		

Source: CEGIS Field Survey, 2017-18 and 2018-19

Sampling Site/ Location	Total Catch (ton): 2019-20, 2020-21 and 2021-22																			
	20 <sup>th</sup> QM		21 <sup>st</sup> QM		22 <sup>nd</sup> QM		23 <sup>rd</sup> QM		25 <sup>th</sup> QM		26 <sup>th</sup> QM		27 <sup>th</sup> QM		28 <sup>th</sup> QM		29 <sup>th</sup> QM		30 <sup>th</sup> QM	
	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)
Bhekatkhali Khal, Rajnagar	Bagda	32	Bagda	2.72	Bagda	0.8	Harina	0.02	Bagda	1.2	Patari	0.2	-	-	Bagda	0.7	Bagda	0.5	Patari	0.30
	Horina	48	Harina	3.44	Harina	1.0	-	-	Harina	2.0	Tilapia	0.5	-	-	Harina	0.15	Harina	0.6	Harina	0.10
	-	-	Tilapia	0.7	Chali	0.2	-	-	Tilapia	1.0	Paissa	0.05	-	-	-	-	Paissa	0.05	Tilapia	1.20
	-	-	Parse	0.17	Patari	0.3	-	-	-	-	Harina	0.2	-	-	-	-	Tilapia	2.0	Chali	0.10
	-	-	-	-	Tairel	0.03	-	-	-	-	Carp	1.0	-	-	-	-	Chali	0.3		
	-	-	-	-	Tilapia	0.5	-	-	-	-	Rui	0.05	-	-	-	-				
	-	-	-	-	Datina	0.02	-	-	-	-	Grass Carp	0.05	-	-	-	-				
											Golda	0.02	-	-	-	-				
Sub-total =		80		7.0		2.8		0.02		4.2		2.37	-	-		0.85		3.45		1.70
Kapashdanga- Muralia	Bagda	1.41	Bagda	6.74	Bagda	3.42	Harina	0.01	Bagda	4.84	Bagda	1.45	-	-	Bagda	0.04	Bagda	2.73	Bagda	0.07
	Paissa	0.60	Golda	0.01	Harina	3.96	-	-	Hatina	0.92	Hatina	1.08	-	-	Hatina	0.14	Harina	0.96	Harina	0.81
	Crab	0.00	Harina	0.65	Chali	0.38	-	-	Chali	0.20	Chali	0.30	-	-	Chali	0.03	Chali	0.11	Chali	0.01
	Tilapia	0.30	Chali	0.04	Bele	2.11	-	-	Bele	0.27	Bele	0.19	-	-			Bele	0.44	Bele	0.58
	Golda	0.10	Bele	0.09	Paissa	2.62	-	-	Paissa	0.04	Paissa	1.80	-	-			Paissa	0.2	Paissa	0.34
	Horina	2.92	Tilapia	0.22	Tilapia	9.85	-	-	Tilapia	3.87	Tilapia	6.93	-	-			Tilapia	12.9	Tilapia	7.82
	Chali	1.52	Tengra	0.57	Golda	0.04	-	-	Golda	0.03	Golda	0.03	-	-			Tengra	0.01	Tengra	0.02
	Bele	1.35	Bhangan	0.08	Tengra	0.17	-	-	Tengra	0.01	Tengra	0.17	-	-					Patari	1.76
	Tengra	0.27	-	-	Patari	2.25	-	-	Patari	0.11	Patari	0.25	-	-					Datina	0.06
	Major Carp	0.55	-	-	Chemo	0.02	-	-	Datna	0.01	Catol	0.04	-	-					Rui	0.27
	-	-	-	-	Datina	1.01	-	-	Rui	0.47	Chemo	0.32	-	-					Kailla	0.03
	-	-	-	-	Rui	1.27	-	-	Chaka	0.05			-	-						
	-	-	-	-	Chaka	0.01	-	-	-	1.56			-	-						
	-	-	-	-	Kailla	0.96	-	-	-	-			-	-						
	-	-	-	-	Nundi Bele	0.02	-	-	-	-			-	-						
	-	-	-	-	Kakra	0.49	-	-	-	-			-	-						
Sub-total =		9		8.0		29		0.01		12.38		12.57	-	-		0.21		17.38		11.76
Chunkuri-2	Bagda	0.04	Patari	0.01	Tilapia	0.02	-	-	Paissa	0.05	Sada Chingri	0.03	-	-	Bagda	0.01	Paissa	0.12	Paissa	0.08
	Paissa	0.00	Tair/Tailla	0.01	Paissa	0.066	-	-	Golda	0.03	Paissa	0.03	-	-	Harina	0.06	Bagda	0.04	Bagda	0.04
	Khorsula	0.00	Bhangan	0.01	Khorsul	0.009	-	-	Kharulla	0.01	Patari	0.02	-	-	Kakra	0.01	Tilapia	0.08	Tilapia	0.16

Sampling Site/ Location	Total Catch (ton): 2019-20, 2020-21 and 2021-22																			
	20 <sup>th</sup> QM		21 <sup>st</sup> QM		22 <sup>nd</sup> QM		23 <sup>rd</sup> QM		25 <sup>th</sup> QM		26 <sup>th</sup> QM		27 <sup>th</sup> QM		28 <sup>th</sup> QM		29 <sup>th</sup> QM		30 <sup>th</sup> QM	
	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)
	Horina	0.10	Datina	0.03	Bagda	0.015	-	-	Bagda	0.10	Tengra	0.01	-	-			Harina	0.06	Harina	0.04
	Motka	0.04	Bagda	0.02	Golda	0.006	-	-	Bele	0.03	Datina	0.02	-	-			Kakra	0.12	Patari	0.04
	Chali	0.03	Golda	0.03	Patari	0.015	-	-	Harina	0.15	Ilish	0.005	-	-			Patari	0.02	Kala Chingri	0.04
	Chaka	0.01	Faissa	0.01	Harina	0.008	-	-	Tengra	0.02	Golda	0.01	-	-			Kala Icha	0.04	Sada Chingri	0.04
	Bele	0.01	Chaka Chingri	0.01	Chali	0.009	-	-	Tairu	0.03	Nilotica	0.06	-	-			Sada Icha	0.04	Golda	0.01
	Crab	0.03	Harina	0.02	China Punti	0.047	-	-	Chaka	0.01	Baila	0.004	-	-			Bele	0.01		
	-	-	-	-	Tengra	0.008	-	-	Datina	0.02	Goda Chingri	0.001	-	-			Golda	0.01		
	-	-	-	-	Baila	0.003	-	-	-	-	Chaka Chingri	0.2	-	-						
	-	-	-	-	Datina	0.02	-	-	-	-	Harina	0.02	-	-						
											Chitra	0.004	-	-						
											Pheksa	0.01	-	-						
											Bhangan	0.004	-	-						
											Tairel	0.01	-	-						
											Golda	0.01	-	-						
											Bagda	0.02	-	-						
Sub-total =		0.24		0.15		0.46		0.00		0.44		0.25	-	-		0.08		0.54		0.45

Source: CEGIS Field Survey, 2019-2020 and 2020-2021

## (E) Traffic Survey data

Table E.1: Traffic Volume Survey at Khulna Mongla Road (Khudir Bottola)

Date: November 04, 2021 (Thursday)

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	Factor	Khulna to Mongla	Mongla to Khulna	PCU	Khulna to Mongla	Mongla to Khulna	PCU	Khulna to Mongla	Mongla to Khulna	PCU
Pedestrian	0	27	15	0	23	12	0	30	35	0
Auto Rickshaw	0.8	5	5	8	9	4	10	5	15	16
Van	0.6	59	79	83	81	70	91	14	91	63
Cycle	0.2	27	14	8	9	14	5	2	27	6
Human Howler	0.6	20	15	20	9	15	14	9	5	8
CNG	0.5	2	1	1	1	1	1	0	1	1
Private Car	1	21	23	43	30	24	54	4	23	27
Motor Cycle	0.3	138	132	81	161	142	91	10	202	64
Jeep	1	10	6	16	6	6	12	1	5	6
Pick-up	2	15	7	44	9	6	28	3	12	30
Micro	1	19	20	39	17	16	33	6	13	18
Bus	2.5	31	35	164	41	27	170	0	32	80
Light Truck	2	17	16	65	16	8	48	1	31	63
Medium Truck	2	12	25	73	29	38	134	3	64	134
Heavy Truck	2	17	9	50	12	16	54	1	10	21
Total				693			743			535

Table E.2: Traffic Volume Survey at Khulna Mongla Road (Gonai Bridge)

Date: November 03, 2021 (Wednesday)

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	Factor	Babubari to Plant site	Plant site to Babubari	PCU	Babubari to Plant site	Plant site to Babubari	PCU	Babubari to Plant site	Plant site to Babubari	PCU
Pedestrian	0	1	13	0	26	9	0	33	22	0
Auto Rickshaw	0.8	1	2	2	4	5	6	5	2	6
Van	0.6	17	24	25	38	20	34	14	12	16
Cycle	0.2	9	3	2	5	1	1	2	2	1
Human Howler	0.6	11	11	14	13	10	13	9	9	10
CNG	0.5	0	0	0	0	0	0	0	0	0

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	Factor	Babubari to Plant site	Plant site to Babubari	PCU	Babubari to Plant site	Plant site to Babubari	PCU	Babubari to Plant site	Plant site to Babubari	PCU
Private Car	1	11	3	13	2	3	5	4	5	9
Motor Cycle	0.3	32	19	15	42	35	23	10	17	8
Jeep	1	1	1	1	0	1	1	1	1	2
Pick-up	2	5	6	21	3	4	12	3	8	22
Micro	1	7	4	11	3	2	5	6	5	10
Bus	2.5	1	1	5	1	0	3	0	3	6
Light Truck	2	2	1	5	2	0	3	1	0	2
Medium Truck	2	2	1	6	1	0	2	3	5	16
Heavy Truck	2	1	0	1	1	1	2	1	1	4
			<b>Total</b>	<b>122</b>			<b>110</b>			<b>112</b>

Table E.3: Traffic Volume Survey at Power Plant access road (Gonabelai Bridge)

Date: November 02, 2021 (Friday)

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	Factor	Khulna to Mongla	Mongla to Khulna	PCU	Khulna to Mongla	Mongla to Khulna	PCU	Khulna to Mongla	Mongla to Khulna	PCU
Pedestrian	0	21	19	0	32	10	0	38	49	0
Auto Rickshaw	0.8	2	3	4	3	4	6	3	3	4
Van	0.6	38	30	41	42	54	58	36	41	46
Cycle	0.2	7	2	2	4	5	2	4	8	2
Human Howler	0.6	29	39	41	19	32	30	36	38	44
CNG	0.5	0	0	0	0	0	0	0	0	0
Private Car	1	13	4	17	9	9	18	7	27	34
Motor Cycle	0.3	55	48	31	64	71	40	64	83	44
Jeep	1	4	1	5	4	3	6	2	9	11
Pick-up	2	7	9	33	8	4	22	9	4	26
Micro	1	14	7	20	5	5	10	6	24	30
Bus	2.5	14	10	62	10	8	45	10	20	75
Light Truck	2	9	4	27	5	11	31	3	9	23
Medium Truck	2	12	6	35	35	26	122	25	36	121
Heavy Truck	2	6	2	16	15	7	43	12	14	52
			<b>Total</b>	<b>332</b>			<b>432</b>			<b>511</b>

**(F) Existing Cropping Pattern of Monitoring Agriculture Plot**

Year	Cropping Season	Monitoring Spot-1 (Baranpara)	Monitoring Spot-2 (Chunkuri-2)	Monitoring Spot-3 (Kapalimet)	Monitoring Spot-4 (Chakgona)	Monitoring Spot-5 (Basherhula)	Monitoring Spot-6 (Bidyarban)
2013-2014	Kharif-I	Fallow	Fallow	Fallow	Fallow	Fallow	-
	Kharif-II	Local Aman	HYV Aman	Local Aman	Local Aman	Local Aman	-
	Rabi	Fallow	Fallow	Fallow	Fallow	Fallow	-
2014-2015	Kharif-I	Fallow	Fallow	Fallow	Fallow	Fallow	-
	Kharif-II	HYV Aman	Local Aman	Fallow	Fallow	Local Aman	-
	Rabi	Fallow	Fallow	Fallow	Fallow	Fallow	-
2015-2016	Kharif-I	Fallow	Fallow	Fallow	Fallow	Fallow	-
	Kharif-II	HYV Aman	HYV Aman	Fallow	Fallow	Local Aman	-
	Rabi	Fallow	Fallow	Fallow	Fallow	Fallow	-
2016-2017	Kharif-I	Fallow	Fallow	Fallow	Fallow	Fallow	-
	Kharif-II	HYV Aman	Local Aman	Fallow	Fallow	Local Aman	-
	Rabi	Fallow	Fallow	Fallow	Fallow	Fallow	-
2017-2018	Kharif-I	Fallow	Fallow	Fallow	Fallow	Fallow	-
	Kharif-II	Local Aman	Local Aman	Fallow	Fallow	Local Aman	
	Rabi	Fallow	Fallow	Fallow	Fallow	Fallow	
2018-2019	Kharif-I	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow
	Kharif-II	Local Aman	Local Aman	Fallow	Local Aman	Local Aman	Local Aman
	Rabi	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow
2019-2020	Kharif-I	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow
	Kharif-II	Local Aman	Local Aman	Fallow	Local Aman	Local Aman	Local Aman
	Rabi	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow
2020-2021	Monitoring field visit was not taken place due to COVID-19 Pandemic						
2021-2022	Kharif-I	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow
	Kharif-II	BR10	Local Aman	Fallow	Local Aman	Local Aman	BR10
	Rabi	Fallow	Fallow	Fallow	Fallow	Fallow	Fallow

## (G) Monitoring results

**aecl** **Adroit Environment Consultants Ltd.**  
A House of Complete Environmental Management Solutions

**AECL LABORATORY ANALYSIS REPORT**  
**AMBIENT AIR QUALITY TEST REPORT**

Project Title : 2x660 MW Maitree Super Thermal Project  
Project Location : Rampal, Bagherhat

Description of Sample : Ambient Air  
Sample Collector : Adroit Environment Consultants Ltd. (Monitoring team)  
Sampling date : 28<sup>th</sup> October to 10<sup>th</sup> November, 2021  
Reporting date : 9<sup>th</sup> January, 2022

**Description of analysis**

Sample Location ID	Concentration present of different parameter in ambient air							Remarks
	PM <sub>2.5</sub>	PM <sub>10</sub>	SPM	SO <sub>2</sub>	NO <sub>x</sub>	CO	O <sub>3</sub>	
AQ1	79.64	102.33	193.43	16.92	48.41	1	68	Not comply
AQ2	55.31	69.40	129.45	20.76	31.69	1	29	Not comply
AQ3	56.83	83.46	144.48	16.28	21.64	0	11	Complies
AQ4	44.65	71.35	118.49	14.55	20.85	1.1	41	Complies
AQ5	41.98	61.48	104.73	12.19	18.39	1.4	34	Not comply
AQ6	29.61	44.28	77.88	10.59	17.21	1	9	Complies
AQ7	58.34	73.17	134.60	21.39	38.46	0	28	Not comply
AQ8	65.66	124.55	195.17	26.18	38.58	4.9	59	Not comply
AQ9	51.83	72.40	128.30	17.44	29.16	2.4	43	Not comply
AQ10	31.20	49.07	83.16	12.68	22.27	1	11	Complies
AQ11	38.51	49.27	89.36	14.33	16.27	0	22	Complies
AQ12	23.60	51.88	79.47	15.89	21.39	1	8	Complies
AQ13	42.59	64.71	107.31	12.80	19.33	1.1	19	Complies
Units	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>	µg/m <sup>3</sup>	
Test Duration (Hours)	24	24	8	8	8	8	8	
Method of Analysis	Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob & Hochheiser	CO Meter	O <sub>3</sub> Meter	
Bangladesh (DoE) Standard	65	150	200	365	100	10	157	
WHO Standard	75	150	NF	125	200	NF	160	

(NF – not found, DoE – Department of Environment.)

Note: This monitoring report was usually accomplished by - Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model- Envirotech India AAS-127BL).

1. Fine Particulate Matter (PM<sub>2.5</sub>).  
2. Respirable Dust Content (PM<sub>10</sub>).  
3. Suspended Particulate Matter (SPM).  
4. Oxides of Nitrogen (NO<sub>x</sub>).  
5. Oxides of Sulfur (SO<sub>2</sub>).  
6. Carbene Mono-Oxide (CO).

Comment: The above result reveals that location AQ1 & AQ8 i.e., township area & Khan Jahan Ali toll plaza doesn't conform to the standard limit.

**Md. Faisal Bin Mahmud**  
Sr. Chemist

**Md. Saiful Islam**  
Chief Operating Officer

Head Office: House # 01(2nd Floor), Road # 16, Sector # 07, Uttara, Dhaka-1230, Bangladesh  
Registered Office: 26/78/B, kurtipara, Uttarkhan, Dhaka-1230, Bangladesh. Tel: +88-02-48950261-62  
Mob: 0173376609-10, Fax: +88-02-9116714, Email: aeclbdhaka@gmail.com, nukhan05@gmail.com  
www.aecl-bd.org

**Government of the People's Republic of Bangladesh**  
**Office of the Chief Chemist**  
**Department of Public Health Engineering**  
**Central Lab, 38-39, Mohakhali C/A, Dhaka-1212**  
Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc\_central\_lab@yahoo.com

Lab Memo: 476/ CC, DPHE, CL, Dhaka

Date: 23-12-2021

**Physical /Chemical/ Bacteriological Analysis of Water Sample**

Sample ID: CEN2021120264

Sample Receiving date: 20-09-2021

Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021

Sample Source: Surface Water

Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.

Dist: Bagherhat, Upa: Rampal

Care Taker: CEGIS (Sample ID :SW-01)

Union; Vill: -

Sample Collection date: -

Date of Testing: 20/09/2021-30/11/2021



**LABORATORY TEST RESULTS:**

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Calcium (Ca)	75	36	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
5	Chloride	150-600	23	mg/L	Titrimetric	-
6	Bi-Carbonate (HCO <sub>3</sub> <sup>-</sup> )	0.0	100	mg/L	Titrimetric	-
7	Cr (Total)	0.05	0.033	mg/L	AAS	0.0003
8	Hardness	200-500	140	mg/L	Titrimetric	-
9	Iron (Fe)	0.3-1	5.69	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.017	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	20	mg/L	AAS	0.05
12	Phosphate	6.0	4.2	mg/L	UVS	0.10
13	Potassium (K)	12.0	9	mg/L	AAS	-
14	Sodium (Na)	200	13	mg/L	AAS	0.34
15	Total Dissolved Solid (TDS)	1000	58	mg/L	Multimeter	-
16	Total Suspended Solid (TSS)	10	12	mg/L	Gravimetric Method	-
17	Turbidity	10	162	NTU	Turbidity Meter	-
18	Carbonate (CO <sub>3</sub> )	-	0.22	mg/L	Titrimetric	-

Comments: Sample was collected & supplied by client.  
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

**Md. Biplab Hossain**  
Chief Chemist  
Department of Public Health Engineering  
Central Laboratory Mohakhali, Dhaka

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Lab Memo: 476/ CC, DPHE, CL, Dhaka

Date: 23-12-2021

**Physical /Chemical/ Bacteriological Analysis of Water Sample**





Sample ID: CEN2021120265	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-02)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021

**LABORATORY TEST RESULTS:**



Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.036	mg/L	AAS	0.0003
5	Hardness	200-500	200	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.019	mg/L	AAS	0.001
7	Phosphate	6.0	0.60	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	105	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	14	mg/L	Gravimetric Method	-

Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer Signature:  23.12.21	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23/12/2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Signature:  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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	<p align="center"><b>Government of the People's Republic of Bangladesh</b>  <b>Office of the Chief Chemist</b>  <b>Department of Public Health Engineering</b>  <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b>          Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com</p>	
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Lab Memo: 476/ CC, DPHE, CL, Dhaka

Date: 23-12-2021

**Physical /Chemical/ Bacteriological Analysis of Water Sample**

Sample ID: CEN2021120266	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-03)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021

**LABORATORY TEST RESULTS:**

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00019	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.033	mg/L	AAS	0.0003
5	Hardness	200-500	180	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.019	mg/L	AAS	0.001
7	Phosphate	6.0	0.54	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	106	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	9	mg/L	Gravimetric Method	-



Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer Signature:  23.12.21	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23/12/2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Signature:  Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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	<p align="center"><b>Government of the People's Republic of Bangladesh</b>  <b>Office of the Chief Chemist</b>  <b>Department of Public Health Engineering</b>  <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b>          Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com</p>	
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Lab Memo: 476/ CC, DPHE, CL, Dhaka

Date: 23-12-2021

**Physical /Chemical/ Bacteriological Analysis of Water Sample**





Sample ID: CEN2021120268	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-05)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021

**LABORATORY TEST RESULTS:**

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00024	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.023	mg/L	AAS	0.0003
5	Hardness	200-500	175	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.012	mg/L	AAS	0.001
7	Phosphate	6.0	2.1	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	97	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	11	mg/L	Gravimetric Method	-

Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer Signature:  23.12.21	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23.12.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Signature:  23.12.21 Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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	<p align="center"><b>Government of the People's Republic of Bangladesh</b>  <b>Office of the Chief Chemist</b>  <b>Department of Public Health Engineering</b>  <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b>          Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com</p>	
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Lab Memo: 476/ CC, DPHE, CL, Dhaka

Date: 23-12-2021

**Physical /Chemical/ Bacteriological Analysis of Water Sample**




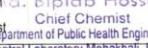
Sample ID: CEN2021120269	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-06)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021

**LABORATORY TEST RESULTS:**



Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	12	mg/L	CRM	-
4	Cr (Total)	0.05	0.029	mg/L	AAS	0.0003
5	Hardness	200-500	175	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.016	mg/L	AAS	0.001
7	Phosphate	6.0	3.4	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	110	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	8	mg/L	Gravimetric Method	-

Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer Signature:  23.12.21	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23.12.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Signature:  23.12.21 Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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	<p align="center"><b>Government of the People's Republic of Bangladesh</b>  <b>Office of the Chief Chemist</b>  <b>Department of Public Health Engineering</b>  <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b>          Phone: 88-02-9861927, Fax: 88-02-9862003, Email: wqmsc_central_lab@yahoo.com</p>	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021

## Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021120270	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-07)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021

## LABORATORY TEST RESULTS:



Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Calcium (Ca)	75	34	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
5	Chloride	150-600	37	mg/L	Titrimetric	-
6	Bi-Carbonate (HCO <sub>3</sub> <sup>-</sup> )	0.0	105	mg/L	Titrimetric	-
7	Cr (Total)	0.05	0.027	mg/L	AAS	0.0003
8	Hardness	200-500	140	mg/L	Titrimetric	-
9	Iron (Fe)	0.3-1	9.92	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.022	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	23	mg/L	AAS	0.05
12	Phosphate	6.0	5.4	mg/L	UVS	0.10
13	Potassium (K)	12.0	10	mg/L	AAS	-
14	Sodium (Na)	200	24	mg/L	AAS	0.34
15	Total Dissolved Solid (TDS)	1000	158	mg/L	Multimeter	-
16	Total Suspended Solid (TSS)	10	12	mg/L	Gravimetric Method	-
17	Turbidity	10	95.6	NTU	Turbidity Meter	-
18	Carbonate (CO <sub>3</sub> )	-	0.32	mg/L	Titrimetric	-

Comments: Sample was collected & supplied by client.  
 N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MF- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

**Md. Biplab Hossain**  
 Chief Chemist  
 Department of Public Health Engineering  
 Central Laboratory Mohakhali, Dhaka

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	<p align="center"><b>Government of the People's Republic of Bangladesh</b>  <b>Office of the Chief Chemist</b>  <b>Department of Public Health Engineering</b>  <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b>          Phone: 88-02-9861927, Fax: 88-02-9862003, Email: wqmsc_central_lab@yahoo.com</p>	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021





## Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021120271	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-08)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021

## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
4	Cr (Total)	0.05	0.025	mg/L	AAS	0.0003
5	Hardness	200-500	130	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.015	mg/L	AAS	0.001
7	Phosphate	6.0	3.7	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	110	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	9	mg/L	Gravimetric Method	-



Comments: Sample was collected & supplied by client.  
 N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MF- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	 23.12.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 23.12.2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 23.12.21	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	 23.12.2021

**Md. Biplab Hossain**  
 Chief Chemist  
 Department of Public Health Engineering  
 Central Laboratory Mohakhali, Dhaka

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Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021

## Physical /Chemical/ Bacteriological Analysis of Water Sample





Sample ID: CEN2021120272	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID: SW-09)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021



## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	12	mg/L	CRM	-
4	Cr (Total)	0.05	0.022	mg/L	AAS	0.0003
5	Hardness	200-500	100	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.016	mg/L	AAS	0.001
7	Phosphate	6.0	2.7	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	100	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	15	mg/L	Gravimetric Method	-

Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	 23.12.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 23.12.2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 23.12.21	2.) Name: Md. Biplob Hossain Designation: Chief Chemist	 23.12.2021

	<b>Government of the People's Republic of Bangladesh</b> <b>Office of the Chief Chemist</b> <b>Department of Public Health Engineering</b> <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b> Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021

## Physical /Chemical/ Bacteriological Analysis of Water Sample





Sample ID: CEN2021120273	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID: SW-10)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021



## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00033	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	16	mg/L	CRM	-
4	Cr (Total)	0.05	0.027	mg/L	AAS	0.0003
5	Hardness	200-500	145	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.022	mg/L	AAS	0.001
7	Phosphate	6.0	3.4	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	216	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	13	mg/L	Gravimetric Method	-

Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	 23.12.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 23.12.2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 23.12.21	2.) Name: Md. Biplob Hossain Designation: Chief Chemist	 23.12.2021

	<b>Government of the People's Republic of Bangladesh</b> <b>Office of the Chief Chemist</b> <b>Department of Public Health Engineering</b> <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b> <small>Phone: 88-02-9861927, Fax: 88-02-9862033, Email: wqmsc_central_lab@yahoo.com</small>	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021

## Physical /Chemical/ Bacteriological Analysis of Water Sample

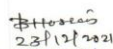
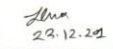
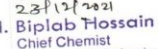
Sample ID: CEN2021120274	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Suface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-11)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021



## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	48	mg/L	CRM	-
4	Cr (Total)	0.05	0.017	mg/L	AAS	0.0003
5	Hardness	200-500	400	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
7	Phosphate	6.0	0.20	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	1270	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	3	mg/L	Gravimetric Method	-

Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	 23.12.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 23.12.2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 23.12.2021	2.) Name: Md. Biplob Hossain Designation: Chief Chemist	 23.12.2021

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Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021

## Physical /Chemical/ Bacteriological Analysis of Water Sample


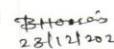
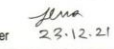
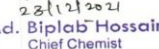
Sample ID: CEN2021120275	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Suface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-12)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021



## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	32	mg/L	CRM	-
4	Cr (Total)	0.05	0.040	mg/L	AAS	0.0003
5	Hardness	200-500	150	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.023	mg/L	AAS	0.001
7	Phosphate	6.0	0.27	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	180	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-

Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	 23.12.2021	1.) Name: Mita Sarker Designation: Senior Chemist	 23.12.2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	 23.12.2021	2.) Name: Md. Biplob Hossain Designation: Chief Chemist	 23.12.2021

	<b>Government of the People's Republic of Bangladesh</b> <b>Office of the Chief Chemist</b> <b>Department of Public Health Engineering</b> <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b> Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021





## Physical /Chemical/ Bacteriological Analysis of Water Sample



Sample ID: CEN2021120276	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-13)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021

## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	16	mg/L	CRM	-
4	Cr (Total)	0.05	0.031	mg/L	AAS	0.0003
5	Hardness	200-500	160	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.011	mg/L	AAS	0.001
7	Phosphate	6.0	1.9	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	240	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	9	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.  
 N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer Signature:  23.12.21	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23.12.2021 2.) Name: Md. Biplob Hossain Designation: Chief Chemist Signature:  Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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	<b>Government of the People's Republic of Bangladesh</b> <b>Office of the Chief Chemist</b> <b>Department of Public Health Engineering</b> <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b> Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021



## Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021120277	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-14)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021



## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	80	mg/L	CRM	-
4	Cr (Total)	0.05	0.025	mg/L	AAS	0.0003
5	Hardness	200-500	480	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.005	mg/L	AAS	0.001
7	Phosphate	6.0	0.87	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	1700	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	16	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.  
 N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.21	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23.12.21
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	<b>Government of the People's Republic of Bangladesh</b> <b>Office of the Chief Chemist</b> <b>Department of Public Health Engineering</b> <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b> Phone: 88-02-9861927, Fax: 88-02-9862003, Email: wqmsc_central_lab@yahoo.com	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021

## Physical /Chemical/ Bacteriological Analysis of Water Sample



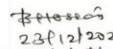

Sample ID: CEN2021120278	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Surface Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :SW-15)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021



## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	32	mg/L	CRM	-
4	Cr (Total)	0.05	0.034	mg/L	AAS	0.0003
5	Hardness	200-500	470	mg/L	Titrimetric	-
6	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
7	Phosphate	6.0	0.50	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	1610	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	13	mg/L	Gravimetric Method	-

Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer Signature:  23.12.21	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23.12.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Signature:  23.12.2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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	<b>Government of the People's Republic of Bangladesh</b> <b>Office of the Chief Chemist</b> <b>Department of Public Health Engineering</b> <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b> Phone: 88-02-9861927, Fax: 88-02-9862003, Email: wqmsc_central_lab@yahoo.com	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021

## Physical /Chemical/ Bacteriological Analysis of Water Sample



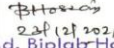
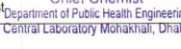
Sample ID: CEN2021120279	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Ground Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID :GW-01, Project site)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021



## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.012	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
3	Hardness	200-500	160	mg/L	Titrimetric	-
4	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
5	Phosphate	6.0	1.7	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	890	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

Comments: Sample was collected &amp; supplied by client.

N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer Signature:  23.12.21	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23.12.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Signature:  23.12.2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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	<b>Government of the People's Republic of Bangladesh</b> <b>Office of the Chief Chemist</b> <b>Department of Public Health Engineering</b> <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b> Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021


## Physical /Chemical/ Bacteriological Analysis of Water Sample



Sample ID: CEN2021120280	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Ground Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID: GW-02, Rajnagar)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021

## LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	195	mg/L	Titrimetric	-
4	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
5	Phosphate	6.0	1.2	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	360	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.  
 N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.2021	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23.12.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Signature:  23.12.21 Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
---	---

	<b>Government of the People's Republic of Bangladesh</b> <b>Office of the Chief Chemist</b> <b>Department of Public Health Engineering</b> <b>Central Lab, 38-39, Mohakhali C/A, Dhaka-1212</b> Phone: 88-02-9881927, Fax: 88-02-9882003, Email: wqmsc_central_lab@yahoo.com	
Lab Memo: 476/ CC, DPHE, CL, Dhaka		Date: 23-12-2021





## Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2021120281	Sample Receiving date: 20-09-2021
Ref. Memo No: 42.06.2626.119.37.001.21-1928 & Dated: 19-09-2021	Sample Source: Ground Water
Sent by: Mohammed Mukteruzzaman, Director, P, E & Mineral Resources Division, CEGIS, Gulshan-1, Dhaka.	Dist: Bagerhat, Upa: Rampal
Care Taker: CEGIS (Sample ID: GW-02, Karpasdanga)	Union:, Vill.:
Sample Collection date:	Date of Testing: 20/09/2021-30/11/2021


## LABORATORY TEST RESULTS:


Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.061	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	140	mg/L	Titrimetric	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Phosphate	6.0	5.0	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	610	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	2	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.  
 N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, MFM- Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ- Limit of Quantitation.

<b>Test Performed by:</b> 1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer Signature:  23.12.2021 2.) Name: Taslima Akhter Designation: Sample Analyzer Signature:  23.12.21	<b>Countersigned/Approved by:</b> 1.) Name: Mita Sarker Designation: Senior Chemist Signature:  23.12.2021 2.) Name: Md. Biplab Hossain Designation: Chief Chemist Signature:  23.12.21 Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
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		জীবনের জন্য বিজ্ঞান শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন		
বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)				
Institute Name: Institute of National Analytical Research & Service (INARS)				
Analysis Report				
Analytical Service Cell Ref No: Sep2021031727		Unit (Lab/Inst.) Ref No: A-248-252		
Lab ID: INS-248-252		Sample Receiving Date: 26/09/2021		
Sample ID: A-248-252		Submission Date: 23 Sep 2021		
		Report Delivery Date: 01/11/2021		
Sample Description: Jetty site, Maidara, Mongla, Harbaria, Akram point				
Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216				
Number of Sample: 5				
Report Details:				
Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-248	Soil (Sample-01, Jetty Site)	Arsenic (As)	3.42 mg/kg	3114.C
		Lead (Pb)	5.51 mg/kg	3111.B
		Mercury (Hg)	0.02 mg/kg	3112.B
		pH at 25.1°C	7.99 (5% Solution)	4500-H'.B
		Sulphate (SO <sub>4</sub> )	89.4 mg/kg	4110.B



**Note:**

a. The results reported here pertained to the sample received in this laboratory only.


b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.


c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory.

d. The report shall not be reproduced/published partly or fully without prior approval of the authority.

Analytical Service Cell  
 Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh  
 Telephone: 9671108, Fax: 88-02-9671108 E-mail: asc@bcsir.gov.bd Website: www.bcsir.gov.bd

1st of November 2021 01:07 PM

		জীবনের জন্য বিজ্ঞান শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন		
বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)				
Institute Name: Institute of National Analytical Research & Service (INARS)				
Analysis Report				
Analytical Service Cell Ref No: Sep2021031727		Unit (Lab/Inst.) Ref No: A-248-252		
Lab ID: INS-248-252		Sample Receiving Date: 26/09/2021		
Sample ID: A-248-252		Submission Date: 23 Sep 2021		
		Report Delivery Date: 01/11/2021		
Sample Description: Jetty site, Maidara, Mongla, Harbaria, Akram point				
Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216				
Number of Sample: 5				
Report Details:				
Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-248	Soil (Sample-01, Jetty Site)	Arsenic (As)	3.42 mg/kg	3114.C
		Lead (Pb)	5.51 mg/kg	3111.B
		Mercury (Hg)	0.02 mg/kg	3112.B
		pH at 25.1°C	7.99 (5% Solution)	4500-H'.B
		Sulphate (SO <sub>4</sub> )	89.4 mg/kg	4110.B



**Note:**

a. The results reported here pertained to the sample received in this laboratory only.

b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.



c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory.



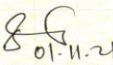

d. The report shall not be reproduced/published partly or fully without prior approval of the authority.

Analytical Service Cell  
 Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh  
 Telephone: 9671108, Fax: 88-02-9671108 E-mail: asc@bcsir.gov.bd Website: www.bcsir.gov.bd


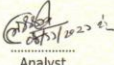
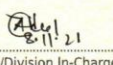
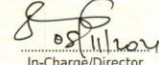
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		জীবনের জন্য বিজ্ঞান 'শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন' বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)		
Institute Name: Institute of National Analytical Research & Service (INARS)				
Analysis Report				
Analytical Service Cell Ref No: Sep2021031723 Lab ID: INS-222-239 Sample ID: A-222-239		Unit (Lab/Inst.) Ref No: A-222-239 Sample Receiving Date: 26/09/2021 Submission Date: 23 Sep 2021 Report Delivery Date: 01/11/2021		
Sample Description: Sample No : 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15 : Rajnagar, Kapashdanga, Power plant ground water				
Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216				
Number of Sample: 18				
Report Details:				
Lab ID	Particulars of supplied sample	Parameter	Concentration	Test Method (APHA)
A-222	Water (Sample-01)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-223	Water (Sample-02)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-224	Water (Sample-03)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-225	Water (Sample-04)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-226	Water (Sample-05)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-227	Water (Sample-06)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-228	Water (Sample-07)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-229	Water (Sample-08)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-230	Water (Sample-09)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
 <p>Note:</p> <p>a. The results reported here pertained to the sample received in this laboratory only.</p> <p>b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.</p> <p>c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory.</p> <p>d. The report shall not be reproduced/published partly or fully without prior approval of the authority.</p>				
Analytical Service Cell Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh Telephone: 9671108, Fax: 88-02-9671108 E-mail: asc@bcsir.gov.bd Website: www.bcsir.gov.bd				
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		জীবনের জন্য বিজ্ঞান 'শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন' বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)																																														
<table border="1"> <tr> <td>A-231</td> <td>Water (Sample-10)</td> <td>Mercury (Hg)</td> <td>Less than 0.001 mg/L</td> <td>3112.B</td> </tr> <tr> <td>A-232</td> <td>Water (Sample-11)</td> <td>Mercury (Hg)</td> <td>Less than 0.001 mg/L</td> <td>3112.B</td> </tr> <tr> <td>A-233</td> <td>Water (Sample-12)</td> <td>Mercury (Hg)</td> <td>Less than 0.001 mg/L</td> <td>3112.B</td> </tr> <tr> <td>A-234</td> <td>Water (Sample-13)</td> <td>Mercury (Hg)</td> <td>Less than 0.001 mg/L</td> <td>3112.B</td> </tr> <tr> <td>A-235</td> <td>Water (Sample-14)</td> <td>Mercury (Hg)</td> <td>Less than 0.001 mg/L</td> <td>3112.B</td> </tr> <tr> <td>A-236</td> <td>Water (Sample-15)</td> <td>Mercury (Hg)</td> <td>Less than 0.001 mg/L</td> <td>3112.B</td> </tr> <tr> <td>A-237</td> <td>Water (Sample-16, Rajnagar)</td> <td>Mercury (Hg)</td> <td>Less than 0.001 mg/L</td> <td>3112.B</td> </tr> <tr> <td>A-238</td> <td>Water (Sample-17, Kapashdanga)</td> <td>Mercury (Hg)</td> <td>Less than 0.001 mg/L</td> <td>3112.B</td> </tr> <tr> <td>A-239</td> <td>Water (Sample-18, Power plant ground water)</td> <td>Mercury (Hg)</td> <td>Less than 0.001 mg/L</td> <td>3112.B</td> </tr> </table>				A-231	Water (Sample-10)	Mercury (Hg)	Less than 0.001 mg/L	3112.B	A-232	Water (Sample-11)	Mercury (Hg)	Less than 0.001 mg/L	3112.B	A-233	Water (Sample-12)	Mercury (Hg)	Less than 0.001 mg/L	3112.B	A-234	Water (Sample-13)	Mercury (Hg)	Less than 0.001 mg/L	3112.B	A-235	Water (Sample-14)	Mercury (Hg)	Less than 0.001 mg/L	3112.B	A-236	Water (Sample-15)	Mercury (Hg)	Less than 0.001 mg/L	3112.B	A-237	Water (Sample-16, Rajnagar)	Mercury (Hg)	Less than 0.001 mg/L	3112.B	A-238	Water (Sample-17, Kapashdanga)	Mercury (Hg)	Less than 0.001 mg/L	3112.B	A-239	Water (Sample-18, Power plant ground water)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-231	Water (Sample-10)	Mercury (Hg)	Less than 0.001 mg/L	3112.B																																												
A-232	Water (Sample-11)	Mercury (Hg)	Less than 0.001 mg/L	3112.B																																												
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A-234	Water (Sample-13)	Mercury (Hg)	Less than 0.001 mg/L	3112.B																																												
A-235	Water (Sample-14)	Mercury (Hg)	Less than 0.001 mg/L	3112.B																																												
A-236	Water (Sample-15)	Mercury (Hg)	Less than 0.001 mg/L	3112.B																																												
A-237	Water (Sample-16, Rajnagar)	Mercury (Hg)	Less than 0.001 mg/L	3112.B																																												
A-238	Water (Sample-17, Kapashdanga)	Mercury (Hg)	Less than 0.001 mg/L	3112.B																																												
A-239	Water (Sample-18, Power plant ground water)	Mercury (Hg)	Less than 0.001 mg/L	3112.B																																												
 Analyst Md. Abu Bakar Siddique Senior Scientific Officer Institute of National Analytical Research and Service (INARS) BCSIR, Dhaka-1205.		 In-Charge/Director Shamim Ahmed Director (In-Charge) Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205																																														
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		জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন"		
বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)				
Institute Name: Institute of National Analytical Research & Service (INARS)				
Analysis Report				
Analytical Service Cell Ref No: Sep2021031724		Unit (Lab/Inst.) Ref No: A-240-242		
Lab ID: INS-240-242		Sample Receiving Date: 26/09/2021		
Sample ID: A-240-242		Submission Date: 23 Sep 2021		
		Report Delivery Date: 01/11/2021		
Sample Description: Jetty, Harbaria, Hiron pont				
Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216				
Number of Sample: 3				
Report Details:				
Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-240	Water (Sample: 01, Jetty Site)	TOC (Total Organic Carbon)	Less than 5.0 mg/L	5310.B
		TOC (Total Organic Content)	250 mg/L	5310.B
A-241	Water (Sample: 02, Harbaria)	TOC (Total Organic Carbon)	20.2 mg/L	5310.B
		TOC (Total Organic Content)	200 mg/L	5310.B
A-242	Water (Sample: 03, Hiron Point)	TOC (Total Organic Carbon)	Less than 5.0 mg/L	5310.B
		TOC (Total Organic Content)	544 mg/L	5310.B
 Analyst Md. Mijal Uddin Scientific Officer Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205				
 Section/Division In-Charge				
 In-Charge/Director Shamim Ahmed Director (In-Charge) Institute of National Analytical Research & Service (INARS) BCSIR, Dhaka-1205				
Note: a. The results reported here pertained to the sample received in this laboratory only. b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date. c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory. d. The report shall not be reproduced/published partly or fully without prior approval of the authority.				
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		জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন"		
বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)				
Institute Name: Institute of National Analytical Research & Service (INARS)				
Analysis Report				
Analytical Service Cell Ref No: Sep2021031724		Unit (Lab/Inst.) Ref No: A-240-242		
Lab ID: INS-240-242		Sample Receiving Date: 26/09/2021		
Sample ID: A-240-242		Submission Date: 23 Sep 2021		
		Report Delivery Date: 01/11/2021		
Sample Description: Jetty, Harbaria, Hiron pont				
Client's Details: Mahadi Hassan Center For Environmental And Geographic Information Services House#House No. 06, , Road No. 23/C, Dhaka-1216				
Number of Sample: 3				
Report Details:				
Lab ID	Particulars of supplied sample	Parameters	Concentration (mg/L)	Test Method (APHA)
				
				
Note: a. The results reported here pertained to the sample received in this laboratory only. b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date. c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory. d. The report shall not be reproduced/published partly or fully without prior approval of the authority.				
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		জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন"	
বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)			
A-240	Water, Poly Aromatic Hydrocarbon (PAH) Sample: 01, Jetty Site	Acenaphthylene	ND 6440.B
		Anthracene	ND 6440.B
		Benzo(A) Anthracene	ND 6440.B
		Benzo(A) Pyrene	ND 6440.B
		Benzo(B) Fluoranthene	ND 6440.B
		Benzo(G,H,I) Perilene	ND 6440.B
		Benzo(K) Fluoranthene	ND 6440.B
		Chrysene	ND 6440.B
		Dibenzo(A,H) Anthracene	ND 6440.B
		Fluorene	ND 6440.B
		Phenanthrene	ND 6440.B
		Pyrene	ND 6440.B
A-241	Water, Poly Aromatic Hydrocarbon (PAH) Sample: 02, Harbaria	Acenaphthylene	ND 6440.B
		Anthracene	ND 6440.B
		Benzo(A) Anthracene	ND 6440.B
		Benzo(A) Pyrene	ND 6440.B
		Benzo(B) Fluoranthene	ND 6440.B
		Benzo(G,H,I) Perilene	ND 6440.B
		Benzo(K) Fluoranthene	ND 6440.B
		Chrysene	ND 6440.B
		Dibenzo(A,H) Anthracene	ND 6440.B
		Fluorene	ND 6440.B
		Phenanthrene	ND 6440.B
		Pyrene	ND 6440.B





Note:

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 Telephone: 9671108, Fax: 88-02-9671108 E-mail: asc@bcsir.gov.bd Website: www.bcsir.gov.bd

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		জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন সব মানুষের উন্নয়ন"	
বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর) BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)			
A-242	Water, Poly Aromatic Hydrocarbon (PAH) Sample: 03, Hiron Point	Acenaphthylene	ND 6440.B
		Anthracene	ND 6440.B
		Benzo(A) Anthracene	ND 6440.B
		Benzo(A) Pyrene	ND 6440.B
		Benzo(B) Fluoranthene	ND 6440.B
		Benzo(G,H,I) Perilene	ND 6440.B
		Benzo(K) Fluoranthene	ND 6440.B
		Chrysene	ND 6440.B
		Dibenzo(A, H) Anthracene	ND 6440.B
		Fluorene	ND 6440.B
		Phenanthrene	ND 6440.B
		Pyrene	ND 6440.B



Note:

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08.11.2021  
 Analyst  
 A. H. M. Shofiqul Islam Molla Jamal  
 Senior Scientific Officer  
 Institute of National Analytical Research & Service (INARS)  
 BCSIR, Dhaka-1205.

08.11.2021  
 Section/Division In-Charge  
 Shamim Ahmed  
 Director (In-Charge)  
 Institute of National Analytical Research & Service (INARS)  
 BCSIR, Dhaka-1205.






জীবনের জন্য বিজ্ঞান

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)

BAKLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)

Institute Name: Institute of National Analytical Research & Service (INARS)

**Analysis Report**



ANALYTICAL SERVICE CELL

ACCREDITED TO ISO/IEC 17025:2005

Analytical Service Cell Ref No: Sep2021031725

Unit (Lab/Inst.) Ref No: A-243-247

Lab ID: INS-243-247

Sample Receiving Date: 26/09/2021

Sample ID: A-243-247

Submission Date: 23 Sep 2021

Report Delivery Date: 01/11/2021

Sample Description: Maidara, Mongla, Harbaria, Akram point, Hiron point

Client's Details: Mahadi Hassan  
Center For Environmental And Geographic Information Services  
House#House No. 06, Road No. 23/C, Dhaka-1216

Number of Sample: 5

**Report Details:**

Lab ID	Particulars of supplied sample	Parameters	Concentration	Test Method (APHA)
A-243	Water (Sample:01, Maidara)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-244	Water (Sample:02, Mongla)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-245	Water (Sample:03, Harbaria)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-246	Water (Sample:04, Akram Point)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-247	Water (Sample:05, Hiron Point)	Oil and Grease	Less than 2.0 mg/L	5520.B

*(Signature)*  
01.11.2021  
Analyst

**A. H. M. Shofiqul Islam Molla Jamal**  
Senior Scientific Officer  
Institute of National Analytical Research & Service (INARS)  
BCSIR, Dhaka-1205.

*(Signature)*  
01.11.21  
Section/Division In-Charge

**Shamim Ahmed**  
Director (In-Charge)  
Institute of National Analytical Research & Service (INARS)  
BCSIR, Dhaka-1205

*(Signature)*  
01.11.21  
In-Charge/Director

**Note:**

a. The results reported here pertained to the sample received in this laboratory only.

b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.

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Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh

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অধ্যাপক ড. মোহম্মদ হোসেন

**ফরেস্ট্রি এন্ড উড টেকনোলজি ডিসিপ্লিন**

খুলনা বিশ্ববিদ্যালয়, খুলনা-৯২০৮

বাংলাদেশ।



Prof. Dr. Mahmood Hossain

**Forestry & Wood Technology Discipline**

Khulna University, Khulna-9208

Bangladesh.

**Results for June 2021 Samples**

Serial no	Layer	Sample weight for Bulk density (g)	Organic carbon (%)	EC (ms/cm)	pH	Nitrogen final concentration (mg/g)	Phosphorus final concentration (mg/g)
1	0-15	84.79	3.20	3.9	6.94	0.5902	0.448
2	15-30	104.21	2.55	3.23	7.44	0.773	0.526
3	30-50	115.01	2.39	4.28	7.63	0.3228	0.46
4	50-100	114.81	2.06	4.97	7.55	0.4978	0.494
5	0-15	93.85	2.66	1.97	7.76	1.1576	0.486
6	15-30	105.88	2.10	2.71	7.64	0.6102	0.404
7	30-50	105.2	2.28	3.67	7.51	1.0856	0.404
8	50-100	115.54	2.20	5.87	7.56	0.4256	0.548
9	0-15	108.37	2.42	3.72	7.59	0.6504	0.412
10	15-30	118.32	1.90	3.95	7.45	0.5478	0.51
11	30-50	116.91	2.31	5.99	7.18	0.8142	0.46
12	50-100	109.44	2.38	7.09	7.25	0.7346	0.462
13	0-15	79.88	3.20	4.51	7.78	1.1116	0.478
14	15-30	76.39	3.62	2.76	7.66	1.0476	0.416
15	30-50	65.6	2.82	2.64	7.45	1.0498	0.422
16	50-100	74.46	3.02	1.93	7.28	1.1842	0.428
17	0-15	106.49	1.52	1.8	7.67	0.6198	0.442
18	15-30	110.55	1.39	3.5	7.58	0.37	0.398
19	30-50	124.37	1.36	3.94	7.62	0.7128	0.45
20	50-100	111.5	1.41	4.04	7.67	0.4862	0.35
21	0-15	93.22	3.38	1.87	7.71	1.032	0.45
22	15-30	97.63	3.22	3.37	7.57	1.075	0.69
23	30-50	103.2	3.13	4.67	7.55	0.6714	0.358
24	50-100	106.78	2.68	3.26	7.38	0.5316	0.454
25	0-15	130.73	0.80	0.37	7.8	0.2988	0.898
26	15-30	144.37	1.10	0.32	7.79	0.3146	0.806
27	30-50	132.19	0.64	1.12	7.25	0.023	0.664
28	50-100	140.67	2.10	1.13	7.69	0.1904	0.394
29	0-15	140.92	0.59	1.75	7.62	0.1802	0.728
30	15-30	119.32	2.41	2.28	7.45	0.4518	0.508
31	30-50	124.93	1.91	3.4	7.53	0.6372	0.474
32	50-100	128.45	1.86	3.39	7.65	0.8408	0.43
33	0-15	107.04	2.17	3.43	7.4	0.8072	0.44
34	15-30	110.38	1.69	4.4	7.44	0.4736	0.38
35	30-50	127.06	1.56	5.74	7.36	0.7638	0.398
36	50-100	127.37	1.47	4.19	7.38	0.5702	0.424
37	0-15	88.08	1.80	2.39	7.72	0.686	0.294
38	15-30	117.28	2.04	4.35	7.55	0.5406	0.424
39	30-50	104.94	2.55	4.88	7.17	0.7148	0.464
40	50-100	115.77	1.57	4.54	7.21	0.4548	0.43
41	0-15	123.23	2.43	1.47	7.8	0.5322	0.448
42	15-30	104.55	2.48	4.33	7.66	0.5648	0.394
43	30-50	114.67	2.64	4.41	7.57	0.6998	0.386
44	50-100	124.95	2.06	4.48	7.67	0.4418	0.406
45	0-15	112.06	2.39	1.45	7.4	1.0226	0.46
46	15-30	119.56	2.32	5.94	7.35	1.2004	0.448
47	30-50	113.69	2.16	4.85	7.34	0.4142	0.42
48	50-100	132.69	2.03	4.71	7.47	0.5994	0.422
49	0-15	130.56	1.79	2.03	7.65	0.7786	0.428
50	15-30	135.73	2.49	5.5	7.45	1.5482	0.458
51	30-50	128.81	2.15	4.46	7.67	1.0242	0.496
52	50-100	122.81	2.24	5.62	7.69	0.8006	0.452
53	0-15	117.78	2.07	5.74	7.8	0.7138	0.376
54	15-30	116.88	1.91	5.79	7.81	0.6688	0.396
55	30-50	122.38	1.73	4.98	7.77	0.6428	0.398
56	50-100	102.45	1.38	1.53	7.65	0.6934	0.4
57	0-15	112.52	2.05	3.82	7.71	0.9188	0.376
58	15-30	106.75	1.81	4.84	7.77	0.8658	0.414
59	30-50	104.04	1.85	2.48	7.8	0.577	0.418
60	50-100	113.17	1.20	1.75	7.82	0.6506	0.434

Phone: (PABX) 041-720171-3, 724717 Ext.-2111 (Off) Fax: 880-41-731244, 880-41-724717

E-mail: mahmoodhossain@hotmail.com