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

27th Quarter Monitoring Report

Monitoring Period: November 2020 – January 2021

May 2021

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Acknowledgements

The Center for Environmental and Geographic Information Services (CEGIS) is indebted to Bangladesh-India Friendship Power Company (Pvt.) Limited (BIFPCL) for awarding the contract on ***"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."*** to CEGIS. The current document constitutes 27th quarterly monitoring aspects covering all the preselected parameters and locations as specified in EIA of Power plant as well as EIA of coal transportation.

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Table of Contents

List of Tables

List of Figures

Abbreviations and Acronyms

AAS	Atomic Absorption Spectrophotometer
AECL	Adroit Environment Consultants Ltd
As, Pb, Hg	Arsenic, Lead and Mercury
BCSIR	Bangldesh 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 = 10-2 km2 = 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/m3≈1 ppm (w/w)

1 mg/m3 = 1 µg /L

1 pascal = 1 N/m2= 0.01 millibar

1 square mile = 640 acre = 2.590 km2

Energy Units

1 GWyr = 8.76 x 109 kW

1 horsepower = 746 W

1 KWh = 3412 Btu

1 kWh = 859.85 kcal

1 KWh = 3.6 x 106 J

1MW=1000KW=106W

Glossary

Aman:	Group of rice varieties grown in the monsoon season and harvested in the post-monsoon season. This is generally transplanted at the beginning of monsoon from July-August and harvested in November-Dec. Mostly rain-fed, supplemental irrigation needed in places during dry spell.
Aus:	Group of rice varieties sown in the pre-monsoon season and harvested in the monsoon season. These are broadcasted/transplanted during March-April and harvested during June-July. Generally, rain-fed, irrigation needed for HYVT. (High yield variety) Aus.
B Aus:	Broadcast Aus
Bazar:	Market
Beel:	A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.
Boro:	A group of rice varieties sown and transplanted in winter and harvested at the end of the pre-monsoon season. These are mostly HYV and fully irrigated, planted in December-January and harvested before the onset of monsoon in April- May.
Haat:	Market place where market exchanges are carried out either once, twice or thrice a week, however not every day.
Gear/Jaal:	Different types of fishing net to catch fish from the water bodies.
Kutcha:	A house made of locally available materials with earthen floor, commonly used in the rural areas.
Khal:	A drainage channel usually small, sometimes man-made through which the water flows. These may or may not be perennial.
Kharif:	Pre-monsoon and monsoon growing season. Cropping season linked to monsoon between March-October, often divided into kharif-1 (March-June) and kharif-2 (July-October).
Perennial Khal:	Water available in the khal all the year round.
Pacca:	Well-constructed building using modern masonry materials.
Rabi:	Dry agricultural crop growing season; mainly used for the cool winter season between November and February.
Seasonal Khal:	Water not available in the khal all the year round.
T. *Aman*:	Transplanted Aman
Upazila:	Upazila is an administrative subdivision of a District.

Executive Summary

This 27th quarterly monitoring report covers the status of EMP (Environmental Management Plan) implementation 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 monthe of January, 2021 CEGIS team carried out the monitoring activities covering every monitoring aspects as assigned in the ToR (Terms of Reference) and mentioned in the 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.

At the initial stage of this pandemic, the project implementation activities were like extension and development of internal road network, jetty construction activities, construction of key components, mechanical and civil infrastructure development works etc. After withdrawal of government holiday/lockdown due to the pandemic outbreak, the project authority again started to work carefully step by steps prioritizing the health issues for the workers and officers.

The monitoring activities regarding compliances covers the status of Environmental Management System Action Plan, Occupational Health and Safety & Workers' wellbeing, Biodiversity and Sustainable Management of Natural Resources etc. The monitoring team observed that BIFPCL is typically complying the EMPs as suggested in the EIA report of the Power Plant as well as in the EIA report of Coal Transportation. In addition, as an Environmental Monitoring agency, CEGIS has also recommended few measures as per EMP to be complied for ensuring environmental and social safeguarding of the project activities over the study area.

The recommendations include appropriate and adequate use of face mask and safeguarding of other health rules concerning COVID-19 situation, protection of waste water dumping from labour colony to the nearby water bodies, continuing the river bank protection works, restricting groundwater extraction, hastening the green belt development, raising awareness among the workers for managing the COVID-19 outbreak, blocking off areas where heavy machinery or vehicles are being used, proper implementation for workers association and insurance policies, placement of sufficient waste coloured disposal bins in appropriate locations and most importantly, the continuous inspection of occupational and health safety by the project authority.

According to the document of BIFPCL, the Occupational Health and Safety Policies; grievance redress mechanism; Emergency preparedness and response plan; Fire safety plan; Stakeholder Engagement Plan etc. are being implemented as required. Most importantly, the EPC contractor has continued the specific measures/initiatives for avoiding any unintentional incidents like disease outbreak and accidental incidents. OHS department are arranging robust training sessions, health check-up, thermal scanning and proper hygiene system for COVID protection, employing lockout/ tag out procedures, inspection of all machineries/equipment and tools to ensure that they are in good working order, ensuring license or proper training for workers/drivers/operators/supervisors to operate machineries/equipment/tools and vehicles etc. They are also documenting the daily monitoring of EMP implementation activities like use of PPEs, noise level and water sprinkling at the sensitive places.

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. During the monitoring period concentration of the particulate matter was found higher than the standard limit at Khan Jahan Ali Bridge area, Access road bridge area which might be due to the seasonal effect on air quality and increased

vehicular movement in that area. On the other hand, due to the increased construction activity and vehicular movement inside the plant area, the concentration of the particulate matter was also found higher than the standards of DOE. In order to minimize the particulate matter concentration inside the power plant, the authority needs to implement the necessary initiatives e.g. continuous or periodic water spraying on the connected road networks, install water sprinkler system at the prominent infrastructures like office areas, township area etc., strictly maintains the vehicular speed at the sensitive areas and maintain the EMPs as stated in the EIA study of the power plant. Cluster analysis of the air quality data shows that, Hiron point, Akram Point and Harbaria of Sundarbans represents the locations of minimum pollution level and are away from the nuclei of Mongla industrial zone and the project area. In contrast, Chalna, Mongla Ghat, and Khan Jahan Ali Bridge in Khulna represent the area of maximum pollution as these areas are subjected to higher in population density and increased industrial activities among all sites whereas moidara shapmari, Gaurambha and Bajua represent lower in population density and moderate commercial activities with moderate pollution level.

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 of boiler and chimney, dust from unpaved roads and vehicle movement, construction materials and goods transportation activities through the roads etc. Other sources of pollutants which may contribute to the existing pollution load are the small industries situated around the plant area like cement works and refinery industries etc., diffuse of sources like wood stoves, fires, and wind generated dust etc.

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.

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. During the 27th quarterly monitoring (January, 2021) period, physical condition of the Passur-Sibsa RS was found fairly healthy. There were some fluctuations in the concentrations among different sites only. In addition, pH, Temperature and DO level was found good enough at the project site and in the deep mangrove forests.

TDS, TH and TSS concentration in the observed RS found compatible to national and international standards. Higher COD than permissible limit was found in the deep forests mainly. This may be the effect of sediment loads and high nutrients from the Bay of Bengal. Nitrate (NO_3^-) found in a very standard range in respect to a natural river. On contrary, Phosphate (PO_4^{3-}) showed higher concentrations in two sites of Mongla-Passur Confluence and the Maidara River which could be the agricultural run-off from the upper portion of the adjacent channels.

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, which is even less than half of the recommended concentration (10.0 mg/L) for Inland Surface Water Quality recommended for Bangladesh

It has also been observed that the physical characteristics of groundwater quality is still in good condition and in acceptable state for drinking purpose except slight salinity in the observed water. This salinity might be the reason of saline water infiltration due to excessive withdrawn by the surrounding communities during the dry season. In addition, evaporation is also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes. Chemical characteristics of the groundwater quality was also found suitable and safe to drink as per the recommended limit of Bangladesh (Drinking water standards, ECR'1997). In respect to COD, Nitrate and Phosphate the status is also the same. The observed groundwater is completely free from the heavy metal pollution of Arsenic, Lead, and Mercury till to date

The soil analysis report for the wet season revealed that the salinity of the monitoring plots was increasing.

Base cation concentrations were found in an elevated level at almost all monitoring locations. Manganese (Mn) concentration was found in excessive level at all the spots which might be an immediate impact of increasing salinity. Lead (Pb) concentration was found decreased at all the locations except Bidyarbon. Moreover, presence of Cadmium (Cd) was observed at four locations (Kapaliermet, Chakgna, Bidarbon and Basherhula). But the interesting thing was that the Cd concentration was found higher in substratum than top soil. It indicates Cd is coming from lower horizons which might not be an anthropogenic cause. Agricultural and livestock data was not collected during this monitoring field visit as per TOR obligation. Next survey will be conducted in April, 2021 and report will be incorporated.

Traffic surveys were carried out at three preselected locations around the project site namely Khudir Bottola area, Gonai Bridge at Khulna Mongla Road and Gonabelai/taltola Bridge at Power Plant access road. The analyzed data represents that the Khulna-Mongla Highway receives the largest number of vehicles, compared to other surveyed roads. It was also observed that the vehicular movements during the survey were mostly for the regular activities and rigorous construction activity of the MSTPP in the digraj and vaga region.

Monitoring of 27th 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 eight (05) sites as fishing in other sites in the river were not observed. Amongst the effective sites, five (05) were in the river and three (03) were in the country side (shrimp farms). The followings are the key findings of the 27th quarter monitoring in the fiscal year of 2020-21. 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 and 2019-20), 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) spawning and nursery ground and ii) maturation ground. Shannon-Weiner diversity index has also been observed to vary between 27th quarters with that of all previous quarters. Highest Shannon-Weiner index was found at Akram Point (0.59) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at Mongla Point (0.12). However, maximum FSR was obtained in the Charaputia Khal (n=28), while very low FSR was recorded at Mongla Point (n=3). Fries of fin fish were dominated at three sampling sites i.e. Chalna, Mongla and Chandpai Point but juvenile to adult age group were dominant at Charaputia and Akram Point. Among the fishes Chamua Chingri, Harina, Paissa, Mokta were dominant in the three sampling sites. Fish species like Paissa attain the maximum abundance among the migratory fish species observed in the 27th quarter of monitoring year, 2020-21. Moreover, among migratory species, Paissa, Chela and Baila were observed to migrate long distance. The present study revealed that the highest catch susceptibility was also found in case of Charpata Jal (11.0 kg/haul). In this monitoring, the highest stocking rate in respect of Bagda was observed in Rajnagar Gher followed by Kapashdanga Gher.

In course of ecological monitoring the important ecological component like vegetation composition, plant diversity, vegetation canopy status, plant health, bird habitat status, dolphin occurrence in river systems were monitored for this monitoring season. A total of 53 tree species were recorded from all the monitoring sites with Shanon-Winner diversity index of 3.16. Like previous monitoring tier, vegetation health and canopy status revealed poor condition at Rajnagar site while some were found logged due to land filling activity by the home owner. Coconut tree was found as mostly affected plant species. Except Rajnagar other three site's plant health showd improved trend. Similarly, two bird nest were observed at Rajnagar site whereas occurrence of overseas migratory birds was only seen at large shrimp farm of Kaigardaskathi. Out of seven wetlands, local migratory birds were observed only at five sites. It was reported by the local people that the overseas winter migratory birds were disturbed from the noise and lightings during the night time construction sites. On the other hand, dolphin occurrence was recorded at Passur and Maidara River and some connected tributaries of Passur River like Shella Gang, Dhangmari and Bhadra Khal. The occurrence followed high in Maidara and Bhadra Khal and encounter rate was 8 and 2.98 Individual/km/hour.

Forest Health Monitoring program intended to decide the status, changes, and patterns in pointers of trees condition on certain time between time premise along the Passur River. To discern the true scenario of power plant impact on forest health, it is mandatory to create a baseline condition. Taking this into consideration, CEGIS is conducting forest health monitoring program at five locations namely Sutarkhali, Karamjal, Harbaria, Akram point and Hiron Point at Sundarbans Reserve Forest (SRF) along the Passur River. The Checking markers included plant growth, tree regeneration, tree crown condition, tree damage, lichen network, plant diversity, soil chemistry, and plant physiology were seen in the permanent sample plots (PSPs).it can be predicted in terms of seedling density, pneumatophores, crab hole, canopy cover and leaf area index (m^2 leaf area/m^2 ground area) that the forest condition is demonstarting positive changes intermittently, in spite of the fact that there has some occasional impact. Phonological changes were not found in all PSPs. The Sundarbans forest health is being monitored quarterly as per monitoring schedule and so far, twenty seventh(27^{th}) surveys were conducted at five locations, namely Sutarkhali, Karamjal, Harbaria, Akram point and Hiron point. Seedling perchantage is increase in all PSPs from the last tier but Sedimentation rates are comparatively high in Hiron point almost 25inch. In addition, logging is severely affected at Koromjol and Harbaria. The complex species sundari have been affected in top dying in Harbaria point. Koromjol have great species diversity with wealth regeneration process. Among the species, the height of Baen and Kakra is good in number. The Akram point is situated at the confluence of Shibsa and Passur River.The area have subjected to excessive erosion day by day. Therefore, our first subplot of Akram point has already fall in river and we should have taken another sub plot in this plot. During tidal inflow the forest floor carry large amount of soil sediment than other locations. The number of crab hole increase in this site but the other parameter has no significant change. Generally, it tends to be said that forest health condition along the Passur River is in stable condition.

This monitoring conducted (from November 2020 –January 2021) to understand the status of impacts on livelihoods, working environment, community health and activities under the Corporate Social Responsibility (CSR). Physical observation, telephonic interview, and Face to face interviews were applied as tools for collecting information on social safeguard issues.

Local labors are getting working opportunities based on their skills. People at now have the positive attitudes getting more livelihoods options and business opportunity due to the project intervention. Communication development has made a contribution in which their capacity increases to promote than the previous time. Additionally, about 200 people were registered (under the motor vehicle federation) to run motor vehicles to carry both goods and passenger. Local people are getting interest and learn different skills as they can join in future.

The PMU trained the labor force to obey the health safety rules. Regular tool box training held before starting work to improve the working condition. Debriefing session also held with the BIFPCL to monitor the noncompliance issues. Furthermore, Labor sheds found clean with adequate toilet facilities, drainage, and waste management and drinking water facilities.

Local communities are not facing any kind of problems due to the construction activities. Plantation program is ongoing to improve the greenery environment within the boundary wall of that project. Under the CSR programs, medical campaigns, blanket distribution, wheel chair distribution, and capacity development held in this period of monitoring.

1. Introduction

1.1 Background

The scope of works 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 EIA approval condition no. 32 and Coal Transportation EIA approval condition no.17.

The location of 2x660 MW MSTPP project encompasses Sapmari, Katakhali 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**). According to 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 variation. However, in January, 2021 CEGIS team has carried out the 27th quarterly monitoring activities. The current document constitutes the 27th quarterly monitoring aspects covering all the preselected monitoring parameters and locations. Besides, during this period the Hiron point of Sundarbans was not visited due to rough weather condition.

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 (to monitor the ambient air quality). Potential noise generation sources are also identified and selected for noise level monitoring. 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 are 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 are 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 for ensuring environmental sustainability and social acceptability.

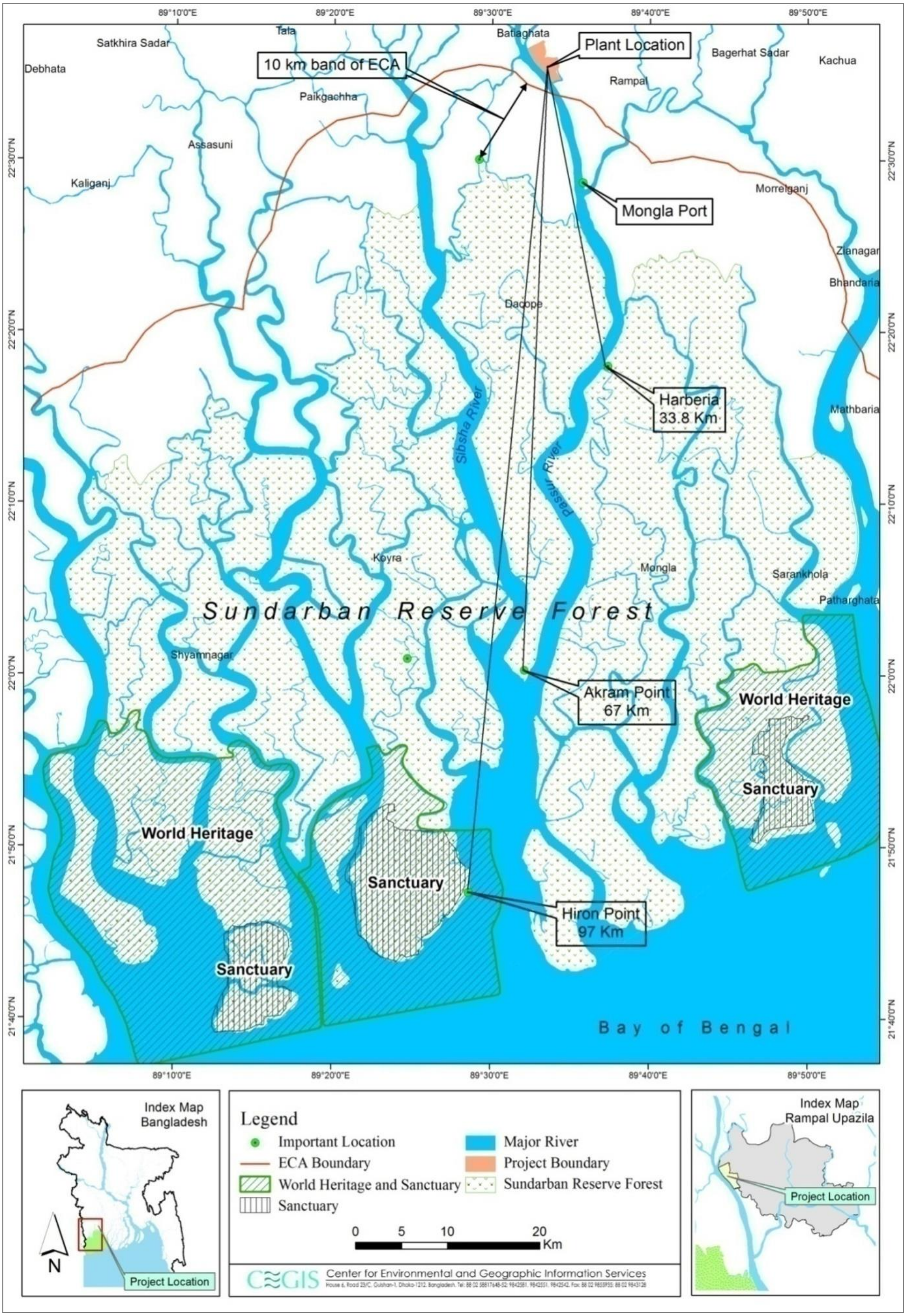


Figure 1.1: Location Map of the Study Area

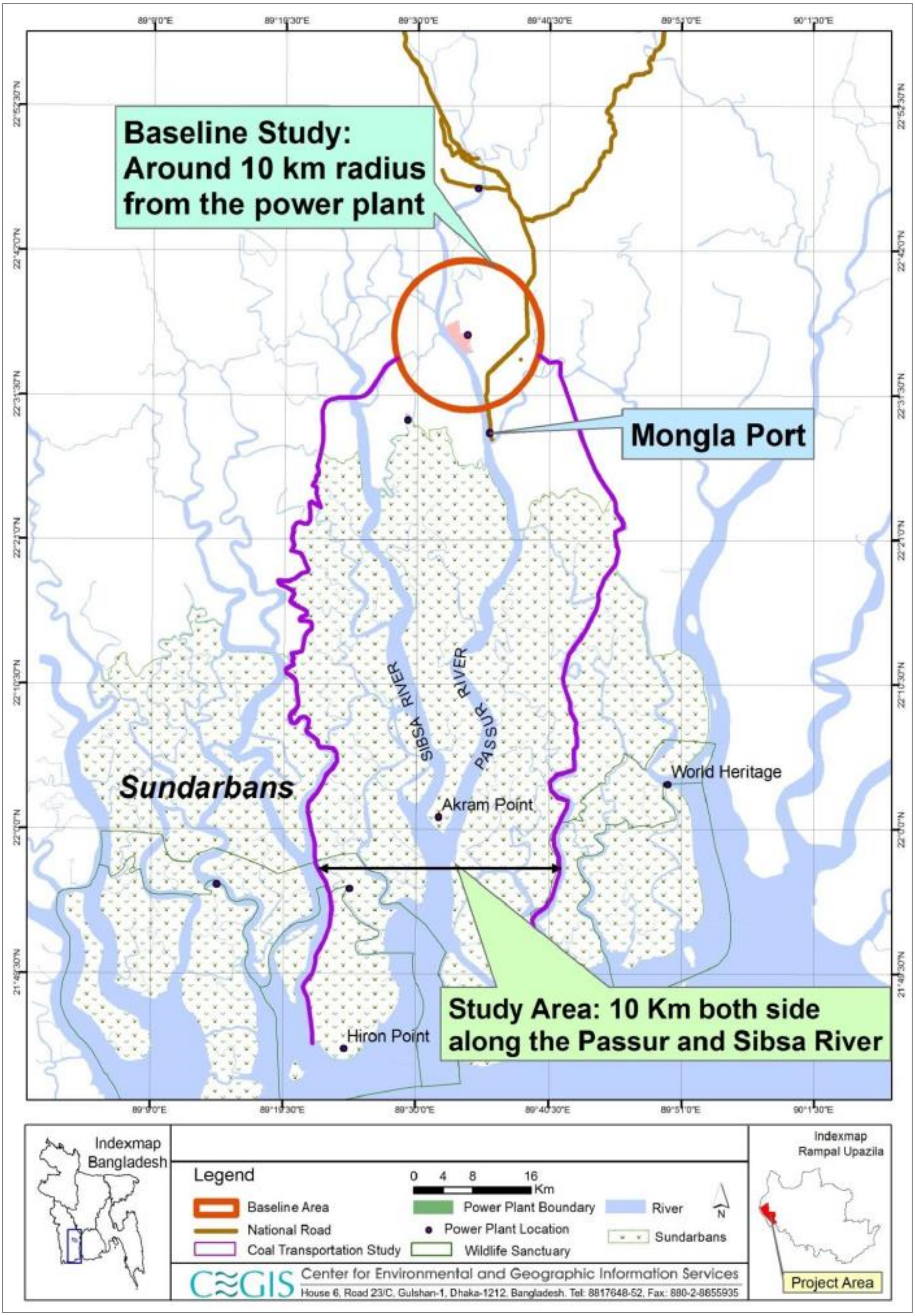


Figure 1.2: AOI of Environmental and Socio-economic Monitoring

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 report 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 dominancy,
- 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 27th 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 so 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, labor 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; Labor 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 except at Hiron point of Sundarbans (due to rough weather condition the team could not reach) 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., $PM_{2.5}$, PM_{10}, and SPM), SOx, NOx, CO and O_3 are expected to be generated from the coal-based Power Plant activities at its different phases i.e. pre-construction, construction and operation. The monitoring locations as well as the indicators were selected during the EIA study based on a number of selected 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 $PM_{2.5}$, PM_{10}, and SPM were tested by gravimetric method. The concentration was analyzed by West-Gaeke method. Likewise, the concentration of NO_2 was tested by Jacob and Hochheiser method and concentration of CO and Ozone (O_3) were measured by Metravi CO-10 meter and Tongdy O_3 Monitor respectively.

2.1.3 Pollution Sources in the Sundarbans

The key sources of air pollution to the Mongla Port Area and project site are: the 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. may be big sources of air pollutants i.e., Particulate matters (PM2.5, PM10 and SPM), Oxides of Sulphur (SOx), Oxides of Nitrogen (NOx) and Green House Gases (GHGs) in the forest area. 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, two additional locations were included in the existing monitoring locations for this quarter. 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 ($PM_{2.5}$, PM_{10} and SPM) SO_X, NO_X, CO and O_3.	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 $PM_{2.5}$: Gravimetric
2		Proposed township area near Chimney location, Mauza: Sapmari Katakhali.	89°32'3.8"E; 22°36'32.5"N		Method of testing PM_{10}: 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_X: 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 NOX: 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		

Sl. No.	Monitoring Indicators	Locations	GPS Points	Frequency	Methods/ Tools/ Techniques
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)	89º 33´ 13.7"E 22º35´43"N		
13		Access road bridge area	89°35'16.49" 22°34'37.11"N		

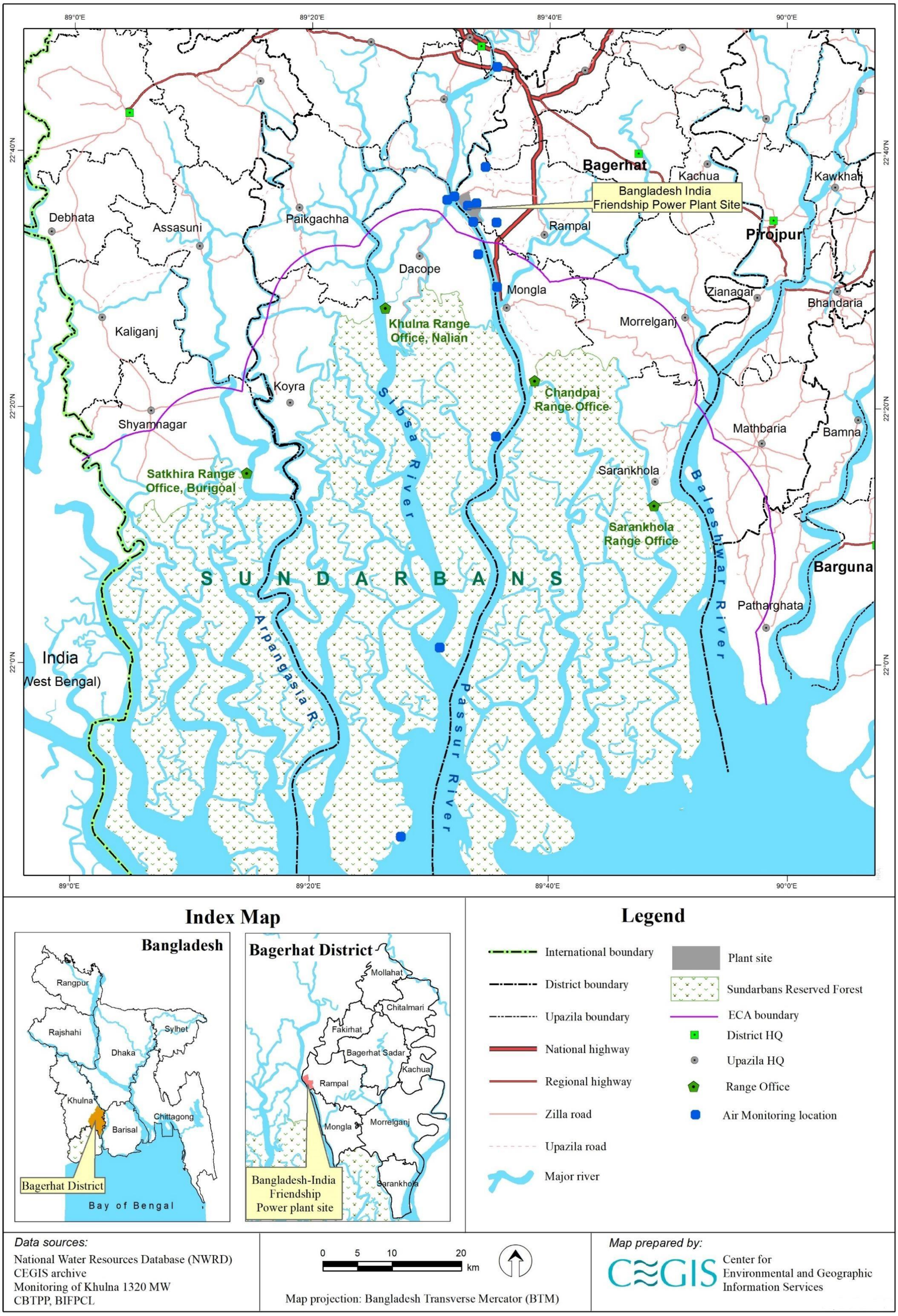


Figure 2.2: Air Quality Monitoring Locations

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**.

During this season, the maximum value (166.72 µg/m^3) of $PM_{2.5}$ was found at Township area of power plant whereas the minimum value (48.20 µg/m^3) was recorded at Akram Point area of the Sundarbans Reserve Forest (SRF). It can be mentioned here that the corresponding values of $PM_{2.5}$ for Township area, Kaigardaskati, Chalna, Mongla Port Area, Khan Jahan Ali Bridge and Access road bridge area were found higher than the standard (ECR' 2005 i.e. 65 µg/m^3) during this monitoring period. On the other hand, PM_{10} concentration was also found highest (234.41 µg/m^3) at Township area of power plant and lowest (90.12 µg/m^3) at Akram Point area of SRF. Similarly, the concentration of SPM was found higher at Township area of power plant (347.39 µg/m^3) whereas, the minimum concentration (144.95 µg/m^3) was observed at Akram Point of SRF. During this monitoring period it was noticeable that, comparing with the standards the observed values of SPM and PM_{10} for Khan Jahan Ali Bridge, Access road bridge and Township area exceeded the standard values set by DoE i.e. 150 µg/m^3 for PM_{10} and 200 µg/m^3 for SPM which might be due to the seasonal effect i.e. winter season when the humidity is generally found to be much lower than the other seasons of the year and the concentration of the particulate matters are found to be higher than the other seasons. However, in order to minimize the particulate matter concentration inside the power plant, the authority needs to 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., strictly maintain the vehicular speed at the senstie areas and maintain the EMPs as stated in the EIA study of the power plant.

On the other hand, the concentration of Sulphur dioxide (SO_2) in ambient air was found much lower than the Bangladesh standard limit of (365 µg/m^3) at all the sampling locations. Among those, the maximum concentration (20.23 µg/m^3) was found at Access road bridge area while the minimum concentration (12.26 µg/m^3) was recorded at Mongla Ghat area. Similarly, the values of NOx were also observed well below than the Bangladesh standard value of 100 µg/m^3. The maximum concentration (37.16 µg/m^3) during this monitoring period was found Maidara area whereas the lowest concentration (19.25 µg/m^3) was recorded at Mongla Ghat area. The contributor of such NOx emission may be from local human hauler, car, bus etc. and SO_2 emission from industrial activities like brickworks, cement works, etc. in that area.

Furthermore, the maximum value of CO (3 µg/m^3) was measured at Township area though the results were found much lower than the standard value (10,000 µg/m^3) set in ECR' 2005. But, the measured values of O_3 was found higher in township area (212 µg/m^3) than the Standard limit 157 µg/m^3 which might be due to the increased vehicular movement and construction activities around the township area. On the contrary, the measured values for the other locations were found much lower than the Standard. 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. Seasonal variations among the concentrations of the parameters are provided in **Figure 2.3** and all the monitoring results are attached in **Table A1 of Appendix IV.**

Table 2.2: Air Quality Monitoring Results (October, 2020)

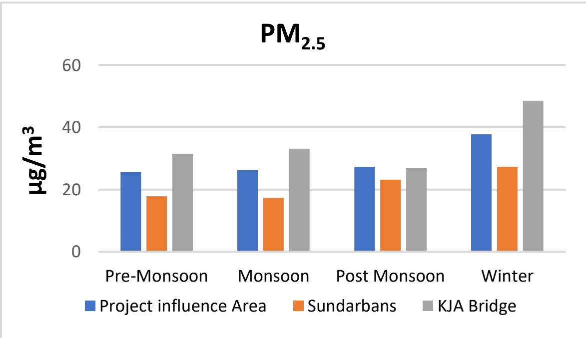
Sl. No.	Location	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		SPM (µg/m³)		SOx (µg/m³)		NOx (µg/m³)		CO (mg/ m³)		O_3 (ppb)	
		Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*	Value	STD*
1	South West corner of the Project boundary (Maidara)	55.35	65	106.13	150	163.48	200	14.74	365	37.16	100	0	10	9	157
2	North-east corner of the project boundary (Sapmari)	52.74	65	112.04	150	170.33	200	18.32	365	29.9	100	0	10	6	157
3	North-west corner of the Project boundary (Kaigardaskati)	68.26	65	131.84	150	180.43	200	16.19	365	34.1	100	0	10	12	157
4	Barni, Gaurambha union (4km North East from the chimney location)	61.29	65	93.36	150	159.8	200	16.47	365	21.18	100	0	10	6	157
5	Chunkuri-2, Bajua Union (4km South West from the chimney location)	59.18	65	117.42	150	188.27	200	16.45	365	26.14	100	0.1	10	23	157
6	Pankhali (Chalna), Dacope, (4km North West from the Chimney location)	66.31	65	102.73	150	156.56	200	16.16	365	28.54	100	1	10	20	157
7	Mongla Port Area	74.19	65	118.67	150	201.16	200	12.26	365	19.25	100	2	10	66	157
8	Harbaria, Sundarbans	53.28	65	100.11	150	146.2	200	14.66	365	21.44	100	0	10	6	157
9	Akram point, Sundarbans	48.2	65	90.12	150	144.95	200	15.05	365	20.6	100	0.2	10	8	157
10	Hiron Point, Sundarbans	55.71	65	99.64	150	155.39	200	16.2	365	23.53	100	0	10	11	157
11	Khulna city near Khan Jahan Ali Bridge	88.71	65	159.22	150	240.18	200	18.8	365	34.2	100	2	10	80	157
12	Project site-1 (Proposed Township area)	166.72	65	234.41	150	347.39	200	18.61	365	33.48	100	3	10	212	157
13	Access road bridge area	94.23	65	188.64	150	269.3	200	20.23	365	26.3	100	0.8	10	68	157

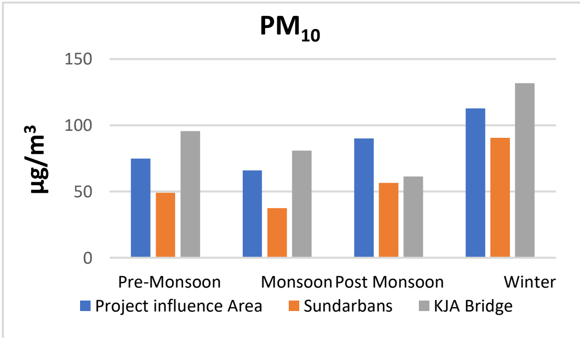
Source: CEGIS field survey; STD-Standard*

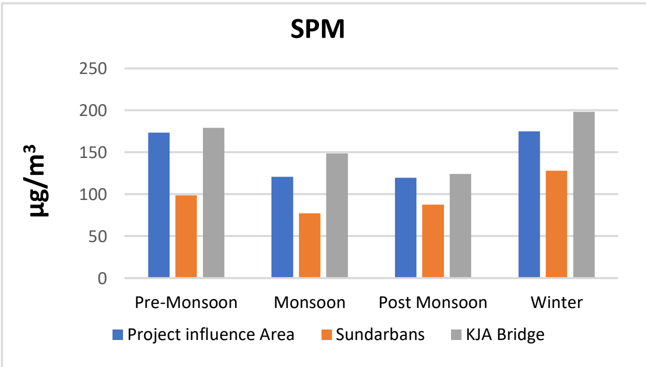
Seasonal variations among the air quality parameters

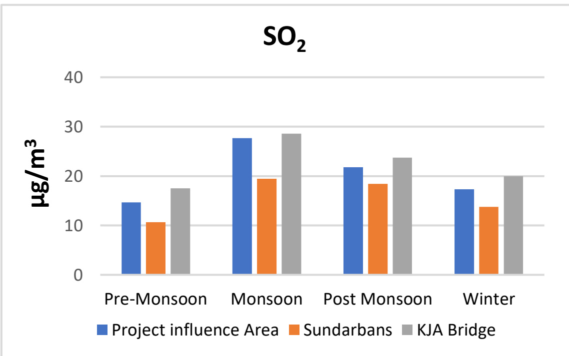
The values of $PM_{2.5}$ as averaged for the corresponding locations were found higher in Khan Jahan Ali Bridge area in in all seasons but lower in project influence area followed by the SRF area. Likewise, SPM and PM_{10} were found to be higher in all seasons at all locations but in case of PM_{10} the concentration was observed to be higher in post-monsoon period in project influence area. On the other hand, the concentrations of SO_2, NOx, CO and O_3 were found higher at Khan Jahan Ali bridge area in all seasons than the project influence area and the SRF area. 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 (**Figure 2.3**)

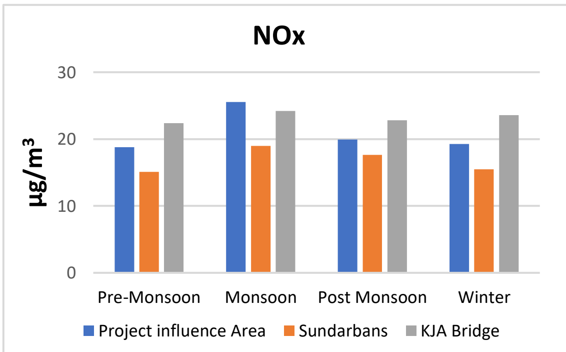
Findings of the previously monitored data with seasonal variation has been appended in the following section-











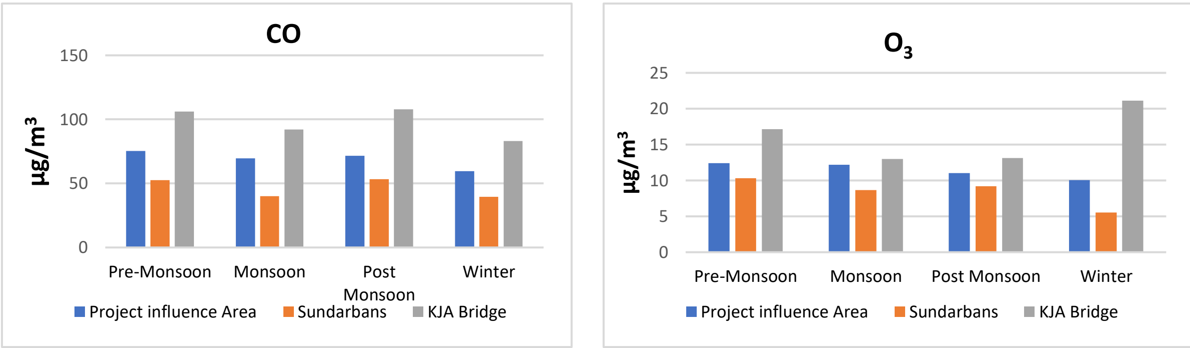


Figure 2.3: Seasonal Variation of the Air Quality Parameters

Cluster analysis

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 dendogram (**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).**

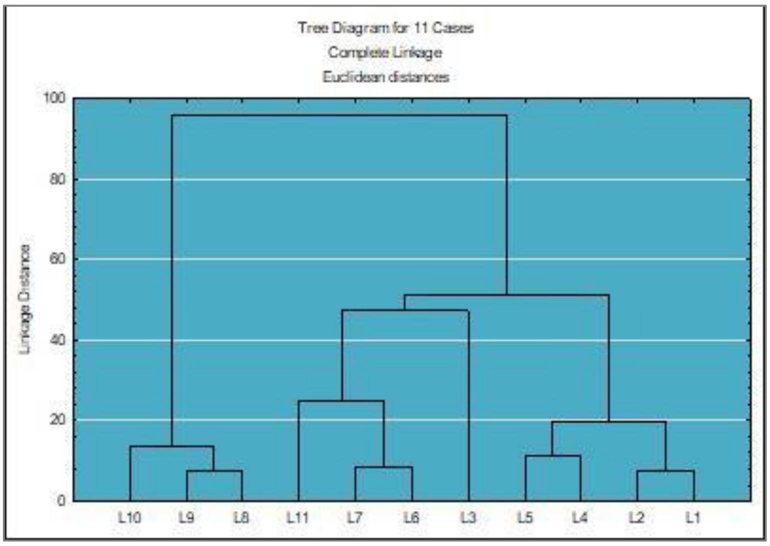


Figure 2.4: Dendogram of the Monitoring Stations using Euclidean Distance

2.1.6 Findings

According to the observed data it can be concluded that the concentration of major air pollutants were 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 higher at Khan Jahan Ali Bridge area, Access road bridge area and in the township area than the standards of DOE. In order to minimize the particulate matter concentration inside the power plant, the authority needs to 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., strictly maintains the vehicular speed at the sensitive areas and maintain the EMPs as stated in the EIA study of the power plant.

However, major sources of criteria pollutants in and around the project site as observed were the piling activities, digging, tunneling 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

Noise is the sound that is not wanted by the perceiver, because it is unpleasant, loud, or interferes with hearing. By extension, in experimental sciences, "noise" refers to any random fluctuations of data that makes more difficult the perception of an expected signal. 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. 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 dB (A). However, 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 in the outside of Sundarbans area.

2.2.1 Methodology

Noise levels were measured thrice in a day (morning, afternoon and evening) at eight locations, twice (morning & evening and; morning and noon) at two locations and once (noon) at one location around the project and study area. 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, the urban and rural vehicles i.e. bus, truck, local human haulers, auto-rickshaws, motorized vans, motorbikes etc. were much noticeable in the study area. On the other hand, engine boats, trawlers, small barges, ships plying over the waterways and the wave breaking sound were found across the River Passur.

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 Katakhali	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"E21°46'27.60"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 **TableC1, C2**, **C3 and C4** respectively in the **Appendix IV**.

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 whole study area can be classified into five distinctive noise zones named as commercial, residential, residential cum commercial (mixed), industrial and silent zone. However, a brief description of the noise status is described in the following section.

Two commercial zones were Chalna bazar (Dacope) and Khan Jahan Ali Bridge (toll office of Khan Jahan Ali Bridge) where levels of noise were recorded as 60.50 dB(A) and 61.94 dB(A) respectively. For these locations, the standard level is 70 dB (A). So, it is evident that levels of noise were 9.50 dB (A) and 8.06 dB (A) lower than that of their corresponding standard setup.

NW Corner of the Project area (Kaigar Daskati), Chunkuri-2 (Bajua), SW corner of the project area (Moidara) and Proposed Township area (Shapmari) falls within the residential zone standard. Observed noise levels at the selected four locations of these four zones were recorded as 51.42 dB (A), 47.05 dB (A), 52.36 dB (A) and 49.09 dB (A) respectively. The level of noise were 3.58 dB (A), 7.95 dB (A), 2.64 dB (A) and 5.91 dB (A) lower than that of their corresponding standard values.

The only mixed zone of the study area is Barni (Gaurambha). The level of noise at this location was recorded as 53.09 dB (A) which was lower by (6.91 dB (A)) than that of its standard value.

The level of noise at Mongla Port, the only industrial zone under this study area was recorded as 56.52 dB (A) which was far lower by 18.48 dB (A) than that of its standard value.

Harbaria, Akram Point and Hiron Point of Sundarbans are under the silent class zone and the standard limit of ambient noise at daytime is 50 dB (A) (Noise pollution control rules, 2006). These three locations are the most important biodiversity hot spot in the Sundarbans. The noise levels were measured at a distance of 100 m inside the forest area from the River bank and found as 44.40 dB (A), 37.85 dB (A) and 38.85 dB (A) during this monitoring period at Harbaria, Akram Point and Hiron Point respectively. Analyzed seasonal variations of noise level are showed in **Figure 2.7** and **Figure 2.8.**

However, it is a matter of great joy that the observed noise level of all the locations was within the standard limit of their corresponding standard values. None of the observed locations was found to exceed the Bangladesh standard limit (Noise Pollution Control Rule, 2006 and ECR, 1997) of noise of their corresponding values **(Table: 2.4).**

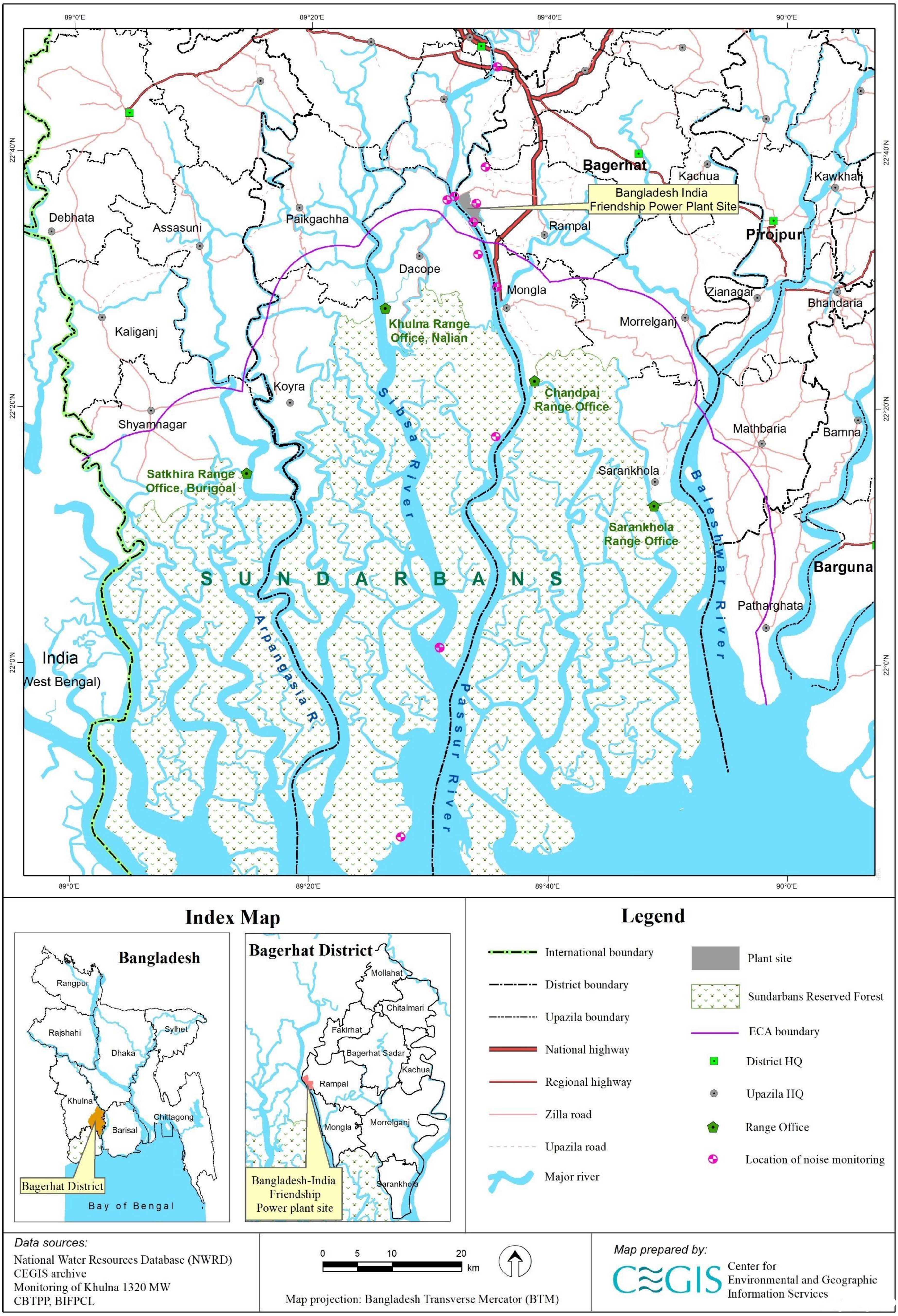


Figure 2.6: Noise Level Monitoring Locations

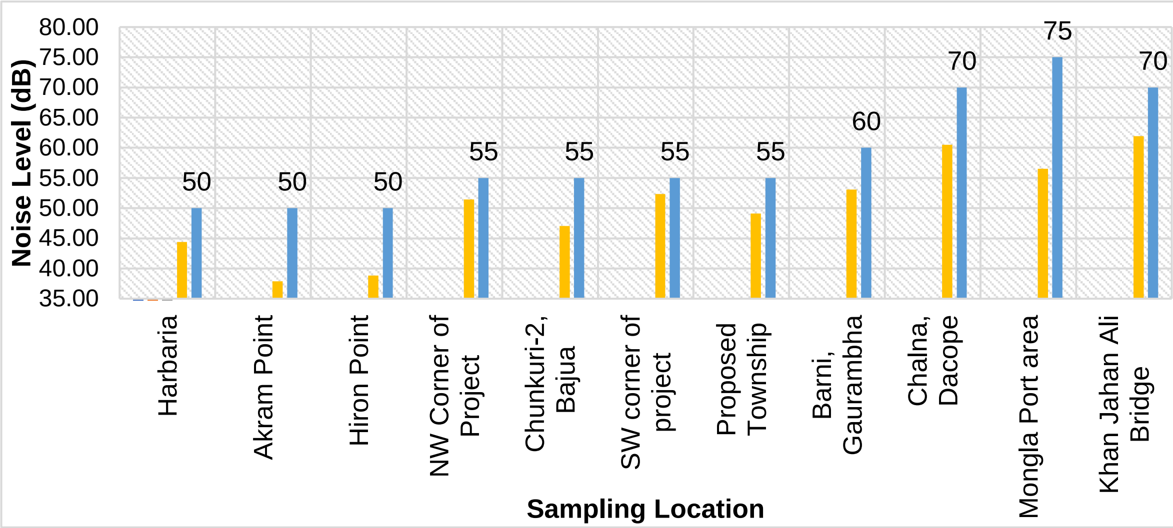


Figure 2.7: Status of Noise level of this monitoring season at different locatons

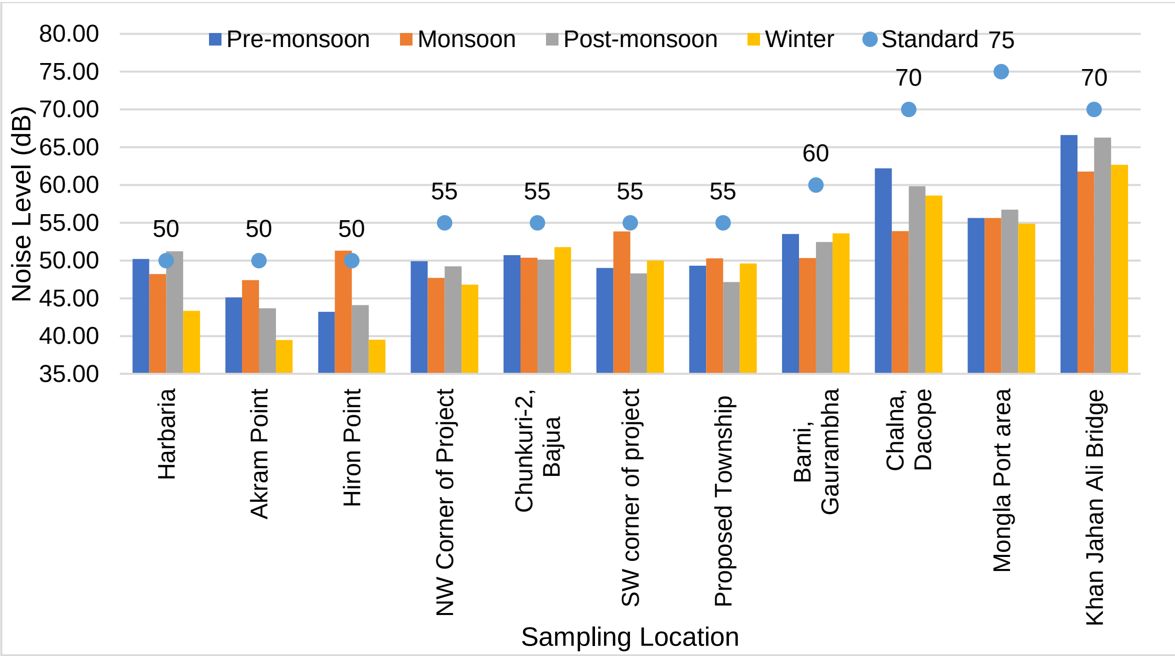


Figure 2.8: Status of Noise Level at the Monitoring Locations

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

	Monitoring periods (Cont.)														
Sl.	**Location**	**QM-26 (Jan-21)**	**QM-25 (Nov-20)**	**QM-24 (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)**
1	*Chalna, Dacope*	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	70
2	*NW Corner of the Project area (Kaigar daskati)*	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	55
3	*Chunkuri-2, Bajua*	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	55
4	*SW corner of the project area (Moidara)*	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	55
5	*Proposed Township area (Shapmari)*	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	55
6	*Barni, Gaurambha*	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*	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 Port area*	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*	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*	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*	38.85	50.70	NM	40.34	40.28	NM	NM	39.21	39.4	NM	NM	38.8	39.79	50

Sl.	Location	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)
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	70
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	55
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	55
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	55
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	55
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. Both national and international guidelines were used to assess the water quality status through monitoring. This report includes physical water quality parameters collected during 27th quarterly monitoring (January 2021) and the tested results obtained from the laboratory up to October 2020 (26th quarterly monitoring). A number of identical sites were selected to observe the quality of the water that have potential use by community, aquatic life, and industrial purposes 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 methodologies were followed for the above-mentioned tasks. Both the surface and groundwater quality statuses in and around the Power Plant and the Sundarbans area were examined during each monitoring. The monitoring results were presented graphically and compared with the national standards (ECR, 1997 and all available amendments).

In the last monitoring scheme, samples were collected from eighteen (18) pre-selected locations (15 locations for surface water along the Passur River, Sibsa River, Maidhara River, near the proposed township area, and 3 locations for groundwater around the study area). The selected monitoring locations 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: 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_5, TDS, TH, TSS, COD, Nitrate, Sulphate, Phosphate, Arsenic, Lead, Mercury, Oil & Grease	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		

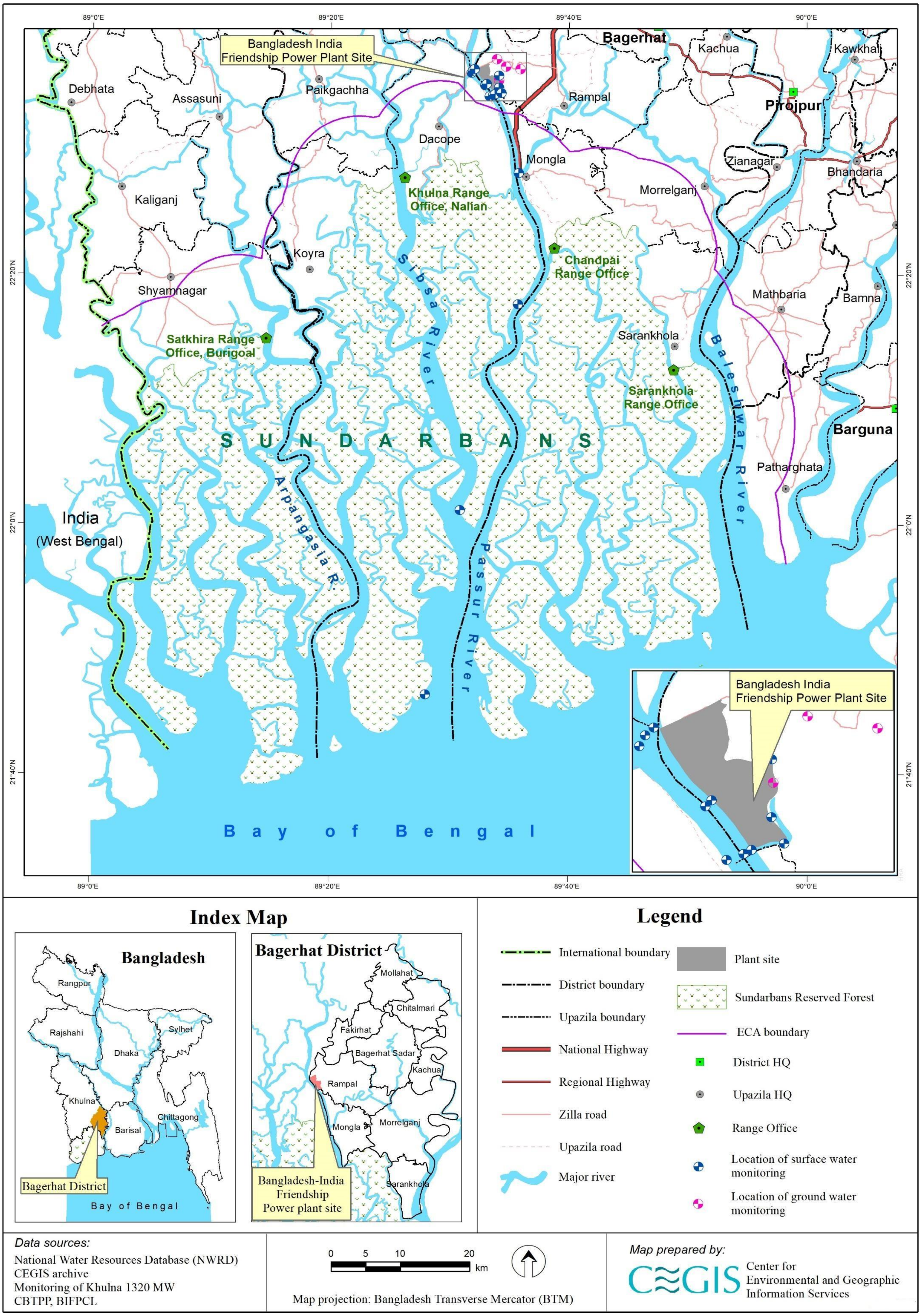


Figure 2.9: Surface Water and Groundwater Quality Monitoring Locations

Table 2.6: 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		

2.3.2 Selection of Parameters

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

2.3.3 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, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Salinity, Nitrate (NO_3^-), Phosphate (PO_4^{3-}), Sulphate (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, NO_3^-, PO_4^{3-} and SO_4^{2-};
- Aggregate organic constituents i.e., BOD, COD; and
- 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. The analysed data of the additional parameters will be recorded and submitted to the DoE and other concerned authorities as per the condition no. 26 of the EIA approval of coal transportation study. Nevertheless, these three (03) additional parameters will be incorporated and discussed in the respective monitoring report (half yearly) after obtaining the analysed results from the respective organizations (BCSIR and DPHE).

2.3.4 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 (NO_3^-), Phosphate (PO_4^{3-}), Sulphate (SO_4^{2-}), and Heavy Metals (As, Pb, Hg).

2.3.5 Sampling Procedure

Standard sampling procedure was followed for both surface and groundwater monitoring to make the water quality status representative and accurate. From sampling bottle preparation to sample collection, preservation and transportation to the designated laboratory, every task was performed with appropriate procedures.

2.3.6 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 6cm 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 and storing below 10^{o}C. Acidified sampling bottles were used for heavy metal (As, Pb, Hg). All samples were preserved as per standard procedure. The insitu testing of the water quality parameters are shown in **Figure 2.10**.

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

2.3.7 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.

2.3.8 Water Quality Parameter Analysis Techniques/Methods

Water quality parameters were analyzed 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	^{0}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_5	5-Day BOD Test at $20^{0}C$	ppm or mg/L	50 (SW)
COD	Closed Reflux Method	ppm or mg/L	200 (SW), 4.0 (GW)
Total Hardness (as $CaCO_3$)	Titrimetric	ppm or mg/L	200-500
Ortho-Phosphate (PO_4^{3-})	UV-VIS Spectrophotometers	ppm or mg/L	6
Nitrate (NO_3^-)	UV-VIS Spectrophotometers	ppm or mg/L	10
Sulphate (SO_4^{2-})	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
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

2.3.9 Water Quality Reporting Arrangement

Water quality status of the power plant area and the Sundarbans deep forests are being observed since April 2014. In this 27th quarterly water quality monitoring report, yearly variations of post-monsoon (October, 2020) for chemical water quality statuses and yearly variations in winter (January 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)	**Power plant & adjacent areas**	In this monitoring site, total 11 sampling points have been averaged to represent the water quality status of power plant and its adjacent surface water bodies. These 11 sampling points are situated in the same river system 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)	**Mongla-Passur confluence**	This monitoring site comprises with an individual monitoring point situates 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)	**Harbaria**	Harbaria site comprises with an individual monitoring point situates 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)	**Akram point**	Akram point is an individual point, which 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)	**Hiron Point**	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 27th monitoring period (January 2021: Winter season) are described below:

pH

The last monitoring (27th quarterly Monitoring) was performed during January of 2021, usually called the winter season of Bangladesh. The pH value ranged from 7.4 to 8.5. The lowest value was found at the Maidara River near Township area whilst highest was at the North East corner of the plant site. The last monitoring season showed consistency to all the other winter seasons monitoring results (**Table B.1: Appendix-IV**). Altogether, average pH value was found 7.8 near both the power plant areas and inside the Sundarbans. However, until now, pH value did not violate the ECR' 1997 Standard yet (6.5-8.5 inland water quality standard and 6-9 for the project waste disposal) from an average point of view.

During post monsoon and winter season, river flow and water level normally reduced due to inadequate rainfall and insufficient inflow from U/S (upstream) of Passur-Sibsa RS (River System). As a result, pH values increased than those of the pre-monsoon and monsoon seasons, which has also reported by others

(*Rahman et al., 2013*). In addition to that, post-monsoon shows a little bit lower pH value than the winter season, as during post-monsoon there was some rains at August while in January it is normally zero. Fluctuations in pH values during different season of the year can be attributed to factors like; removal of CO_2 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 first, second, third, fourth, fifth, sixth and seventh year of Passur-Sibsa RS are presented in **Figure 2.11** and the observed dataset are attached in **Table B.1 of Appendix- IV**.

Temperature

In the winter, surface water temperature is usually low in Bangladesh and averagely it is 24^0C in coastal area. For the last monitoring season, water temperature in the observed area reflected the same **(Figure 2.11**). The range of water temperature was 20-22^0C. Near around the power plant, the average water temperature was recorded at 21^0C while in the more downstream it became 22^0C. This slight variation in temperature due to the heavy loads of nutrients in the confluence area than the upstream segments of the river. According to the ECR, 1997; 20-30^0C water temperature is favorable for the aquatic organisms in tropical environment. It can be concluded that, construction works didn't influence water temperature at all to date.

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 season. The measured temperature in the selected sites during the quarterly monitoring programs of first, second, third, fourth, fifth, sixth and seventh year are presented in **Figure 2.12** and all the observed dataset are attached in **Table B.2** of **Appendix- IV**.

Salinity

In a tidal river system, range of salinity fluctuation is usually high. This situation, therefore, also becomes true for the Passur-Shibsa RS in South West Bangladesh. In the last winter period, salinity ranged between 1.8ppt to 8.2ppt. The average salinity near the power plant area was found around 2.6ppt which was 3.5ppt in 2019. In 2019, the sampling was performed during the February while last time it was performed during January. February is the drier period than the January in Bangladesh in respect to Rainfall and the freshwater availability from upstream. Water salinity was higher in deep reserve forests (4.9ppt average) than the power plant sites (2.8ppt). The maximum salinity was observed at the Hiron point (8.2ppt) inside the Sundarbans. The highest salinity at the Hiron point was because of complete seawater influence.

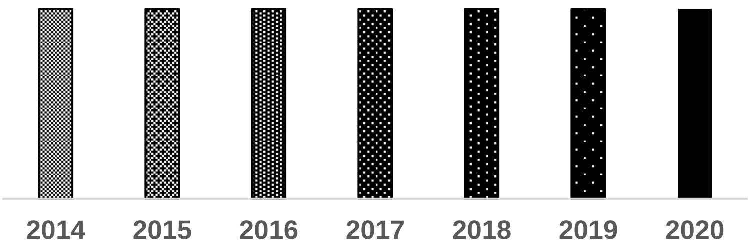
In the winter, salinity concentration is supposed to be the highest after the post-monsoon. Additionally, salinity concentrations showed temporal variations even in the same season. However, it was also found that, the salinity level was not related to any of the activities regarding power plant construction. It could be the result of the variation of the observation period compare to the other winter season's observations. In the monitored river systems, the highest salinity was observed in pre-monsoon season followed by winter season. Freshwater unavailability from upstream and the dominated tidal factors are the main reason of high salinity concentration in pre-monsoon and winter. The water salinity data in the selected sampling stations of Passur-Sibsa RS of the six consecutive monitoring periods are presented in **Figure: 2.13** and all the observed dataset are attached in **Table B.3 of Appendix- IV**.

Dissolved Oxygen

Dissolved oxygen concentrations in river water varies frequently. In tidal influenced river, DO containing capacity depends on its nutrient availability along with its tides. In addition, wind speed in coastal areas also a big factor for DO. In an ideal situation, more than 5.0 mg/L of DO should be available at least in a river

(ECR,1997). In the last monitoring, DO ranged in between 6.4-9.6 mg/L. There was spatial variation in DO concentrations in the study area. However, DO level of the observed sites did not found to be lower than recommended concentrations that are required by the aquatic life forms. The average DO level was found 8.4 mg/L near the power plant areas which reduces to 8.2 mg/L in the deep Sundarbans forests.

DO level of the Passur-Sibsa RS was found comparatively higher than any other previous winter season observations. This change was due to the complete high tide and sudden rains with wind in the river which increased the DO level for a while. In case of seasonal variations, maximum concentrations were observed during monsoon and post monsoon season. Higher DO level in monsoon and post-monsoon season, basically were for heavy rainfall and freshwater availability. During winter, high salinity increases 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). Winter variations of DO at the monitoring sites of Passur-Sibsa RS 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: 2014-2020)

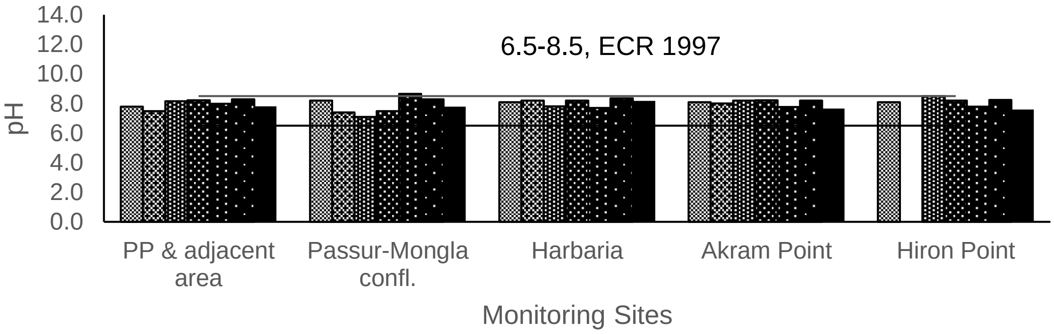


Figure 2.11: Variations in Winter pH values in different monitoring sites

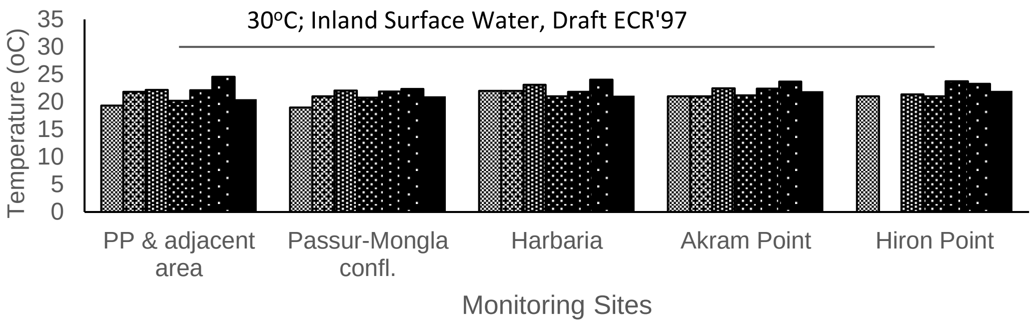


Figure 2.12: Variations in Winter temperature in different monitoring sites

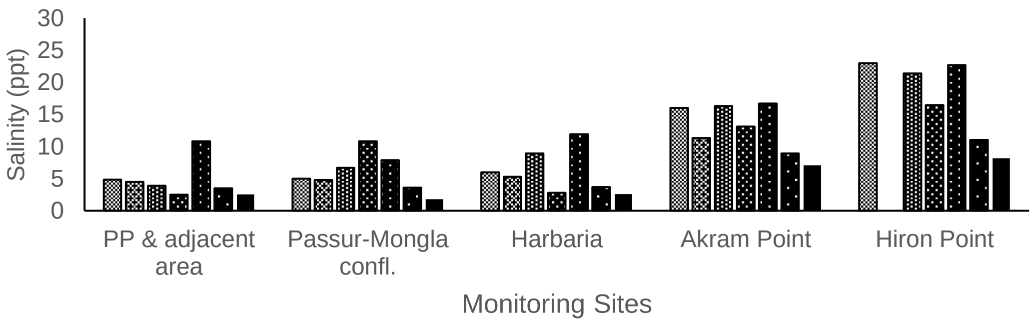


Figure 2.13: Variations in Winter salinity in different monitoring sites

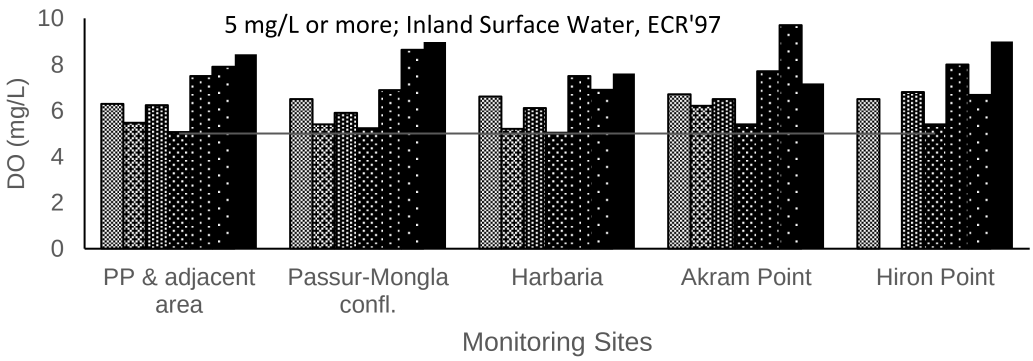


Figure 2.14: Variations in Winter DO in different monitoring sites

Laboratory tested parameters

The laboratory tested results obtained up to October 2020 i.e. Post-monsoon season are described below:

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

TDS mainly indicates the presence of various kinds of compounds like ammonia, nitrate, phosphate, alkalis, some acids, sulphates and metallic ions etc., which comprise both colloidal and dissolved solids in water (*Tareq et al., 2013*). During the last post-monsoon period, the TDS concentrations ranged between 92-206 mg/L near the power plant areas and 148-2,260 mg/L in the deep Sundarbans forest areas (**Figure 2.15**) respectively. Above all these, the average TDS status were always showing the same pattern except the post monsoon season of 2018. TDS of the Hiron point was found around 12,500 mg/L in the post monsoon (2018) which was almost 2/3 times higher than the other seasons observed data (5,750 mg/L in 2019). But, in the month of October 2020, the TDS (around 1,000 mg/L) was found almost half of the previous average especially in the deep forests (2,600 mg/L in 2019). Rainfall during sampling period might changes this in 2020.

In Passur-Sibsa RS, TDS has both spatial and temporal variations. In pre-monsoon and winter, TDS is usually high because of low rainfall and at the tidal effects. The Bay of Bengal contains many minerals and 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 to less than 200 mg/L in most of the cases excluding the deep forests. Regarding spatial variation, the more it is downstream of this RS, the higher the 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 followed by winter season. The higher the nutrients, the higher the TDS and therefore higher occurrence of TH. Insufficient freshwater supply from upstream and low rainfall during winter and pre-monsoon period increase the nutrients concentration in Passur-Sibsa RS. Seawater contains huge quantity of calcium and magnesium, which make the water hard.

In the last post-monsoon season, the TH range was found to be 192-265 mg/L with an average concentration of 225 mg/L in the power plant areas and 210-265 mg/L with an average concentration of 233 mg/L in the deep Sundarbans forests (**Figure 2.16**). Low rainfall in the post-monsoon season of 2019 made the water hard enough to cross the standard of ECR'1997 (200-500 mg/L) in the deep forests areas only. However, in the last post-monsoon visit it was found that the average TH was lower than the ECR'1997 permissible limit where rain was available a bit compare to 2019 (**Table B.8: Appendix IV**). 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).

TSS includes solid materials of organic and inorganic in origins, which are normally suspended in water. In Passur-Sibsa RS, the suspended matters generally contain sand, clay, silt and loam. TSS concentrations among the monitoring sites varied from 6 mg/L to 15 mg/L for the last recorded result. The highest (15 mg/L) value was found at the Left Bank of Passur River at South West corner from the Project boundary (**Figure 2.17**). TSS values in every spot recorded during the last post-monsoon period found to be within the Bangladesh standard limit of 150 mg/L (ECR, 1997). Since 2014 oil spillage, TSS was found higher than the standard limit at 2014 and 2015. After that, the issue was not found any more, and the water bodies revived naturally.

Generally, in Passur-Sibsa RS, TSS was found to be higher in post-monsoon and winter season than those of pre-monsoon and monsoon. During post-monsoon and winter season, the TSS value increases, probably due to comparatively low amount of rains and less 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-Sibsa River in the post-monsoon 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.**

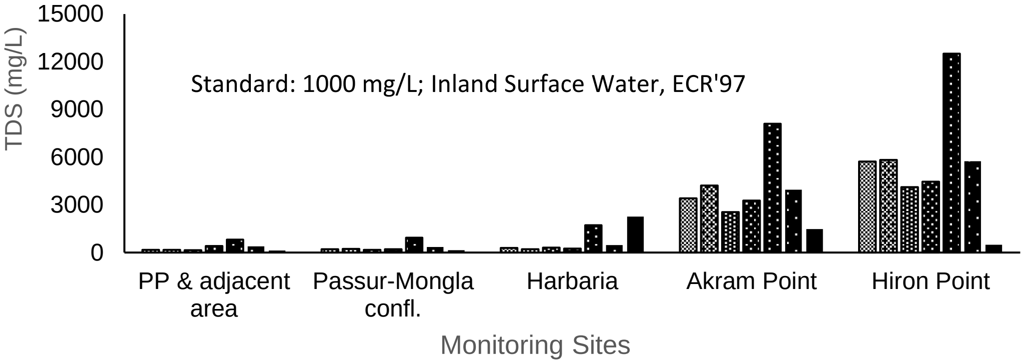


Figure 2.15: Variations of post-monsoon TDS concentrations in different monitoring sites

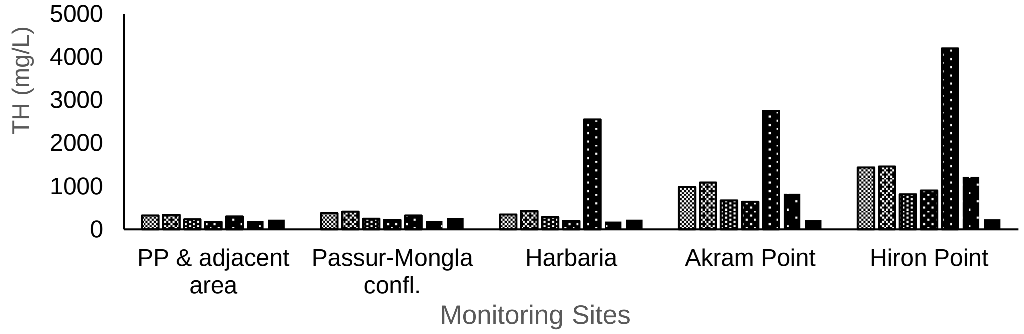


Figure 2.16: Variations of post-monsoon TH status in different monitoring sites

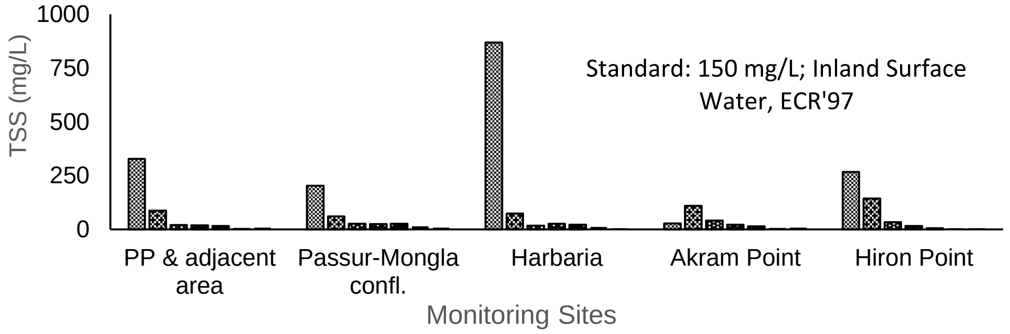


Figure 2.17: Variations of post-monsoon TSS concentrations in different monitoring sites

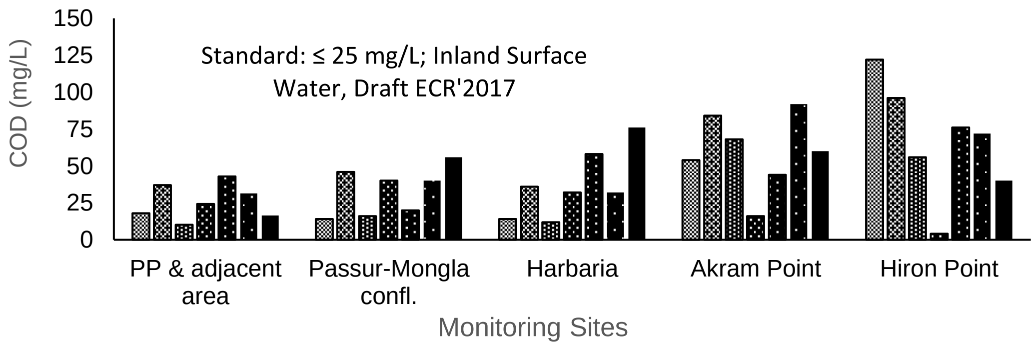


Figure 2.18: Variations of post-monsoon COD concentrations in different monitoring sites

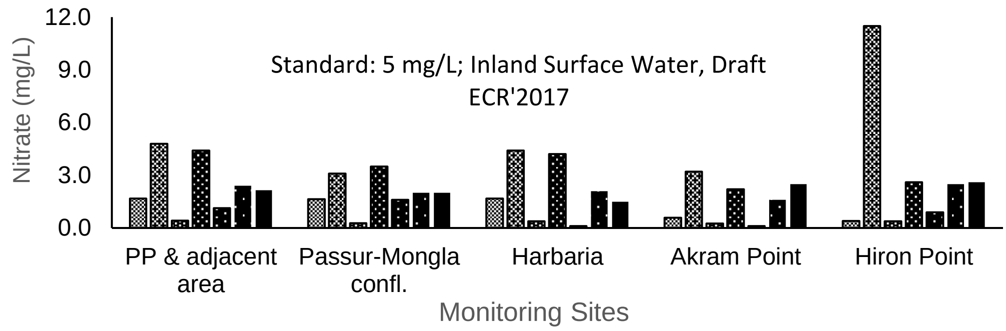


Figure 2.19: Variations post-monsoon Nitrate concentrations in different monitoring sites

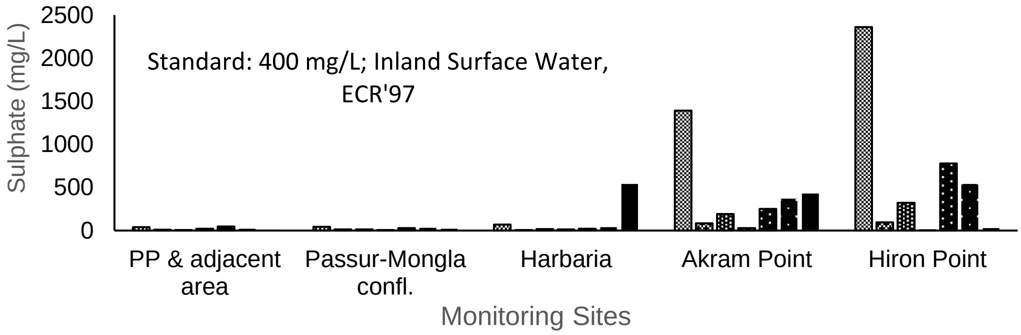


Figure 2.20: Variations of post-monsoon Sulphate concentrations in different monitoring sites

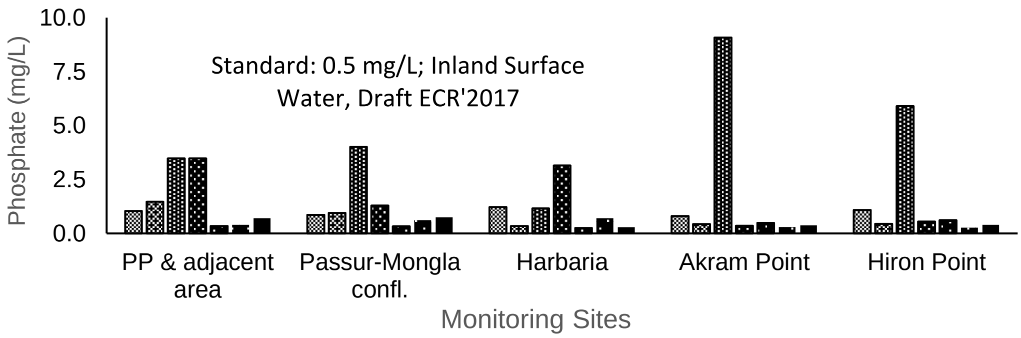


Figure 2.21: Variations of post-monsoon Phosphate concentrations in different monitoring sites

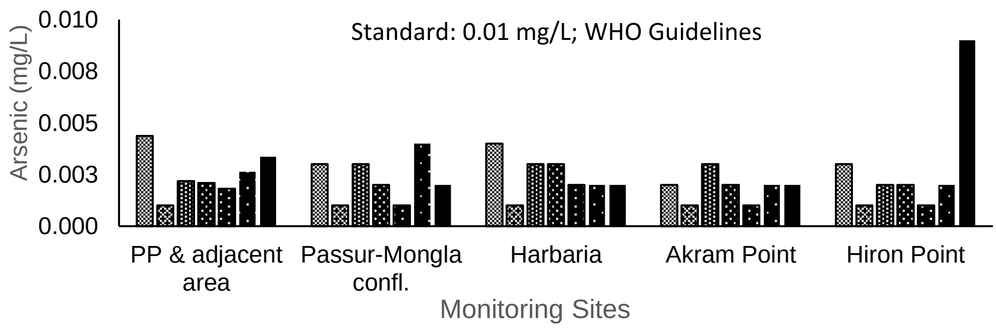


Figure 2.22: Variations of pos-monsoon Arsenic concentrations in different monitoring sites

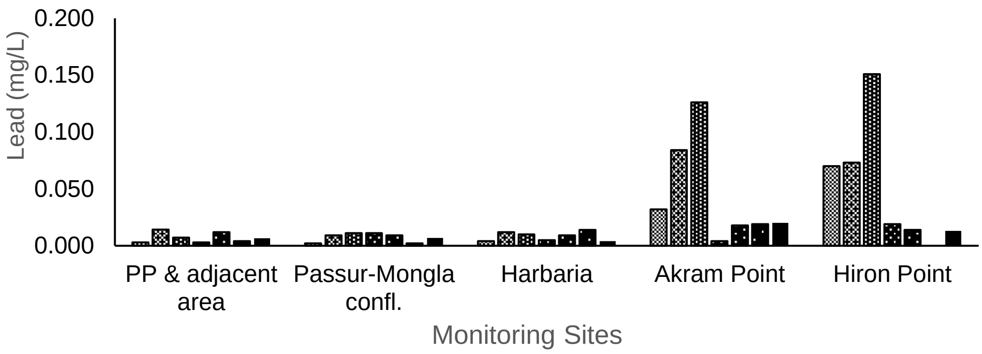


Figure 2.23: Variations post-monsoon Lead concentrations in different monitoring sites

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_2 in the water body.

COD concentrations varied from 8 mg/L to 28 mg/L with an average of 16 mg/L in the power plant areas while it increased a bit in the deep forests with an average of 58 mg/L (40-76 mg/L). The highest value was found at the Harbaria point while the lowest was at near the power plant site. The high values of COD indicate high level of organic pollution in the river water (Sivasubramanium, 1999). **Figure 2.18** indicates that, organic loads are higher in the deep forests of Sundarbans than the upstream areas especially near 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 are complied with the Draft ECR' 2017 (25 mg/L) inland surface water standard observed almost all the sites from power plant adjacent areas. On the other hand, none of the sites did not comply with the same standard from deep forests. Various activities near the power plant sites, other industrial and agricultural activities may influence the COD continuously in the deep forests. The extreme high COD at 2014 was the reason of oil spillage of that year which lead the death of planktons and other aquatic life forms ultimately increased the organic matter decomposition rate.

Over the year, COD concentration was found to be higher in pre-monsoon season followed by winter as these seasons have 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 (wet seasons). In monsoon, higher discharge dilutes the COD load of the river water, which in turn reduces COD concentration in post monsoon. All observed values of COD are shown in **Figure 2.18** and the completely monitored datasets are provided in **Table B.6 of Appendix- IV.**

Nitrate, Sulphate and Phosphate

Usually, Nitrogen is the limiting factor in the marine environment. Therefore, nitrate plays very active role in aquatic organisms' dynamism especially in primary production. In the last monitoring, NO_3^- concentrations varied from 1.0 mg/L to 4.7 mg/L. The maximum concentration was recorded at the right bank of the Passur River at the North West corner from the Project boundary. Average NO_3^- concentration near the power plant areas and the deep forests were the same which was 2.2 mg/L.

NO_3^- concentration showed both temporal and spatial variations among different seasons as well as within the same season. For instance, in the post- monsoon of 2019, power plant and its adjacent areas NO_3^- concentration was around 2.4 mg/L which was found around 0.4 mg/L in the same season of 2016. In case of spatial variation, at the left Bank of Passur River at 100m u/s of North West corner from the Project boundary, NO_3^- concentration was found 4.7 mg/L while it reduced to 1.0 mg/L at the right bank of the project jetty (**Figure 2.19**).

The results obtained from all the monitoring sites were found to be within the standard concentration stated in ECR'1997 (5 mg/L for inland surface water). Naturally, 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., 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.

The highest value (540 mg/L) of sulphate was found at the Harbaria while the lowest ranged 3-31 mg/L at the power plant areas. However, all the observed dataset of SO_4^{2-} found within the standard limit (400 mg/L) specified in ECR, 1997 except the Harbaria and Akram point. During this 26th monitoring, Harbaria and Hiron point were sampled during high tide which made the sulfate high enough in concentration. Comparatively lower concentration of SO_4^{2-} in monsoon and post monsoon seasons could be due to the dilution effect of upstream freshwater (**Figure 2.20**).

High PO_4^{3-} concentration is harmful for all kind of natural water bodies. PO_4^{3-} concentrations were found in between 0.4 mg/L and 1.3 mg/L during the last post-monsoon (**Figure 2.21**). Based on the **Figure 2.21**, it is verified that, PO_4^{3-} concentration did not show any spatial variation during the last post-monsoon but showed temporal variation. Upstream anthropogenic activities probably the reason for this kind of trend along with pattern of rainfalls and bio-geochemical cycles of phosphates. Most of the sites complied with the ECR' 1997/ Draft ECR 2017 rules of 0.5 mg/L of PO_4^{3-} in the inland surface water except the sites of Mongla-Passur confluence and the Maidara river, .

The recorded low phosphate value during dry season 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. Moreover, agricultural runoff also increases phosphate during monsoon and post monsoon season in this area. NO_3^-, SO_4^{2-} and PO_4^{3-} concentration at different monitoring sites of the 26 consecutive monitoring periods are shown in **Figure 2.19, 2.20 and in 2.21** and all the observed dataset are given in **Table B.11, Table B.12** and **Table B.13** of **Appendix- IV**.

<u>*Heavy Metals*</u>

It has earlier been revealed that Arsenic (As) concentration varied between 0.001 to 0.006 mg/L. During this 26th monitoring, the range has become of 0.001-0.009 mg/L. Though there were some seasonal variations in As concentrations, but still As concentration complied 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-$Pb_5(PO_4)_3$ like the way said by Zhu et. al., 2004), which may result in higher amount of Pb concentration in river water. During 26th monitoring, the concentration of Pb ranged 0.001-0.020 mg/L (**Figure 2.23**). The standard concentration for inland surface water is 0.1 mg/L. Previously, Pd was found higher only at the Akram (0.12 mg/L) and Hiron point (0.15 mg/L) than the standards for Bangladesh in 2016.

The values of Mercury (Hg) revealed a continuous consistency among all the spots in all the seasons. The values never exceeded 0.001 mg/L. In the post-monsoon, the concentrations persisted also the same. All the observed data found to be within the Bangladesh standard limit (0.05 mg/L) set by the ECR, 1997 of Bangladesh. The average value of As and Pb concentrations at different monitoring sites of the consecutive monitoring for post-monsoon season are presented in **Figure 2.22 and in 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 analyzed 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 9 December 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^2 (Welle, 2014).

Oil and grease were found to be <2.0 mg/L for all the monitoring sites in the last post-monsoon season. In other seasons (Pre-monsoon, monsoon and winter), this organic compound has increased in the last three consecutive years of 2015, 2016 and 2017. Plying of motorized boats, launches and other tourist boats could be the reasons of high oil and grease including the RASH MELA Festival inside Sundarbans every year. 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. But, in the post monsoon of 2018, 2019 and 2020 the concentration always occurred less than 2.0 mg/L.

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 27th quarterly monitoring (January, 2021), physical condition of the Passur-Sibsa RS was found fairly healthy. There were some fluctuations in the concentrations among different sites only. In addition, pH, Temperature and DO level was good enough at the project site and in the deep mangrove forests.

TDS, TH and TSS concentration in the observed RS found compatible to national and international standards. Higher COD than permissible limit was found in the deep forests mainly. This may be the effect of sediment loads and high nutrients from the Bay of Bengal. Nitrate (NO_3^-) found in a very standard range in respect to a natural river. On contrary, Phosphate (PO_4^{3-}) showed higher concentrations in two sites of Mongla-Passur Confluence and the Maidara River which could be the agricultural run-off from the upper portion of the adjacent channels.

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, which is even less than half of the recommended concentration (10.0 mg/L) for Inland Surface Water Quality recommended for Bangladesh.

2.3.10 Status of the Groundwater quality

In-situ tested parameters

The in-situ tested results obtained up to 27th monitoring period (January 2021: Winter 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^{0}C respectively). The pH values during 27th monitoring scheme were found to vary from 7.2 to 7.5, while temperature ranged in between 22-25^{0}C. No significant differences have been observed against the previous winter season monitoring data. Similarly, no significant variation was recorded in groundwater temperature over the monitoring periods.

Both the results of pH and Temperature were found more or less consistent with all those to the previously obtained respective season's data. The twenty-seven consecutive monitoring results of pH and temperatures (winter) of selected sites are presented in **Figure 2.25: pH, Temperature** and all the observed dataset 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 negligible and in most of the cases below, the minimum detectable limits in all the consecutive monitoring seasons. During this monitoring season, average groundwater salinity of Rajnagar, Kapashdanga and Township area was 0.2 ppt (**Table B.18: Appendix- IV**).

DO ranged between 6.4-6.9 mg/L during this monitoring season. DO concentrations were found within the recommended limit of ECR, 1997 (6.0 mg/L), at all the three sites. 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: 2.25. A**ll the observed dataset of DO and Salinity are attached in **Table B.18** of **Appendix- IV** respectively**.**

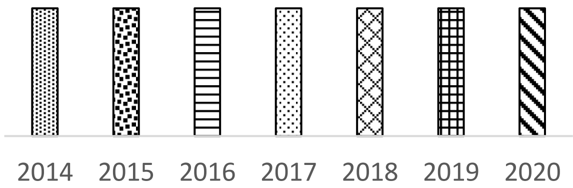


Figure 2.24: Legend direction left to right

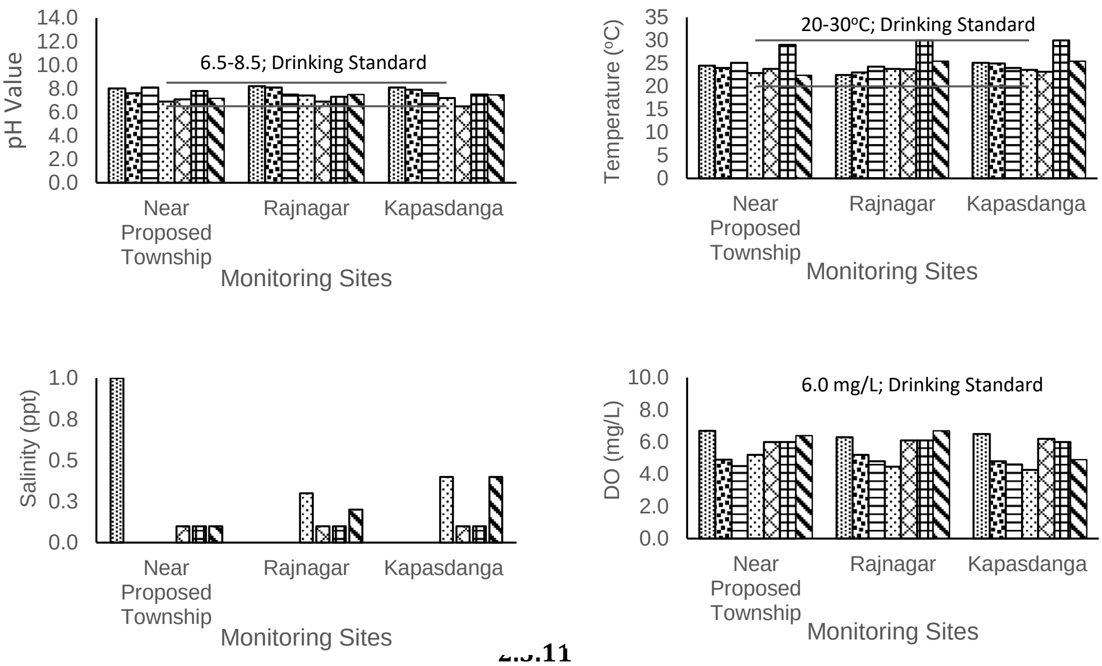


Figure 2.25: Status of pH, Temperature, Salinity and DO of winter season of the last seven consecutive years

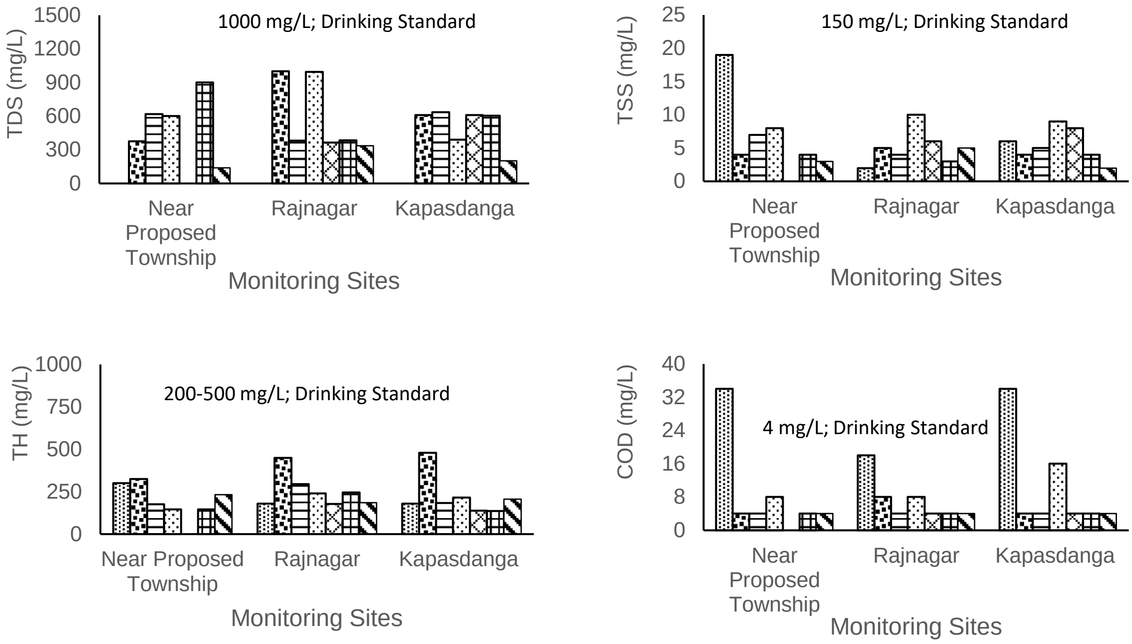
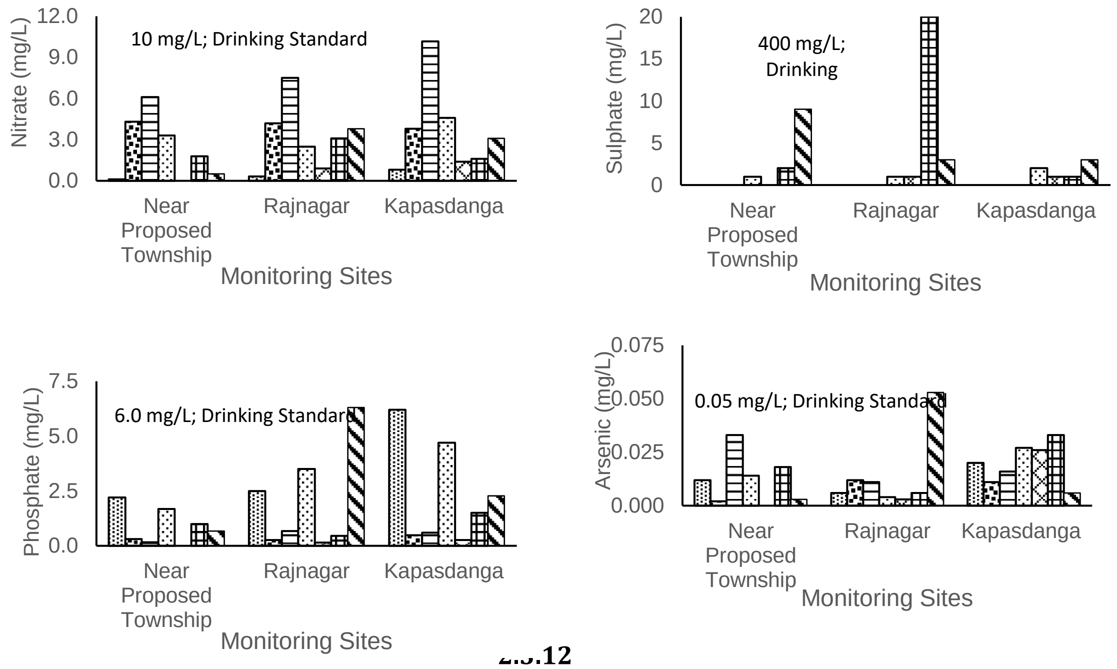


Figure 2.26: Status of TDS, TSS, TH and COD of post-monsoon season of the last seven consecutive years



2.5.12

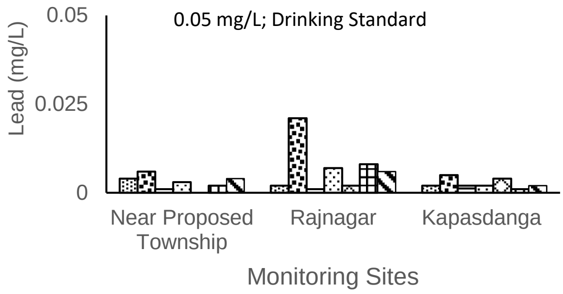


Figure 2.27: Status of Nitrate, Sulphate, Phosphate, Arsenic and Lead of post-monsoon season of the last seven consecutive years

Laboratory tested parameters

The laboratory tested results obtained up to 26th monitoring period (October 2020: Post-monsoon) are described as follows:

TDS, TSS and TH

The highest TDS value of 335 mg/L was recorded in Rajnagar and the lowest was in Township area (139 mg/L). It is mentionable that, TDS concentrations in all the post-monsoon periods were found within the Bangladesh standard limit of 1,000 mg/L (ECR, 1997) (**Figure 2.26: TDS**). Until now, TDS did not come out as an issue in the post-monsoon season. However, in the pre-monsoon season of the year 2014, TDS showed extreme spatial variations. That variation was for the physically damaged Tube wells for a while.

Total Suspended Solids (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 this monitoring period, the TSS concentration ranged in between 2-5 mg/L, which complied with the Standard for Drinking Water Quality, Bangladesh (TSS: 10 mg/L, ECR, 1997) (**Figure 2.26: TSS**). Among all the monitoring seasons, the observed TSS concentrations were much lower in post-monsoon season than the winter season (**Table B.19**). These variations would be due to lack of freshwater availability for sufficient groundwater recharging. In addition, evaporation have also condensed the water along with its suspended matters.

Total Hardness (TH) of the three groundwater monitoring sites varied from 185 mg/L to 232 mg/L (**Figure 2.26: TH**). Township showed the highest concentration during the last post-monsoon only. Over the last six monsoon seasons, drinking water hardness complied with standard limit (200-500 mg/L) set by the ECR' 1997. So far, no incidents of weathering of Ca^{2+} bearing minerals or excessive application of lime was found during the monitoring periods which could cause excessive amount of TH in groundwater.

Groundwater TDS, TSS and TH values of the consecutive post-monsoon periods are presented in **Table B.19** and **B.20 of** A**ppendix- IV.**

Chemical Oxygen Demand

The Bangladesh standard for COD in drinking water is 4.0 mg/L. Monitoring sites completely complied with the Bangladesh Standard as COD concentrations for these sites in the last post- monsoon period were found only 4.0 mg/L. Except the year 2014, all the other COD concentrations of the said season were also within the recommended limit for Bangladesh. The COD concentrations of all the post-monsoon period monitoring sites are given in **Figure 2.26: COD** and all the observed dataset are attached in Table **B.21** of **Appendix-IV**.

Nitrate, Sulphate and Phosphate

Nitrate (NO_3^-) values ranged between 0.5 mg/L and 3.8 mg/L in the last post-monsoon period (**Figure 2.27:**

Nitrate). The maximum value was recorded in Rajnagar while the lowest was at Township. NO_3^- concentrations were ranged within ECR, 1997 limit (10mg/L). NO_3^- in groundwater showed both spatial and temporal variations in post-monsoon season.

Groundwater sulphate (SO_4^{2-}) concentrations have been monitored since 2015. Since then, SO_4^{2-} concentrations never exceeded the Bangladesh Standard for Drinking Water Quality (400 mg/L). SO_4^{2-} concentration in groundwater did not show any pattern yet except a trend of comparatively high concentrations in winter than all other monitoring seasons (**Figure 27**).

Concentrations of PO_4^{3-} were found between 0.7 mg/L and 6.3 mg/L. Rajnagar (6.3 mg/L) crossed the permissible limit of 6.0 mg/L (ECR'1997) (**Figure 2.27**). 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 NO_3^-, SO_4^{2-} and PO_4^{3-} concentrations of groundwater are presented in in **Figure 2.27: Nitrate, Sulphate** and **Phosphate,** 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 0.053 mg/L which are very much within the Bangladesh standard for drinking water quality (ECR'1997) (**Figure 2.27: Arsenic**). It can therefore, be concluded that, groundwater of the monitoring areas is not contaminated by arsenic pollution yet.

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 2.27: Lead**). However, the water of the tube-wells was found suitable for drinking purpose in terms of heavy metal pollution status.

The observed values of As and Pb in all the post-monsoon period monitored sites are presented **in Figure: 2.27** 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 (January 2021), chemicals and presence or concentration of heavy metals (October 2020) characteristics of drinking water. It has been observed that the physical characteristics of groundwater quality is still in good condition and in acceptable state for drinking purpose except slight salinity in the observed water. This salinity might be the reason of saline water infiltration due to excessive withdrawn by the surrounding communities during the dry season. In addition, evaporation is also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes.

Chemical characteristics of the groundwater quality are also found suitable and safe to drink based on the recommended limit for Bangladesh (Drinking water standards, ECR'1997). In respect to COD, Nitrate and Phosphate the status is also the same. The observed groundwater is completely free from the heavy metal pollution of Arsenic, Lead, and Mercury till to date.

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 were collected during 26^{th} monitoring field visit (November, 2020) and sent immediately to laboratory for analysis. The analysis data has been incorporated with this 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.

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

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:

$$ESP = \frac{[Na^{+}]}{[Ca^{2+}+Mg^{2+}+Na^{+}+K^{+}]} \times 100$$

ESP is used to characterise the sodicity s 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 2.28**.

Table 2.9: Land Resources Monitoring Plan

<table>
<tr><th rowspan="2">Site No.</th><th rowspan="2">Monitoring indicators</th><th rowspan="2">Location</th><th colspan="2">GPS (Decimal Degree)</th><th rowspan="2">Sampling Frequency</th><th rowspan="2">Methods/ Tools/ Techniques</th></tr>
<tr><th>Easting</th><th>Northing</th></tr>
<tr><td>1</td><td rowspan="5">Plot use, Soil fertility and Nutrient, Chemical Properties of Soil (pH, Pb, Cd), Crop production and damage</td><td>Mauza: Baranpara Union: Gangarampur Upazila: Batiaghata, District: Khulna</td><td>E-89°30′59.1″</td><td>N-22°37′57.0″</td><td rowspan="5">Bi-yearly (April and October)</td><td rowspan="5">In situ field sampling and Laboratory Testing in SRDI</td></tr>
<tr><td>2</td><td>Mauza: Chunkuri-2 Union: Bajua Upazila: Dacope District: Khulna</td><td>E-89°32′20.0″</td><td>N-22°34′51.0″</td></tr>
<tr><td>3</td><td>Mauza: Kapalirmet/ Buridmial Union: Burirdanga Upazila: Mongla District: Bagerhat</td><td>E-89°36′8.8″</td><td>N-22°32′18.9″</td></tr>
<tr><td>4</td><td>Mauza: Chakgona Union: Rajnagar Upazila: Rampal District: Bagerhat</td><td>E-89°34′25.3″</td><td>N-22°34′18.3″</td></tr>
<tr><td>**5**</td><td>Mauza: Basherhula Union: Rajnagar Upazila: Rampal District: Bagerhat</td><td>E-89°34′25.0″</td><td>N-22°36′14.0″</td></tr>
</table>

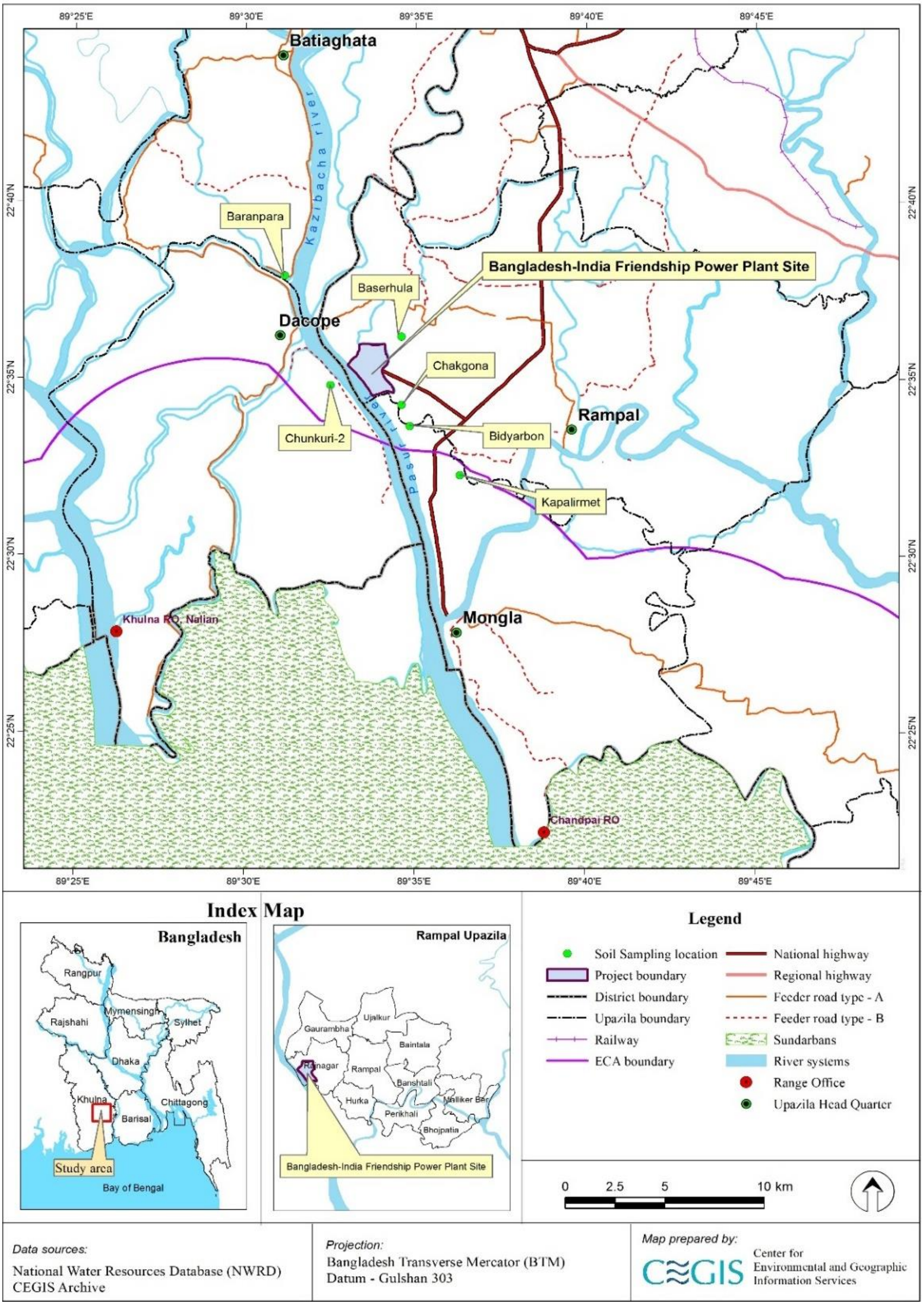


Figure 2.28: Land and Agricultural Resource Monitoring Locations

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_1), 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 Samples 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 this monitoring report.

2.4.3 Status of the monitoring plots

Monitoring plot-1 (Baranpara)

Top soil organic matter concentration is increased than the previous year. Nitrogen follows the similar trend; but phosphorus and Sulphur concentration is decreased. Organic matter concentration increase might be a result of application of organic fertilizer while phosphorus and Sulphur might be washed out or replaced by other elements. Among the macro nutrient, iron and manganese has increased than the previous year. Increasing salinity might be a cause of more availability of Fe. Excess presence of these two elements may suppress other elements (Boron, Zinc and Manganese) present in soil solution. Lead concentration has decreased after increment of last wet season and cadmium presence is not identified in this monitoring period.

Monitoring Plot-2 (Chunkuri-2)

Good agricultural practice is found is this monitoring plot. As a result, soil condition has improved from the previous monitoring. Salinity is decreasing compared to the last wet season monitoring. Among the base cations, potassium and magnesium showed decreasing trend while calcium is decreased. pH is decreased after two wet season. Organic matter and Nitrogen concentration continues to increase for four consecutive years while phosphorus and sulfur concentration is decreased than last wet season monitoring. Phosphorus and sulfur loss reason might be similar to the previous monitoring field.

Among the macro elements, only B showed decreasing trend while other elements (Mn, Zn and Fe) showed increasing trend during the monitoring period. Macro elements have tendency to form chalet with organic matter. Increasing trend of Organic matter concentration was also observed during this monitoring period. This might be due to the decreased concentration of B in the soil Pb concentration is almost similar to last monitoring season while no presence of Cadmium is found.

Monitoring Plot-3 (Kapalirmet)

This monitoring plot was used for fish cultivation during pre-monsoon and post monsoon period. During monsoon period this area completely goes under water. Decreasing salinity was a common scenario of this monitoring plot due to leaching and continues lentic ecosystem. But salinity is increased for two consecutive years. This might be an after impact of regular tidal water allowance in the plot for fish cultivation. Among the base cations Potassium and Magnesium showed increasing trend while Calcium showed decreasing trend. Due to submerged condition, organic matter of this area decreased. Other essential element concentration is follow the similar trend.

Manganese and iron concentration is increased in the micro elements while Zinc and Boron concentration decreased. In this monitoring plot, significant increase of Mn concentration is observed while Zn concentration decreased dramatically, which might be an indication of replacement of one by another. Pb concentration is dropped after second consecutive year. Cadmium concentration has been only observed in the substratum.

Monitoring Plot-4 (Chakgona)

Overall salinity of this area is increased. All base cations (K, Ca, Mg) showed the similar trend. This might be an after impact of tropical cyclone. pH is almost similar to the previous year. Organic matter has decreased, so is Nitrogen and Sulphur. But Phosphorus concentration is increased which is in indication of soil degradation and erosion of top soil of that area during rainy season. Decreasing trend of Zn, B and Fe concentration might be a cause of soil erosion. But increase of Mn might be the impact of increasing salinity.

Pb concentration is decreased. Cadmium has also been identified in all soil horizons which might be an impact of increasing single valent base cations. Moreover, it might be an impact of less washout during rainy season.

Monitoring Plot-5 (Basherhula)

One part of this monitoring plot is exposed to river. So there is a good possibility of quick wash out and soil erosion during monsoon period. This scenario also indicates vulnerability to storm surge and salinity intrusion from riverside during extreme events. Overall EC is increased in this area where base cations (K, Ca, Mg) are also increased. pH is almost similar to last year. Organic matter, Nitrogen, Sulfur and Phosphorus concentration has decreased which might be due to the impact erosion and increasing salinity.

Fe and Mn concentration has increased during this monitoring while Zn and B concentration has decreased. Increasing salinity might reduce the presence of these two elements. Pb concentration has decreased for last couple of years. This might also be a cause of wash out and exposer of sub-soil in the monitoring plot. Cd concentration has also been found where lower horizon contains more that the upper one.

Monitoring Plot-6 (Bidyarbon)

EC has slightly decreased but base cation concentration (K, Ca, Mg) has increased. pH is also increasing. Organic matter concentration has decreased. Major nutrients (N, P and S) follow the similar trend. This might be the impact washout and erosion of the top soil during monsoon. All micro nutrients show (Fe, Zn, B) decreasing trend except Mn. This might be due to increasing salinity intrusion in this area. Lead concentration continues to increase with presence of cadmium in the lower horizons.

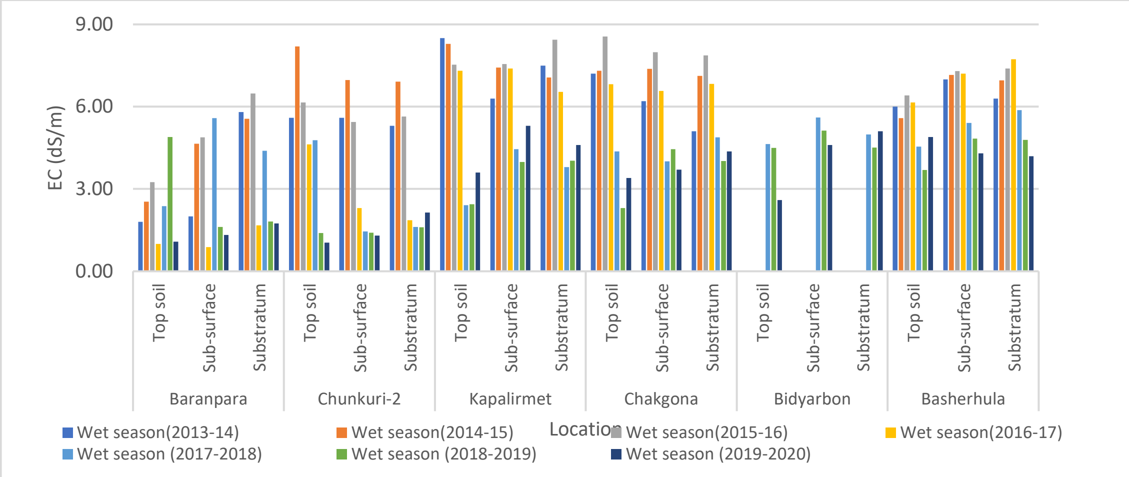


Figure 2.29: Changes of EC (dS/m) in wet seasons in sampling locations throughout the monitoring period

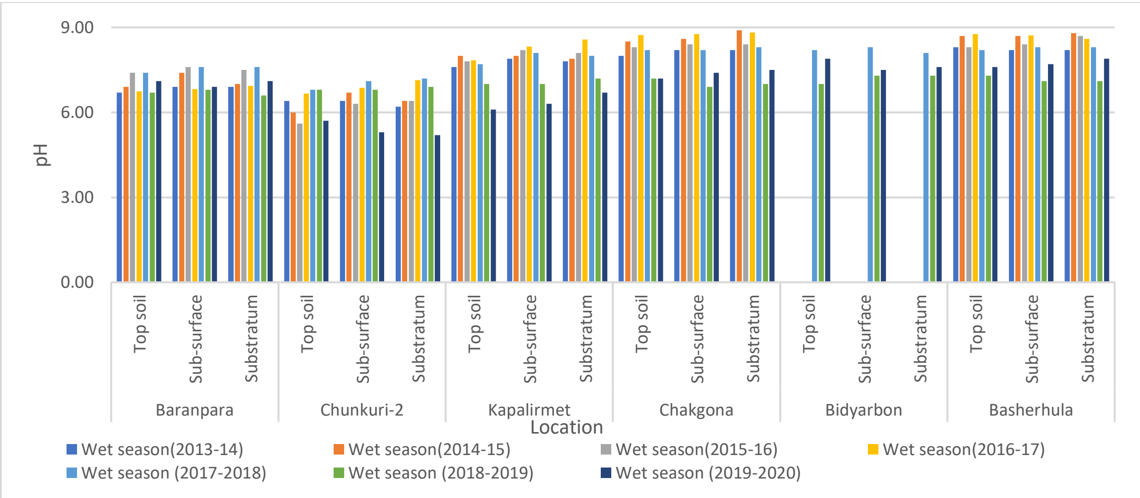


Figure 2.30: Changes of pH in wet seasons in sampling locations throughout the monitoring period

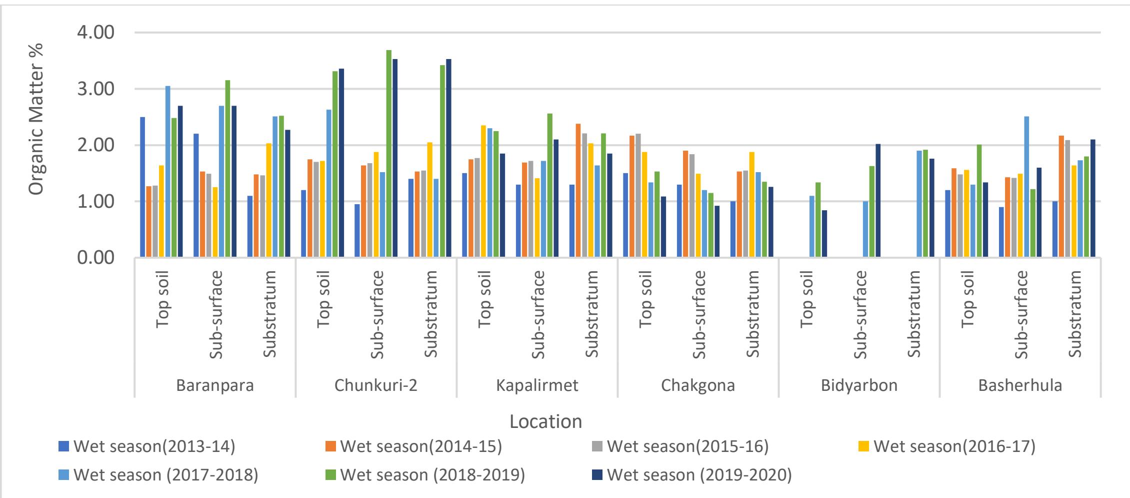


Figure 2.31: Changes of Organic matter (%) in wet seasons in sampling locations throughout the monitoring period

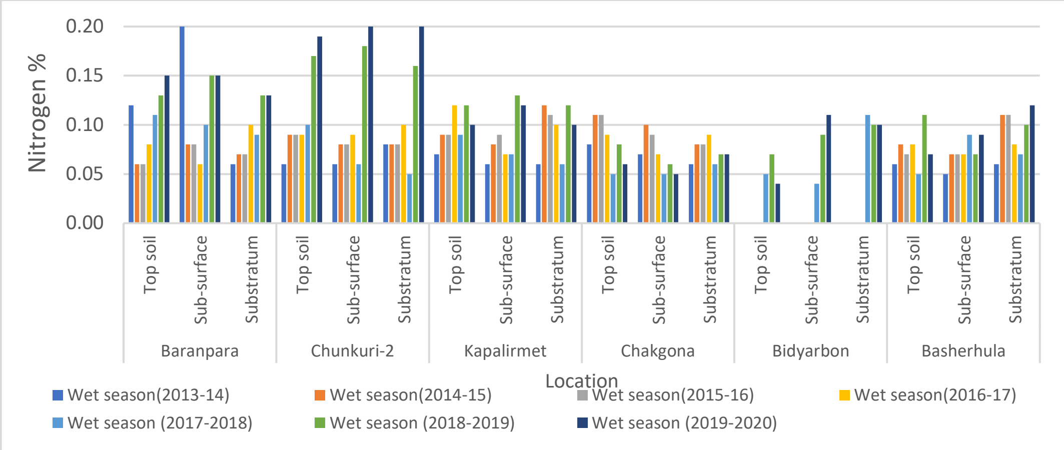


Figure 2.32: Changes of Nitrogen (%) in wet seasons in sampling locations throughout the monitoring period

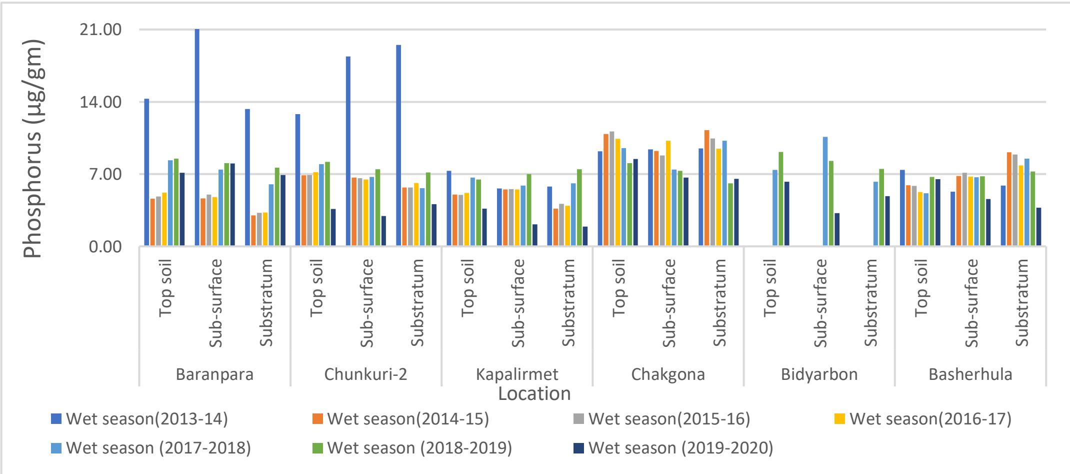


Figure 2.33: Changes of Phosphorus (µg/gm) in wet seasons in sampling locations throughout the monitoring period

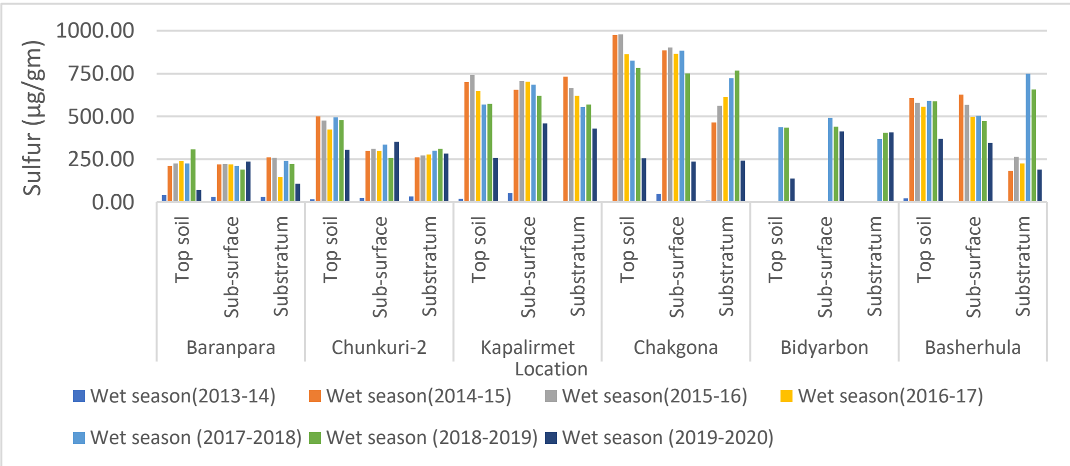


Figure 2.34: Changes of Sulfur (µg/gm) in wet seasons in sampling locations throughout the monitoring period

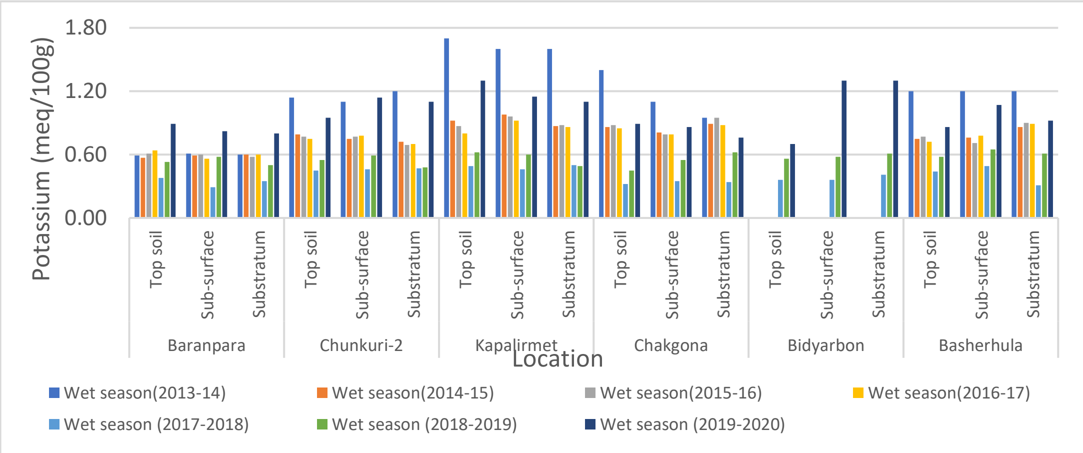


Figure 2.35: Changes of Potassium (meq/100g) in wet seasons in sampling locations throughout the monitoring period

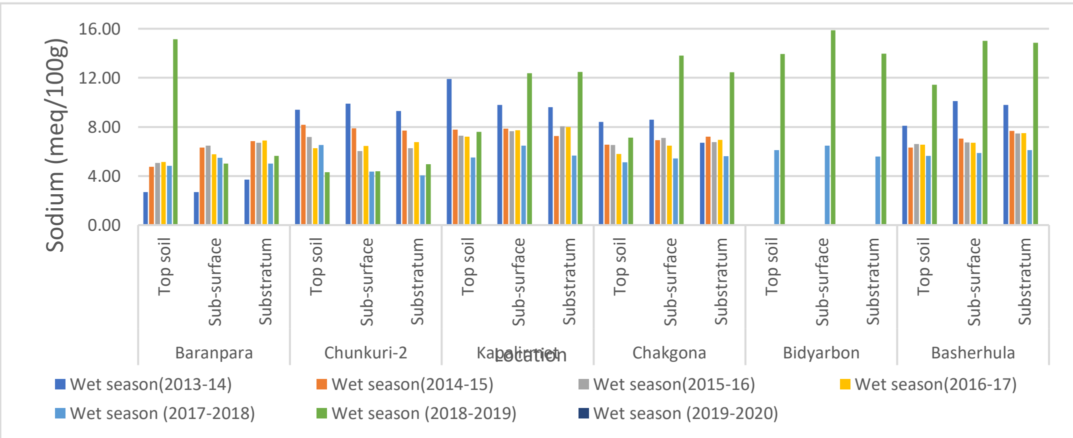


Figure 2.36: Changes of Sodium (meq/100g) in wet seasons in sampling locations throughout the monitoring period

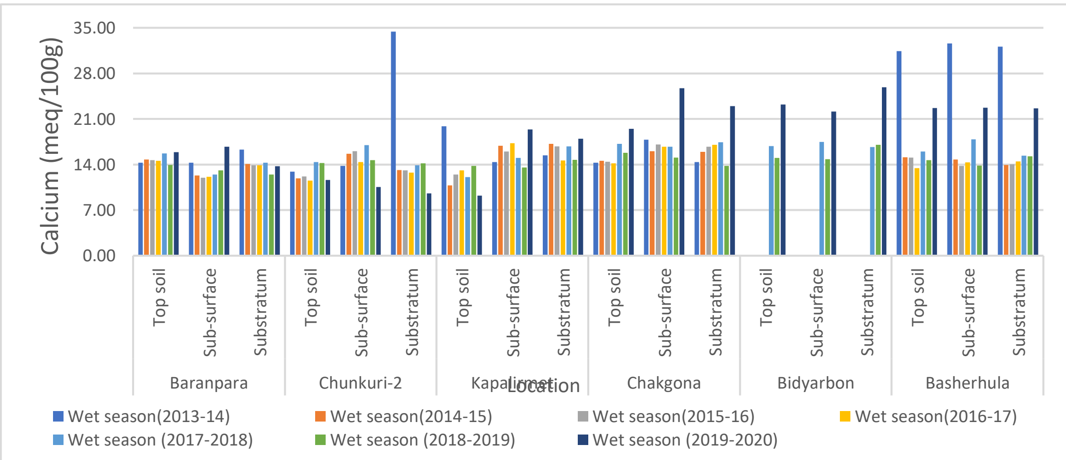


Figure 2.37: Changes of Calcium (meq/100g) in wet seasons in sampling locations throughout the monitoring period

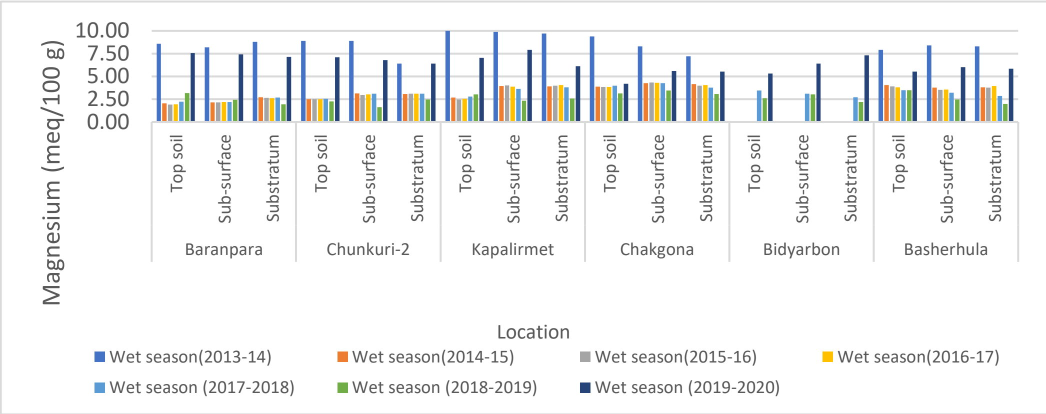


Figure 2.38: Changes of Magnesium (meq/100g) in wet seasons in sampling locations throughout the monitoring period

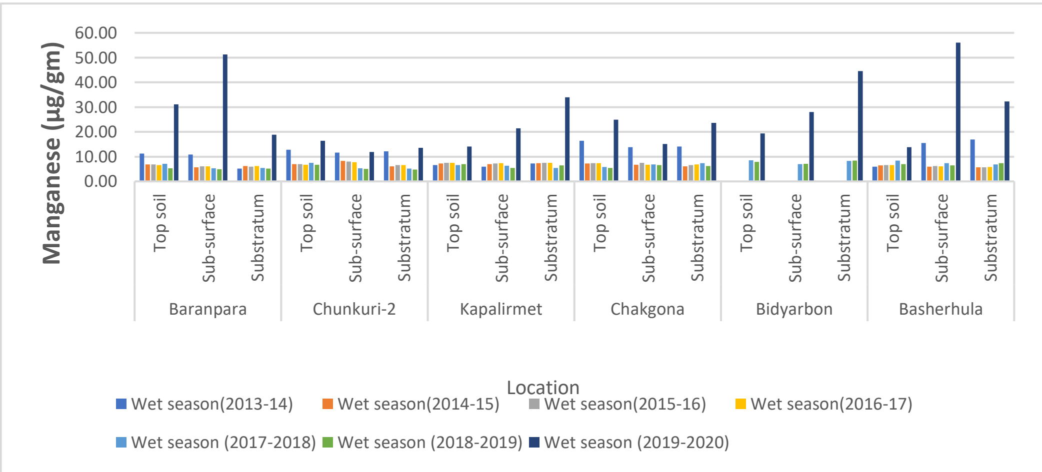


Figure 2.39: Changes of Manganese (µg/gm) in wet seasons in sampling locations throughout the monitoring period

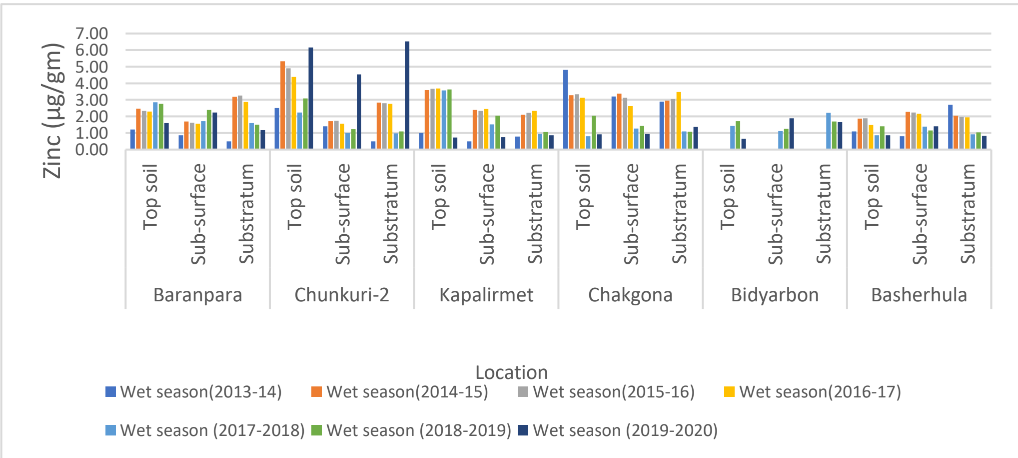


Figure 2.40: Changes of Zinc (µg/gm) in wet seasons in sampling locations throughout the monitoring period

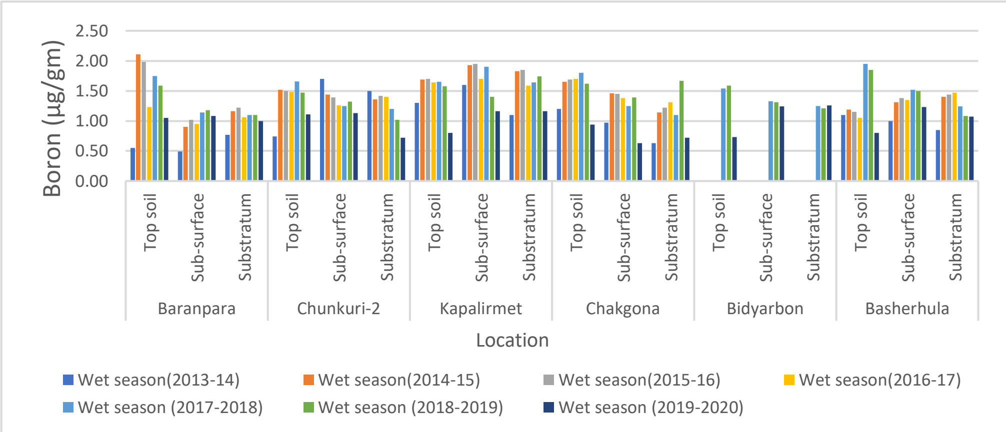


Figure 2.41: Changes of Boron (µg/gm) in wet seasons in sampling locations throughout the monitoring period

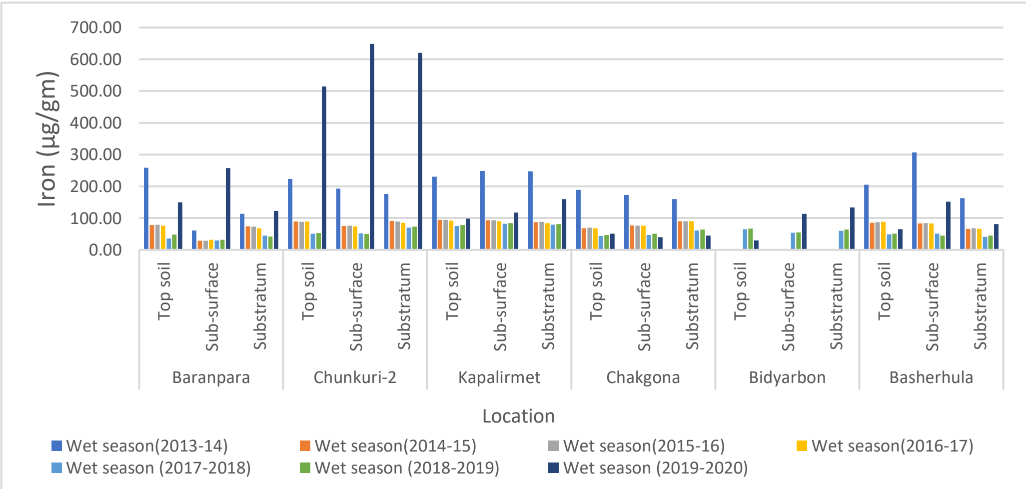


Figure 2.42: Changes of Iron (µg/gm) in wet seasons in sampling locations throughout the monitoring period

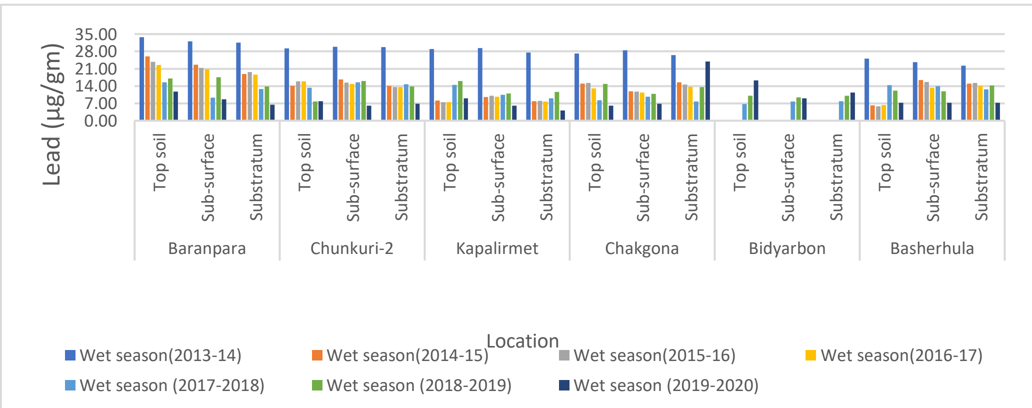


Figure 2.43: Changes of Lead (µg/gm) in wet seasons in sampling locations throughout the monitoring period

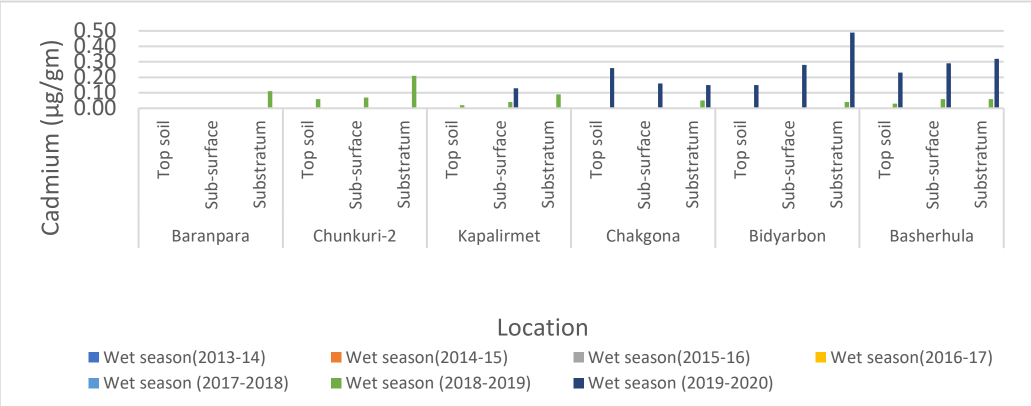


Figure 2.44: Changes of Cadmium (µg/gm) in wet seasons in sampling locations throughout the monitoring period

2.4.4 Agriculture Resources Monitoring

Monitoring of agriculture resources has been scheduled twice a year as per the monitoring plan of the ToR. Next surveys will be conducted and incorporated accordingly.

2.4.5 Livestock Resources Monitoring

The frequency of monitoring for livestock resources data collection is considered twice in a year. Next surveys will be conducted and reported accordingly.

2.5 Transportation Monitoring

2.5.1 Location of Traffic Survey

The traffic survey for this monitoring during the construction phase was conducted from January 22nd to January 24th, 2021 on two weekends and on one weekend at three pre-selected locations around the project site. Weather was heavy foggy during the days when the survey was conducted except one weekday day when sunny weather was observed. 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 2.45**.

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 in **Table 2.11** shows that, the Passenger Car Unit (PCU) per hour suggest that 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	542	991	508
Khulna Mongla Road at Gonai Bridge	194	250	301
Power Plant access road at Gonabelai Bridge	73	80	119

Source: Field Survey, January, 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. Compared to the previous monitoring report, traffic volume and traffic nature in Khulna Mongla Road at Khudir Bottola were found to be higher but at the other two locations (Khulna Mongla Road at Digraj and Power Plant access road at ichamoti Bridge) traffic volume and traffic nature were found to be lower. One of the key factors behind this heavy traffic volume at Khulna Mongla Road at Khudir Bottola is the rigorous and heavy construction works of the Power Plant. On the other hand, reason behind the lower traffic volume at the other two locations may be because the survey date fell on two weekends. Moreover, current pandemic situation could be another reason for the lower traffic volume at those said two locations compared to the immediate previous monitoring results. The detail survey findings regarding the traffic volume surveys as well as the detail calculations are attached in **Appendix E1, E2 and E3**.

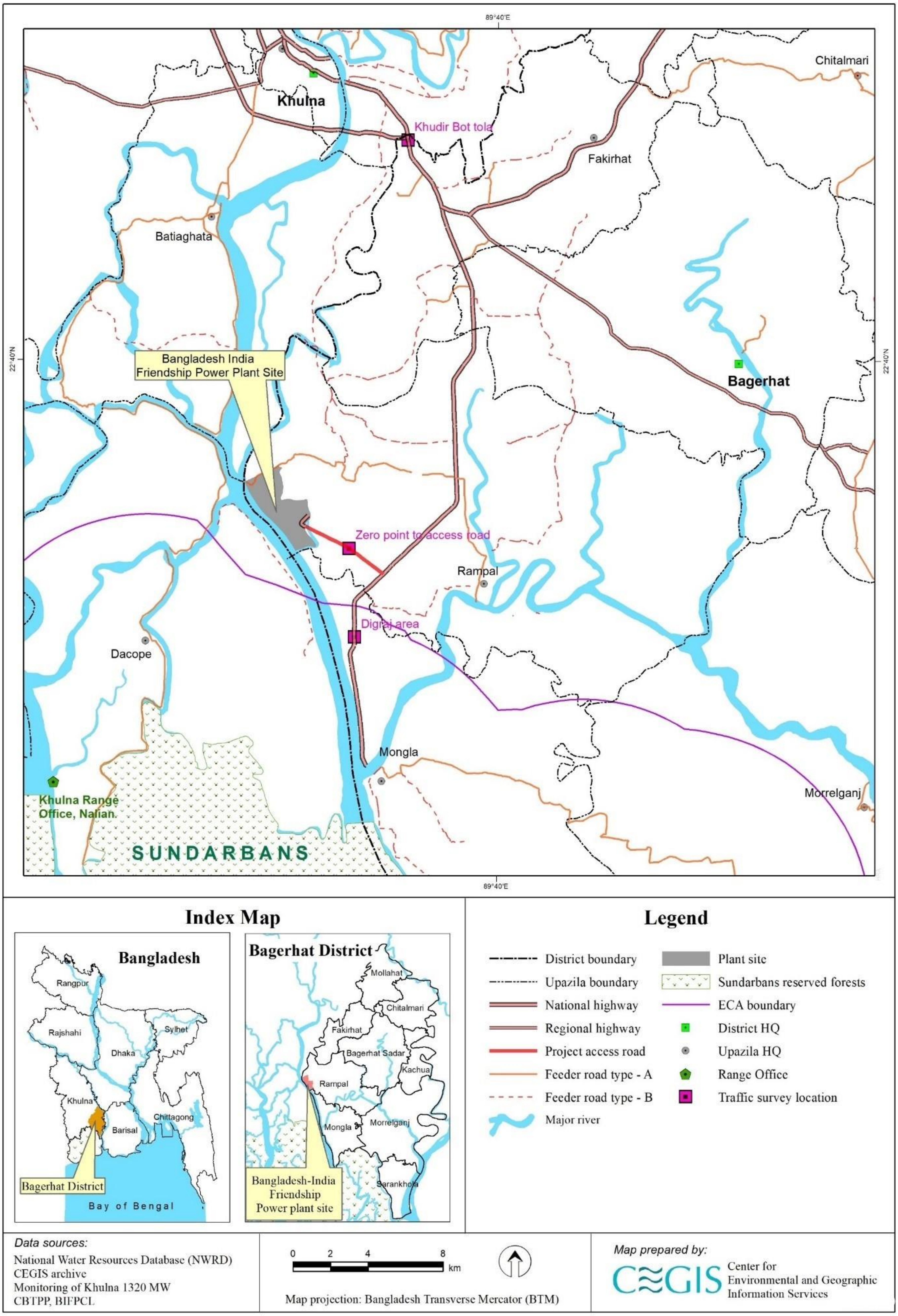


Figure 2.45: Locations of Traffic Survey

2.6 Water resources monitoring

2.6.1 Monitoring of changes in tidal inundation and penetration

For the monitoring of the tidal water level of the Hiron Point, Mongla Port and Rampal Jetty area, daily tidal water level data at Hiron Point and Mongla Port were collected from Bangladesh Inland Transport Authority (BIWTA) for the period from July 2020 to December 2020. Based on the relationship of the water level between Mongla Port and Hiron Point, the lag time and peak attenuation from Mongla Port to Rampal Jetty area were extrapolated.

Relation between Hiron Point and Mongla Port

For the assessment of lag time and peak attenuation between Hiron Point and Mongla Port, daily peak tidal water level were taken into consideration for the period from July 2020 to December 2020. After that, peak tidal water level data were plotted in the same graph both for Hiron Point and Mongla Port which is presented in **Figure 2.46.**

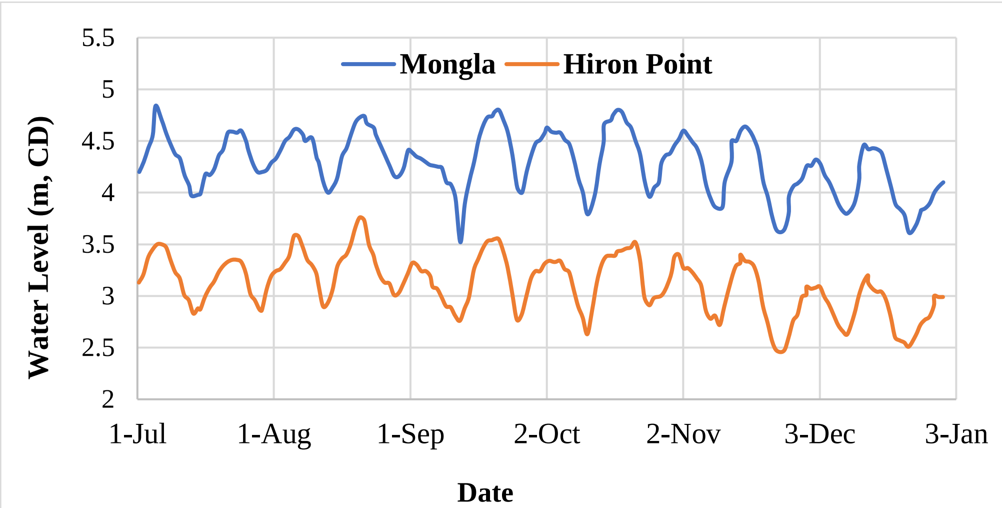


Figure 2.46: Peak water level at Hiron Point and Mongla Port for the period from July 2020 to December 2020

Moreover, maximum water level and corresponding time during full moon and no-moon were assessed to find out the lag time and peak attenuation between two stations (Mongla and Hiron Point) considering the distance between stations. For the assessment of the lag time and peak attenuation between two stations for two different quarters at the second half of the year 2020, tidal water level data from July to September 2020 as well as October to December 2020 were analyzed respectively.

It was found that during no-moon period, peak water level of 3.35 m in July 2020 at Hiron Point travels through tide to upstream at Mongla Port where its peak water level is 4.60 m on the same day (**Figure 2.47**). The peak attenuation between this two stations is 1.25 m during no-moon period in July 2020. It was also found that the travelling time or lag time to reach this peak is around 2 hour 0 minutes. Additionally, peak attenuation for the month August and September 2020 are 1.01 and 1.25 respectively. While the lag time are having same of 1 hour 0 minutes correspondingly for the month of August and September 2020 (**Figure 2.47**). The methodology is shown in Figure 2. It was measured that the distance between Hiron Point and Mongla Port is approximately 80 km. The average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from July to September 2020 is about 1 hour 20 minutes while the peak attenuation is nearly 1.17 m.

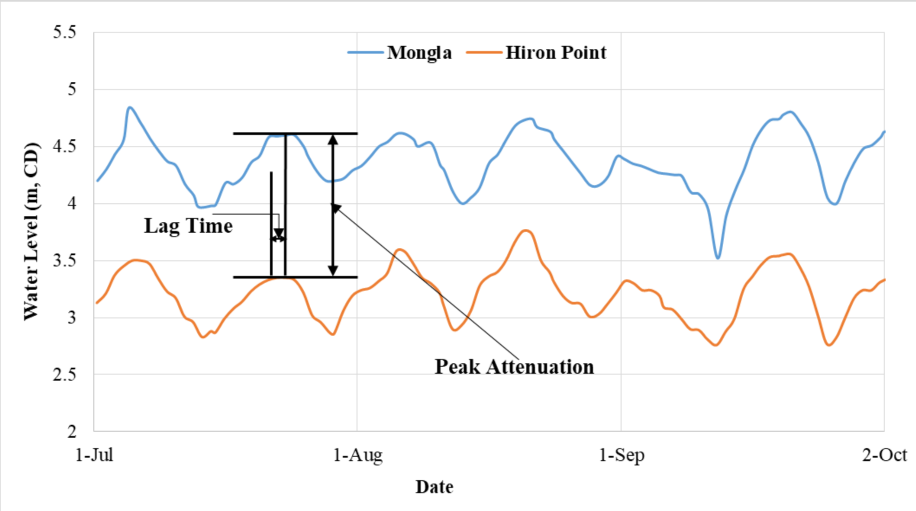


Figure 2.47: Process of calculation of lag time & peak attenuation during the period July-September 2020

Furthermore, analysis was done for the period of October to December 2020 (**Figure 2.48**). It was found that the peak attenuation during the month of October and November are 1.28 and 1.30 respectively while it is 1.29 for the month of December 2020. On the other hand, the lag time to reach peak water level from Hiron Point to Mongla Port for the month of October and November is same which is 2 hour 0 minutes while it is about 1 hour 0 minutes for the month of December 2020 (Figure 3). In addition, average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from October to December 2020 is about 1 hour 40 minutes while the peak attenuation is nearly 1.29 m.

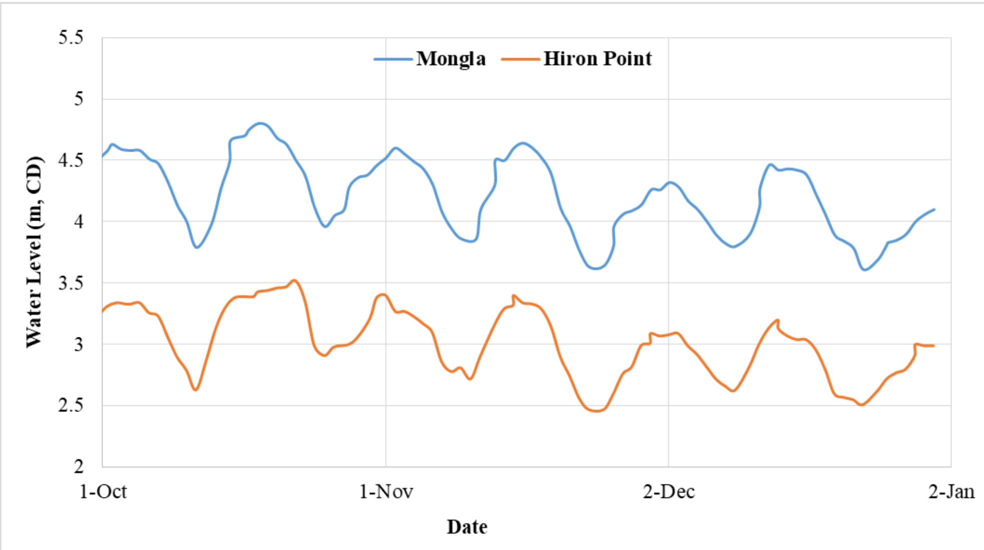


Figure 2.48: Peak water level at Hiron Point and Mongla Port for the period from April 2020 to June 2020

In summary, it was found that average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from July to December 2020 is about 1 hour 30 minutes while the peak attenuation is nearly 1.23 m. Relation between Hiron Point and Mongla Port was used to extrapolate the lag time and peak attenuation at Rampal Jetty area. The travelling distance from Mongla Port to Rampal Jetty area is 15 km. Based on the relation, it was estimated water level at certain peak at Hiron Point needs 1 hour 47 minutes to reach at Rampal Jetty area where peak attenuation is nearby 1.46 m.

2.6.2 Monitoring of erosion and accretion

Bangladesh is a riverine country. Rivers in different hydrological regions have different characteristics. Rivers in the northern parts 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 (Figure 1). 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.

Methods to Assess the Riverbank Erosion and Accretion of the Passur River

For the assessment of the riverbank erosion and accretion, time series satellite images were used. Then images were processed and analyzed before the assessment and identify the locations of erosion and accretion as well as the shifting of bankline in half yearly period. The steps of images processing and analysis is briefly explained below-

Collection and Processing of Images

Sentinel-1 Radarsat satellite images having 10m resolution covering the Passur River from Chalna to Hiron Point for the period September 2020-January 2021 were collected. After that, satellite images were geo-referenced to have the same projection system. Then, it was found that one image differs with other image. In that case, images were co-registered to avoid the distortion with each image

Delineation of Banklines

After collection and processing of images, banklines were delineated for the mentioned period using Arc-GIS tool. Then, banklines were analyzed and superimposed to assess the erosion-accretion and shifting of the river during period from September 2020 to January 2021.

Monitoring of Erosion and Accretion

For monitoring the half yearly riverbank erosion and accretion at the project site, Mongla, Harbaria and Akram point areas, banklines of the Passur River were superimposed with each other. It was found that the river is stable and there is no riverbank erosion or accretion as the river has not shifted from September 2020 to January 2021 (**Figure 2.49**) although there are red color (represents erosion) in few locations along its both banks during its passage from Chalna to Hiron Point which may be considered as insignificant.

2.6.3 Monitoring of Chemical Properties of Bed Materials

Methodology

Sediment is considered 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 has been done during environmental issues monitoring of this project.

Sampling Frequency

The frequency of monitoring for sediment quality has been considered twice in a year (January and July). Accordingly, the sediment sampling was done in 27th monitoring (January, 2021). The sediment quality assessment will be incorporated in 28th monitoring 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 Sulphate. The selected heavy metals are mainly found in coal and assumed to pollute the sediment and water system during operation stage of power plant.

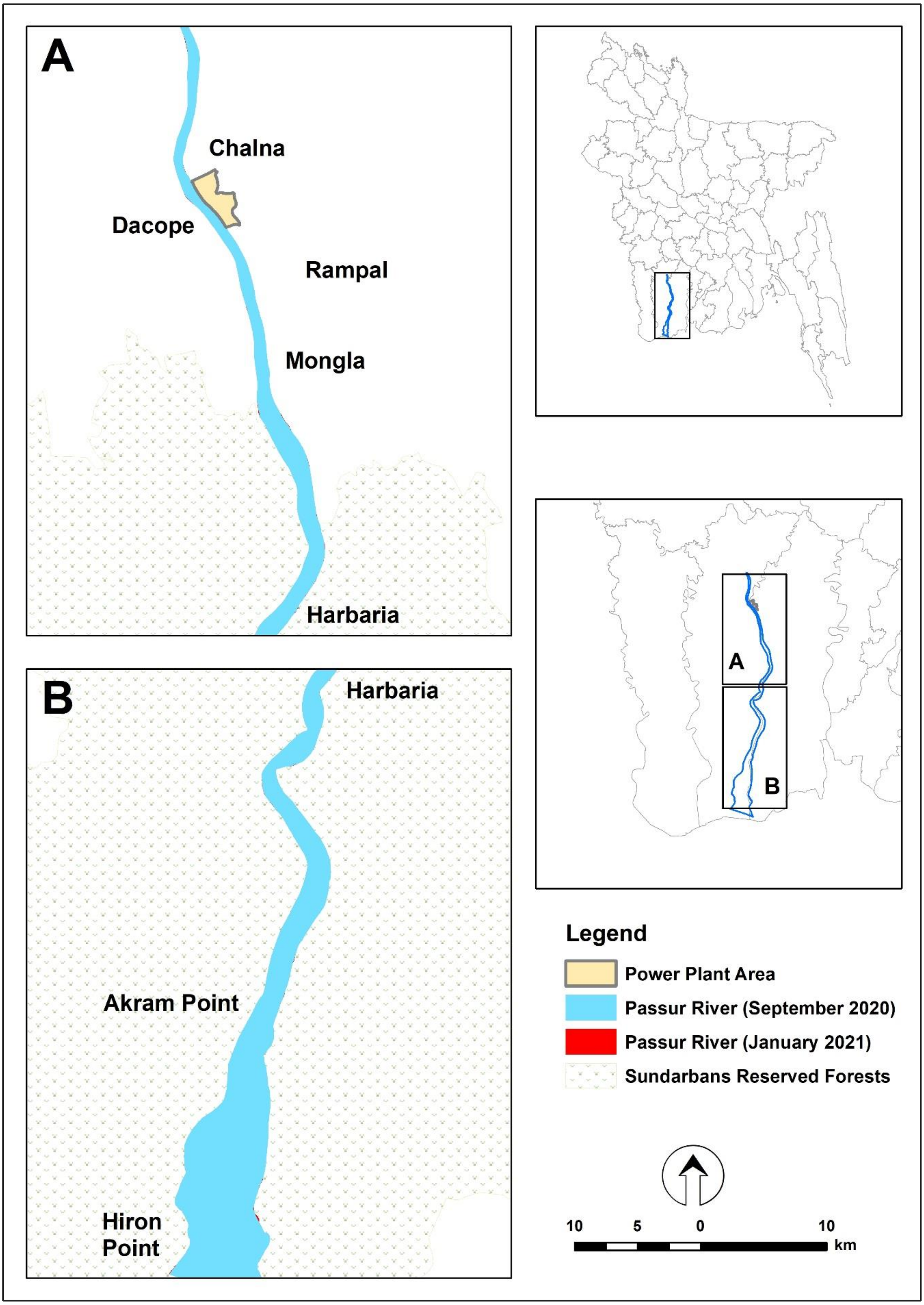


Figure 2.49: Riverbank Erosion and Accretion of the Passur River from September 2020 to January 2021

Location

The sampling locations have been selected in both surrounding of the project area and inside the Sundarbans. The sampling locations are stated in **Table 2.12**. Locations of collected samples are presented in **Figure 2.50**.

Table 2.12: Location and 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_4)	Project Site	N-22°35′21.2″	E-89°32′53.4″	Bi-yearly (January and July)	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″		

Process of Sediment Samples Collection

Plot Selection

The sampling locations were selected on the basis of potential route of coal transhipment 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 were 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

Collected sediment samples have been handed over to BCSIR, Dhaka for laboratory analysis immediate after 27th monitoring. After the analysis the data will be incorporated in 28th monitoring report.

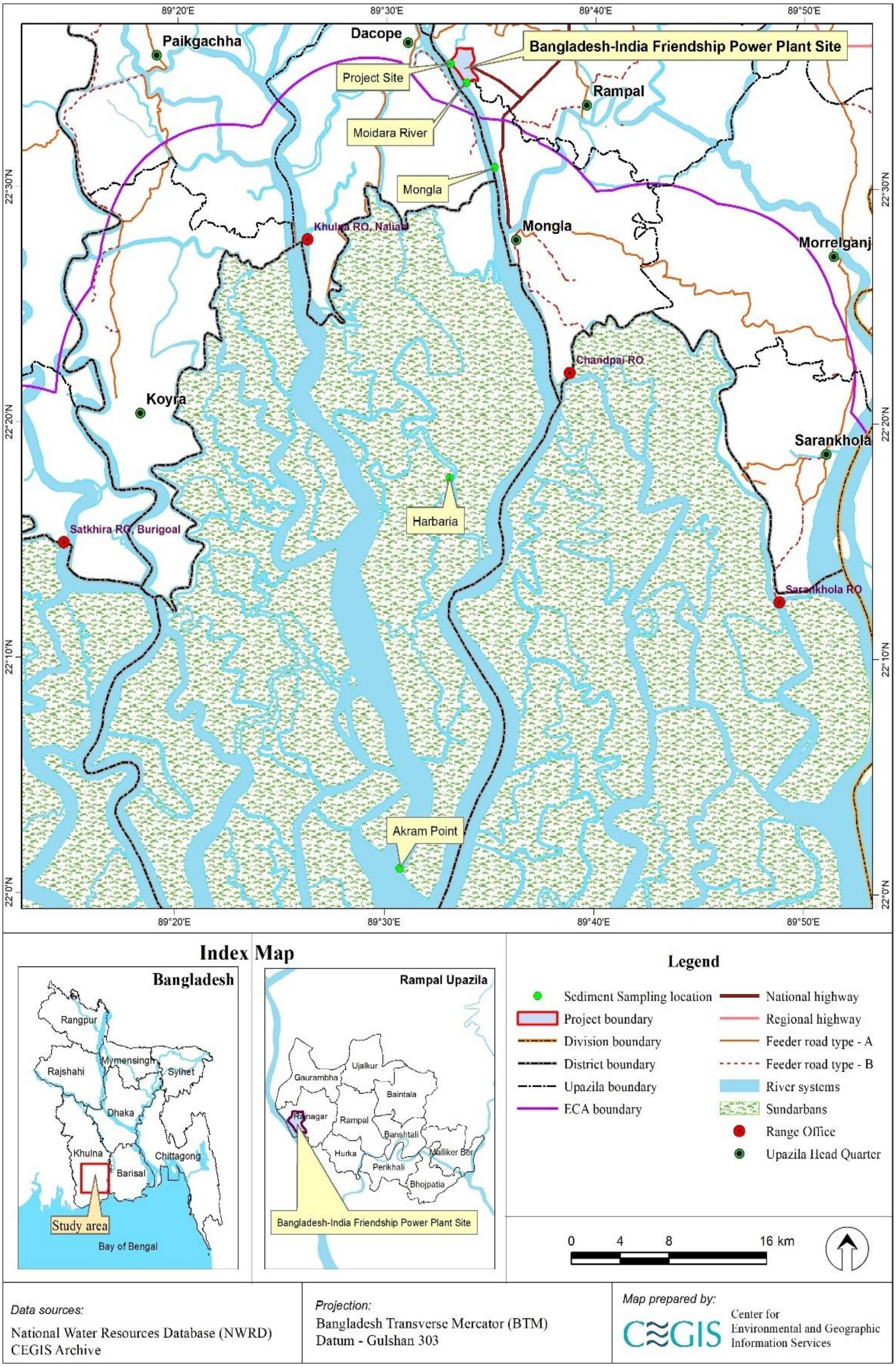


Figure 2.50: Sediment Sampling Locations

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 component of the biological environment around the project site and along the Passur river were categorized into three major groups and which are fisheries resources, ecological resources and Sundarbans Reserve Forest (SRF).

3.1 Fisheries Resources

The monitoring of twenty-six quarters for the session of 2014-15, 2015-16, 2016-17, 2017-18, 2018-2019, 2019-20 as well as of 2020-21 were completed and reported earlier. This chapter contains the findings of 27th quarter and comparison with the earlier 26 quarters.

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.

3.1.1 Methodology

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.

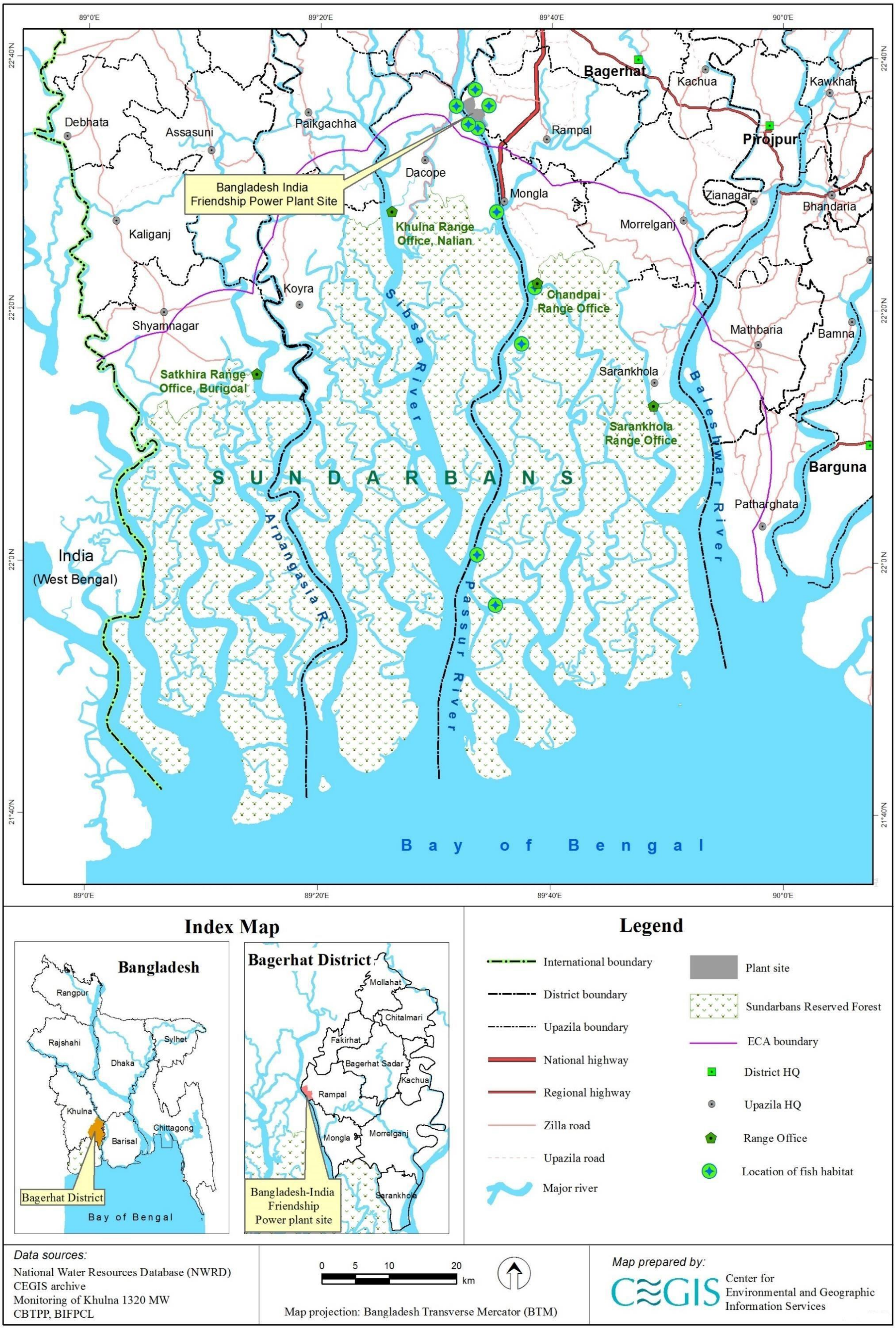


Figure 3.1: Fisheries Resources Monitoring Locations

3.1.2 Status of Monitoring

Followed by the quarter monitoring of the 2014-15, 2015-16, 2016-17, 2017-18, 2018-19 and, 2019-20 and 2020-21 (up to 26th quarter monitoring), 27th quarter monitoring of session 2020-21 was conducted during the period from 22-31 January, 2021. No fishing activities were observed at Haldikhali Khal (B), Bhodra (D), Harbaria (E), Jongra (G) and Maidara point (I) 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.

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 15th quarter monitoring and ten (10) sampling sites from 16th to 25th quarter monitoring according to the ToR in respect of habitat uses for previous quarters of fisheries monitoring (T**able 3.2**).

Table 3.2: Classification of habitat use of 10 sampling sites

Monitoring Quarter	Type of Habitat Use
1st (April, 2014)	• Grazing Ground • Grazing and Breeding Ground
2nd (July, 2014)	• Grazing Ground • Spawning and Nursery Ground
3rd (October, 2014)	• Grazing Ground • Grazing and Breeding Ground • Spawning, Nursery and Grazing Ground
4th (January, 2015)	• Grazing Ground • Grazing and Breeding Ground • Spawning, Nursery and Grazing Ground
5th (April, 2015)	• Grazing Ground • Nursery Ground • Spawning and Nursery
6th (August, 2015)	• Grazing, Breeding Ground • Spawning, and Nursery Ground
7th (October, 2015)	• Grazing Ground, • Nursery Ground and • Growing and Feeding
8th (January, 2016)	• Nursery and Feeding Ground • Growing and Feeding
9th (April, 2016)	• Spawning and Nursery Ground • Feeding and Growing Ground
10th (July, 2016)	• Nursery Ground • Feeding and Breeding Ground
11th (October, 2016)	• Breeding and Spawning Ground

Monitoring Quarter	Type of Habitat Use
	• Feeding and Grazing Ground
12th (January, 2017)	• Grazing and Spawning Ground • Nursing Ground
13th (April, 2017)	• Grazing and Feeding Ground • Nursing Ground
14th (October, 2017)	• Grazing and Feeding Ground • Nursing Ground
15th (January, 2018)	• Grazing and Feeding Ground • Nursing Ground
16th (April, 2018)	• Feeding ground • Growing ground • Nursing ground
17th (July, 2018)	• Spawning and Nursery Ground • Nursery Ground with Feeding and Growing Capacity • Growing and Feeding Ground • Omni-ground
18th (November, 2018)	• Ground for Maturation • Omni-Ground: Nursery and Feeding Ground/Migratory Route; Ground for Maturation; Growing and Maturation Ground; Maturation Ground for Juveniles
19th (February, 2019)	• Ground for Feeding • Omni-Ground including Nursery Ground and Ground for Maturation
20th (April, 2019)	• Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
21st (July, 2019)	• Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
22nd (November, 2019)	• Spawning and Nursery Ground • Omni-Ground including Feeding and Maturation Ground
23rd (February, 2020)	• Nursery Ground • Spawning ground • Ground for maturation and feeding
25th (July, 2020)	• Nursery Ground • Ground for maturation and feeding

During the 27th quarterly monitoring conducted in January of 2020-21 Session, the sampling sites were divided into two major classes and shown in the **Figure-3.2 (Figure D.1 of Appendix IV)**.

Nursery Ground: The catch revealed that availability of Juvenile stage (Length group: <2cm and 3-5cm) of different fish species were dominant at Akram Point (A) and Chalna (J). It indicates that the mentioned sampling sites were found to be used as nursery ground and ground supporting recruitment into adult age group for many medium and large sized fish species.

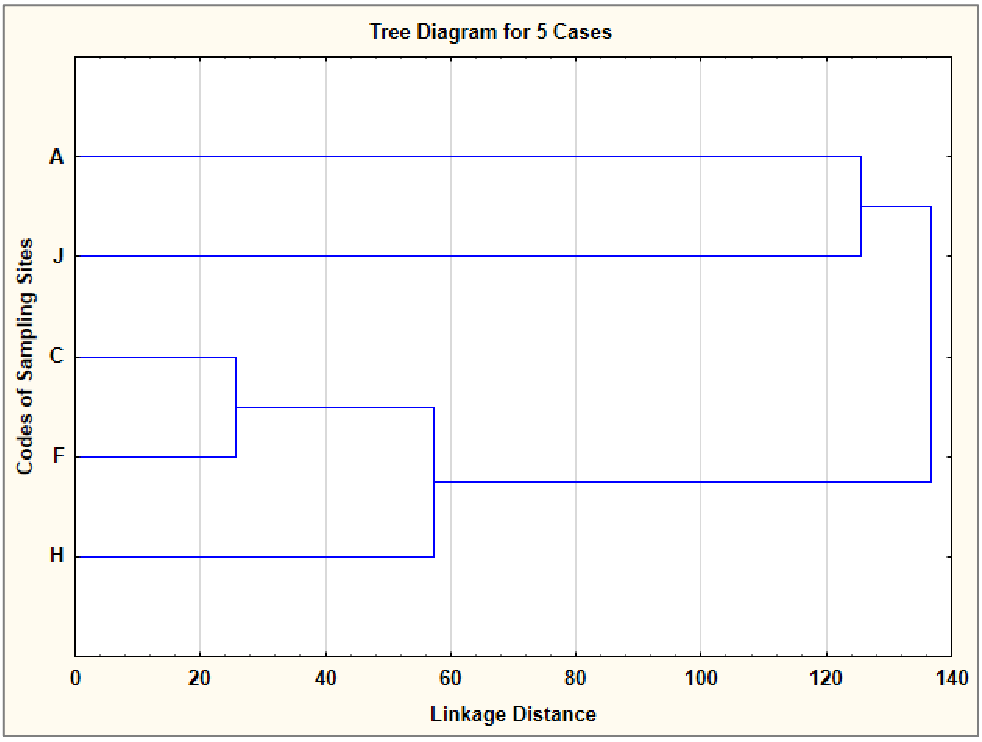
Omni-Ground: Another class, which is found to support multi-length groups (<2cm, 2-3cm, 3-5cm, 5-10cm, 10-20cm and >25cm) of observed fish species, was considered as the omni-ground for fishes. Fishes of this class mainly belong to two major habitats- a) Spawning and Nursery Ground and b) Maturation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

Spawning and Nursery Ground

Among the sampling sites, the sampling sites, Charaputia (C) and Chandpai (F) were identified as spawning and nursery ground for high abundance of fry and juvenile fishes.

Maturation Ground

The sampling sites, Akram Point (A) and Chalna Point (J) were found to be rich in adult age-group. Presence of dominant length groups of 10-20cm and >25cm indicate that the sites function as the maturation ground of different fish species (following the considerations of Rahman, 1989 and 2005; Huda et al., 2003).

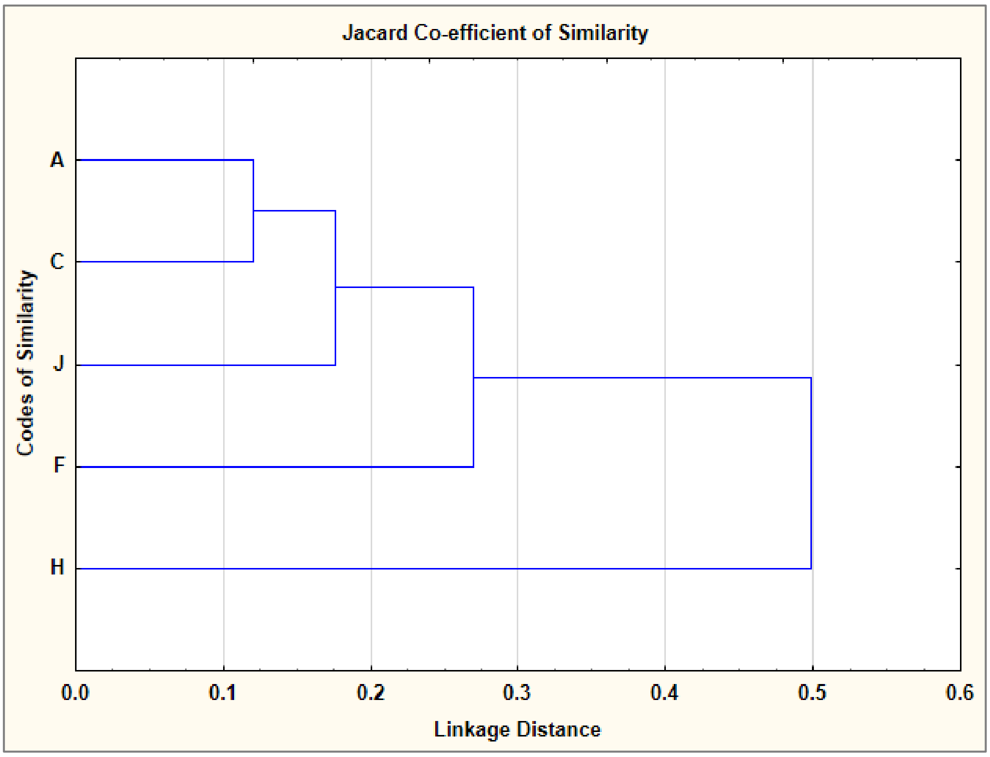


27th Monitoring, January 2021

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

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

The dendogram 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 2020-21 (27th), the JI value between the Akram Point (A) and Charaputia Khal (C) sampling sites were the highest (**Figure 3.3**) which indicates the maximum similarity in species occurrence between these two sites out of 5 sampling sites of available fishing **(Figure D.2 of Appendix IV)**.



27th Monitoring, January 2021

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

Habitat Suitability Index (HSI)

Habitat Suitability Index (HSI) was determined for the year of 2014-15 and 2015-16 considering the exposure to water quality and the production performance of different fish species. Production performance was measured through considering length-structured production assessment model (E. L. Cadima, 2003). Suitability analysis was conducted by applying Iyengar and Sudarshan (1982) developed model. All data was normalized through using UNDP developed normalization equation (*UNDP, 2006*).

In the first year of monitoring, Sheola Khal at Chandpai was found as the most suitable habitat for fish species among the Passur River System. Sheola Khal has also been identified as the most suitable in second year which is followed by Harbaria, Akram Point, Haldikhali, Mongla Point, Maidara and Chalna Point. In third year (2016-17) of monitoring, Harbaria Khal was found to be mostly suitable habitat for fish. In 2017-18, the Sheola Khal at Chandpai was highly suitable habitat, which was observed to support various length groups of diversified fishes. In the last monitoring year (2018-19), the Sheola Khal at Chandpai attained again highest suitability index, which indicates that this habitat has the potentiality to support various length groups of diversified fishes.

Fish Diversity

Shannon-Weiner Index

In this monitoring year of 2020-21, species evenness also varies among the sampling sites. Highest Shannon-Weiner index was found at Akram Point (0.59) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at the Mongla (0.12) (shown in **Table 3.3 and Table 3.4**). 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 **Figure 3.4**.

Fish Species Richness (FSR)

Fish species richness was identified through Simpson's Index1. Considerable difference is noticed in the fish species richness (FSR) in different habitat classes (**Table 3.5** and **Table 3.6** and **Figure-3.5**).

In this monitoring phase, species richness varies with the sampling sites. Maximum FSR was obtained at Charaputia Khal (n=28), while very low FSR was recorded at Mongla Point (n=3). Different scenarios of richness were found in this quarter in comparison to the previous monitoring years. Among habitats in upstream portions of the Passur River, Charaputia Khal was home to rich assemblage of *Chamua Chingri, Paissa* and *Motka Icha*, Akram Point was of *Chali Chingri*, *Chamua Chingri* and *Harina Chingri*. In midstream portion, Chandpai was rich in *Chamua Chingri*.

[1]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.

Table 3.3: Site Wise Species Diversity using Shannon–Weiner Index (1st to 13th QM)

Site	Species No													Shannon-Weiner Index*												
	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th QM	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th 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

Table 3.4: Site Wise Species Diversity using Shannon–Weiner Index (14th to 27th QM)

Site	Species Number													Shannon-Weiner Index												
	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM
A	0	0	3	0	8	0	2	0	0	0	0	7	**18**	0	0	0.92	0	0.16	0	0.65	0	0	0	0	0.64	**0.59**
B	0	0	0	0	2	0	-	0	0	0	0	0	**0**	0	0	0	0	0.92	0	-	0	0	0	0	0	**0**
C	0	0	12	0	0	24	11	0	0	10	0	4	**28**	0	0	0.69	0	0	1.69	0.86	0	0	0.78	0	0.82	**0.53**
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**
E	0	0	0	17	12	0	2	0	0	2	0	9	**0**	0	0	0	0.31	0.73	0	0.99	0	0	0.72	0	0.29	**0**
F	6	17	0	0	0	13	22	19	11	11	0	12	**7**	0.85	0.81	0	0	0	1.44	0.74	0.5	0.81	0.56	0	0.70	**0.18**
G	81	29	21	16	19	0	26	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**
H	112	13	3	18	2	13	-	5	11	10	11	0	**3**	0.54	0.21	0.55	0.49	0	1.44	-	0.14	0.76	0.40	0.55	0	**0.12**
I	3	13	12	10	17	11	8	9	11	12	6	16	**0**	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**
J	4	5	10	14	11	21	12	14	9	8	15	11	**12**	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**

**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)*

Table 3.5: Site wise Rich Species Number (1st to 12th QM)

Site	Location	No. of Rich Species											
		2014-2015				2015-2016				2016-2017			
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
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 3.6: Site wise Rich Species Number (13th to 27th QM)

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

Source: CEGIS Field Survey, April 2014-January2021

Golda Chingri

Bishtara

Chota Baila

Potka

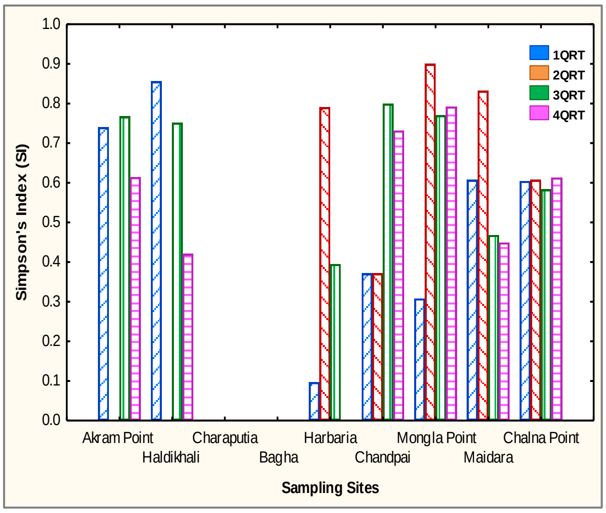
Mutkura Baila

Kukurjib

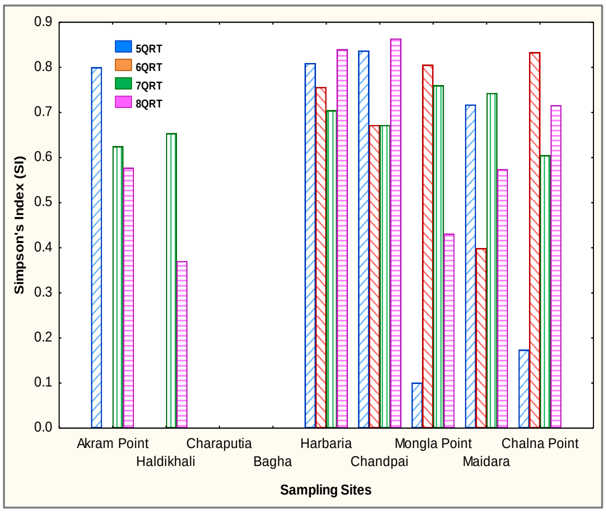
Thurina

Mokta Icha

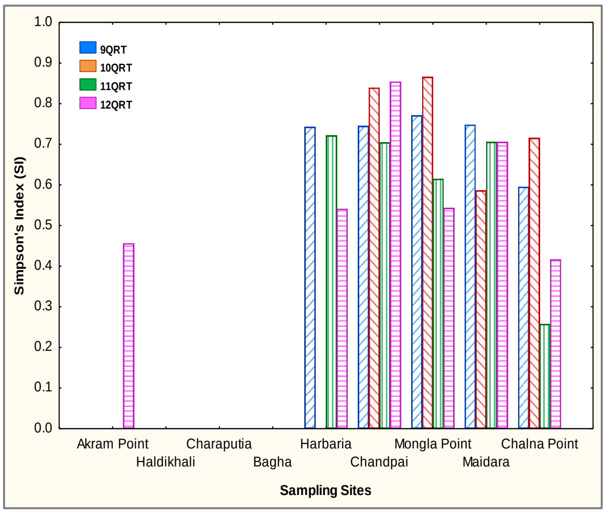
Figure 3.4: Different available observed fish species in 27th quarter monitoring



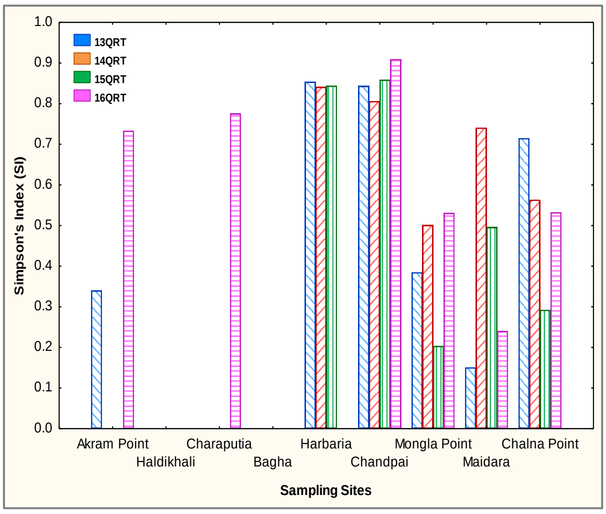
2014-2015



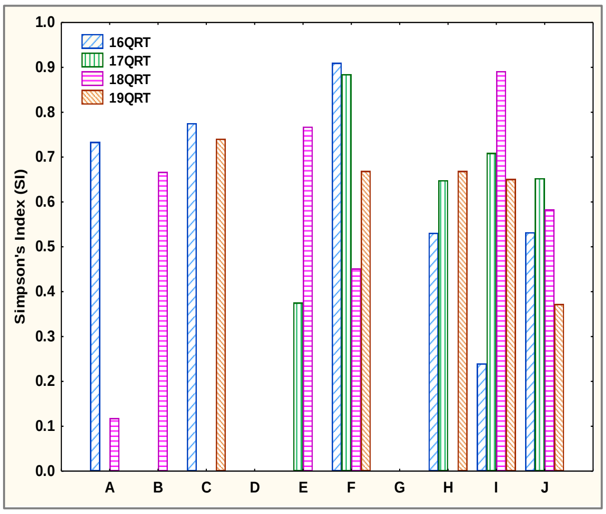
2015-2016



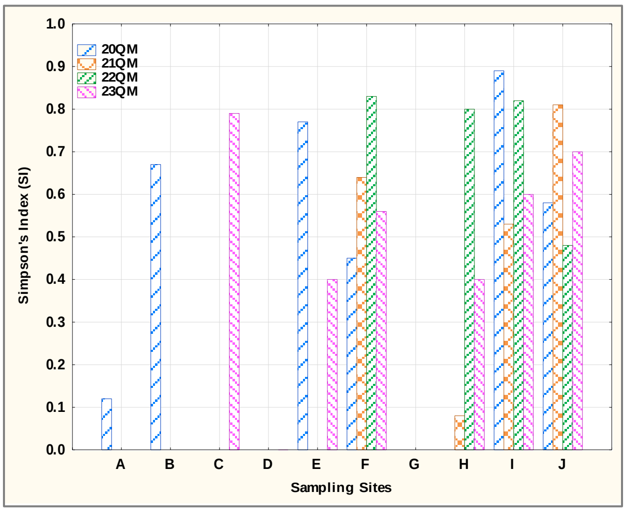
2016-2017



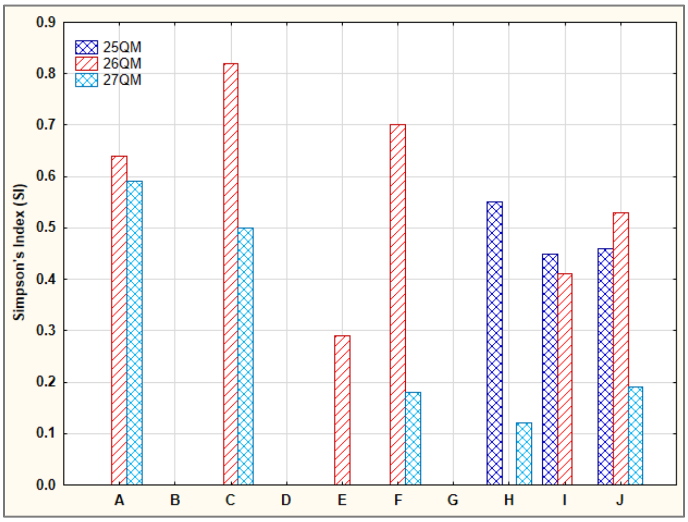
2017-18



2018-19



2019-20



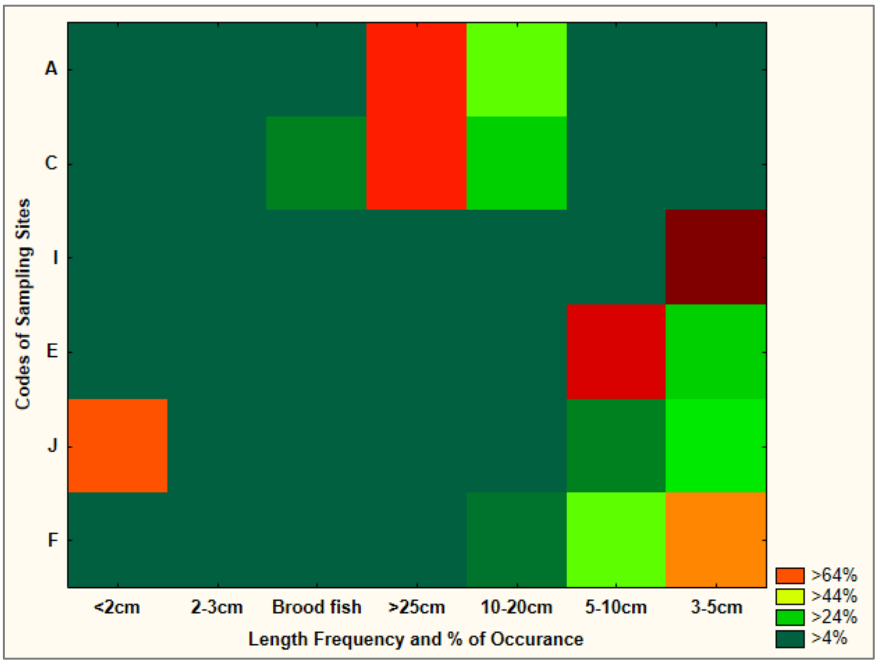
2020-21

(FSR is identified though Simpson's Index)

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

<u>*Fish Community Structure*</u>

Fish community structure was analyzed through counting the length-wise fish individuals (**Figure 3.6**). The following Table **D.3 and D.5** of **Appendix IV** and **Figure 3.6** for 27th quarter of monitoring year of 2020-21 shows that fries were dominant at Chalna, Mongla and Chandpai Point but juvenile to adult age group were dominant at Akram Point and Charaputia .



27th Monitoring, November 2020

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* attain the maximum abundance among the migratory fish species observed in the 27th quarter of monitoring year, 2020-21. The relative abundance of the migratory species is given below in the **Figure 3.7.**

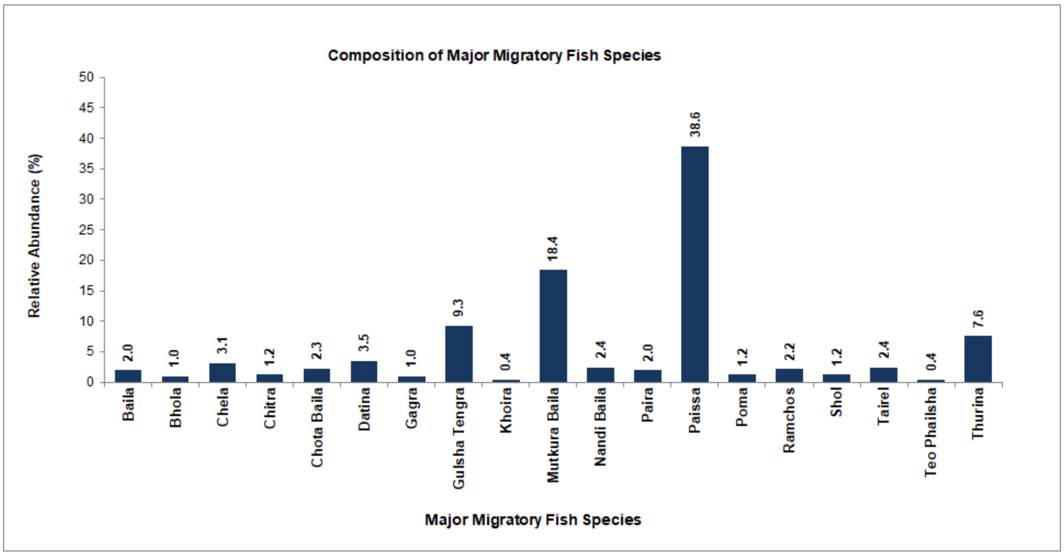


Figure 3.7: Relative abundance of major migratory fish species in sampling sites

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, Chela and Baila were observed to migrate long distance (**Figure 3.8 and** Table **D.6 and Table D.6 of Appendix IV**).

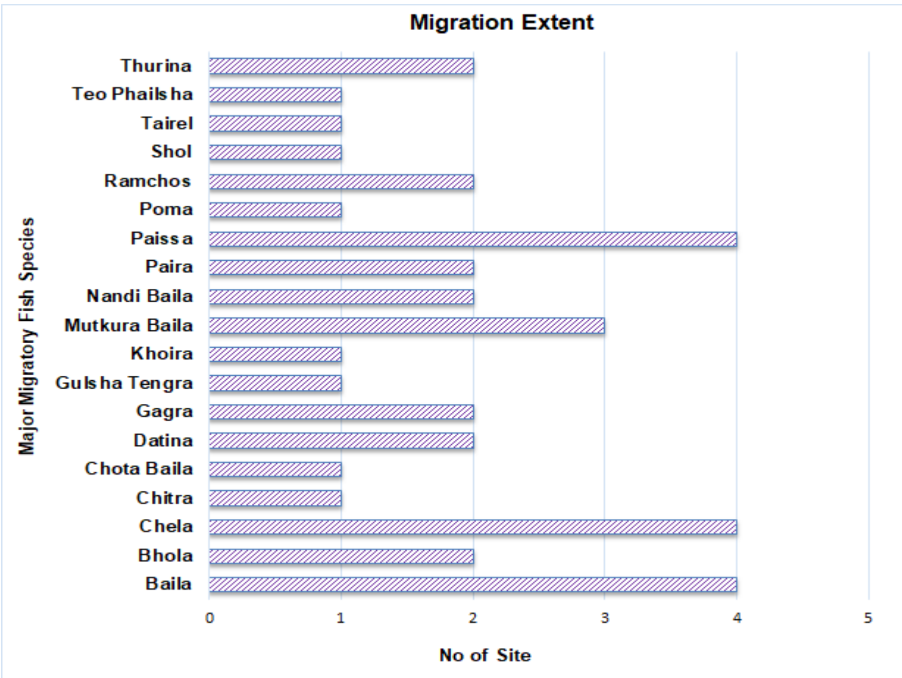


Figure 3.8: Migration extent of major migratory fish species in sampling sites

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 fish stocking was just started during this monitoring period and maximum stocking was found at Rajnagar Gher in case of Bagda Chingri .

Shrimp/Fish Growth Rate and Mortality

During the 27th quarter of monitoring, the growth rate was not observed in the Gher as it was gher preparation phase (**Table 3.7** and **Table 3.8)**.

Table 3.7: Growth Rate and Mortality of Fish/Shrimp (1st to 13th QM)

Gher No.	1st QM (Apr 2014)		2nd QM (Jul 2014)		3rd QM (Oct 2014)		4th QM (Jan 2015)		5th QM (Apr 2015)		6th QM (Aug2015)		7th QM (Oct 2015)		8th QM (Jan 2016)		9th QM		10th QM		11th QM		12th QM		13th 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 3.8: Growth Rate and Mortality of Fish/Shrimp (14th to 27th QM)

Gher No.	14th QM		15th QM		16th QM		17th QM		18th QM		19th QM		20th QM		21st QM		22nd QM		23rd QM		25th QM		26th QM		27th 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	0.03	50	-	-	0.28	0.28	0.38	80	-	-	-	-	0.35	50	0.38	-	0.35		-	-	0.38	-	0.42	35	-	-
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	-	-
3	0.02	25	-	-	0.4	0.4	0.20	50	-	-	-	-	0.34	40	0.36	-	0.37		-	-	0.32	-	0.38	90	-	-

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

Fish Production

<u>*Capture Fish Production*</u>

The present study revealed that the highest catch susceptibility was also found in case of Charpata Jal (11.0 kg/haul) shown in **Table 3.9.**

In 27th quarter monitoring, the highest productivity was found at Charaputia followed by Mongla point and Akram Point (**Table 3.10**It is to be noted that fries found in catch were not considered in the productivity assessment

Table 3.9: Total Catch in Different Gears in the Sampling Sites

Site	Habitat	Gear Name/Type	Haul Duration (hr)	No of Haul	kg/haul
A	Confluence at Akram Point	Khepla Jal	0.1	15	0.2
	Mollakhali Khal	Borshi	0.1	10	0.3
B	Charaputia Khal	Charpata Jal	6	3	11
C	Passur River	Net Jal	0.5	1	-
D	Passur-Mongla Confluence	Bepdi Jal	6	1	4
E	Passur River, Chalna Point	NetNet Jal	0.3-	1-	--
	Confluence at Akram Point	Khepla Jal	0.1	15	0.2
F	Mollakhali Khal	Khepla Jal	0.1	10	0.3
G	Charaputia Khal	Charpata Jal	6	3	11
H	Passur River	Net Jal	0.5	1	-
I	Passur-Mongla Confluence	Bepdi Jal	6	1	4
J	Passur River, Chalna Point	NetNet Jal	0.3-	1-	--
	Confluence at Akram Point	Khepla Jal	0.1	15	0.2

Source: Catch assessment survey, CEGIS, November 2020

*** Weight of Fry is not considered for catch assessment*

Table 3.10: Total Catch in the Sampling Sites

Sampling Site	Total Catch (kg)												
	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th 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)													
	13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM
A	2	0	0	17	0	16	0	0.40	0	0	0	0	30.5	3.5
B	0.25	0	0	0	0	1	0	0.00	0	0	0	0	-	-
C	0	0	0	1.50	0	0	93	17.50	0	0	4.6	0	18.95	33
D	0	0	0	0	0	0	0	0.00	0	0	1.35	0	-	-
E	8.13	1.5	2.56	0	0.1	2	0	0.50	0	0	1.17	0	2.07	-
F	0	0	0	0	0	0	0	0.00	0	0	0	0	0.6	-
G	77.5	10.5	37.67	3	4	27	0	0.00	0	0	0	0	-	-
H	0	0	0	0.33	22	0	5	0.00	11.5	0.2	20	10.5	-	4
I	0.3	0.4	0.67	0.13	3	5	1.2	0.00	0.5	1.7	0.4	3.0	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	-

**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 27th quarter monitoring

Culture Fish Production

The present study on shrimp/fish farm in the 27th quarter monitoring phase was fish stocking phase so fish production was not observed in the 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

<u>Homestead at Rajnagar</u>

This homestead is dominated by Gewa *(Excoecaria agallocha)* among all the trees due to its highest population which get favor from soil's salinity for luxurious succession. Beside this, Safeda *(Manilkara zapota)* and Boroi *(Zizyphus sp)* are the two species of fruit yielding trees. Monocots fruits including Narikel *(Cocos nucifera)* and Khejur *(Phoenix sylvestris)* occupied the top canopy of the vegetation. In addition a number of Bola *(Hibiscus tiliaceus),* Kewra *(Sonneratia apetala)* and one Sundari (*Heritiera fomes)* also found to exist. The homestead very few grasses or undergrowth vegetation.

<u>Homestead at Kalekarber dighi</u>

Two species like Narikel *(Cocos nucifera)* and Khejur *(Phoenix sylvestris)* occupies the top canopy. The homestead have many Mahagoni *(Swietenia mahagoni*) saplings which population is also high. Jaam (Sygizium cumini), Tentul (Tamarindus indica), 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 Koroi *(Albizia saman)* and Raj Koroi *(A. richardiana)* are timber trees those are occupied top canopy height more than 10m. Beside this, Neem *(Azadirachta indica),* Bakul (*Mimusops elengii)* and few number of Kola (Musa sp) are found on these homestead platforms.

<u>Homestead at Chalkghona</u>

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.

<u>Homestead at Barni</u>

Rendi Koroi *(Albizia saman)*, Mahagoni *(Swietenia mahagoni*), Taal *(Borassus flabellifer)*, Narikel *(Cocos nucifera),* Khejur *(Phoenix sylvestris)* are referable. The home owner have 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 quadrate vegetation survey has been conducted at selected homesteads during recent monitoring tier. A total of 53 plant species (excluding undergrowths) has been recorded from 16 number of surveyed sample quadrates within the homesteads. Details of the survey result is presented in **Table 3.11** below.

Table 3.11: Plant species composition of the sampled homesteads

Species Name	Local Name	Rajnagar				Borni				Kalekarber				Chalkghona				Tot. No. of individuals	Biodiversity Index
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16		
Acrostichum aureum	Tiger Fern		3			8	5		13				2			1	1	33	3.16
Adhatoda vasica	Bashok						1											1	
Albizia richardiana	Chambol					1				1				1				3	
Albizia saman	Rendi Koroi	1				5		2		1				1	3			13	
Areca catechu	Supari					1	15		5		1							22	
Azadirachta indica	Neem				1	6	1											8	
Borassus flabeliffer	Taal							2		4	1	4				2		13	
Carica papaya	Pepey								1									1	
Citrus medica	Lebu									1								1	
Cocos nucifera	Narikel	4	3	1	5	3	1	2	1		3	5	4	2			2	36	
Colocasia sp	Kochu						10		4					30				44	
Cordia dichotoma	Bohal/Gum Tree										1				1			2	
Dentella repens	Danton										1							1	
Diospyrus pregrina	Gab					4								1	3			8	
Erythrina ovalifolia	Mandar													1				1	
Eucalyptus sp	Eucalyptus					2												2	
Euphorbia Tirucallii	Pencil Cactus						15											15	
Excoecaria agallocha	Gewa	5	6		12	3	1	2	3						3	7	10	52	

Species Name	Local Name	Rajnagar				Borni				Kalekarber				Chalkghona				Tot. No. of individuals	Biodiversity Index
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16		
Ficus benjamina	Lokkho Pakur	1																1	
Ficus hispida	Dumur								1		3	4						8	
Gossypium herbaceum	Karpus Tula																2	2	
Heritiera fomes	Sundari	2					1											3	
Heritiera fomes	Sundari	2																2	
Hibiscus tiliaceus	Bola		2										5					7	
Hibiscus tiliaceus	Bola	3	3	3														9	
Ipomoea fistulosa	Dhol Kolmi						30	50										80	
lannea coromandelica	Jiga						5				2	1		40				48	
Lawsonia inermis	Mehedi			1					1									2	
Lepisanthes rubiginosa	Amjum/ Baraharina			1														1	
Limonia acidissima	Kotbel			1				1						1				3	
Mangifera indica	Aam						2			1				5	3			11	
Manilkara zapota	Safeda							1		1								2	
Mimusops elengi	Bokul										1							1	
Moringa oleifera	Sazna					1							2	1				4	
Musa sp	Kola		4			17	3	3	3	20	10			6			2	68	
Ocimum sanctum	Tulshi								2					3	1		10	16	
Phoenix sylvestris	Khejur		2	2	2	1	1				1		4		3	1	11	28	
Phylanthus reticulatus	Shitki						1						40					41	
Phyllanthus acidus	Orboroi								1	1					2			4	
Pongamia pinnata	Koroach		1												1			2	

Species Name	Local Name	Rajnagar				Borni				Kalekarber				Chalkghona				Tot. No. of individuals	Biodiversity Index
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16		
Psidium guajava	Peyara						1		1	1				1				4	
Sonneratia apetalla	Kewra				1													1	
Spondias mombin	Amra					2	1											3	
Streblus asper	Shewra										1							1	
Swietenia mahagoni	Mahagoni					7	3	4	1	25	15	4	11	4	3			77	
Syzygium cumini	Jaam													3				3	
Tagetes erecta	Ganda Fhul														1			1	
Tamarindus indica	Tentul				1				1					1				3	
Terminalia arjuna	Arjun													1				1	
Terminalia catapa	Kathbadam														2			2	
Unknown 1						3	3	2	11									19	
Vachellia nilotica	Babla															1	1	2	
Zizyphus sp	Kul boroi						1							2				3	

Note: Q-Quadrate

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 incretion 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 regard, a number of common tree species have been observed in each homesteads.

Leaf spot, lethal yellowing, leaf blast, 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 status have been changed at Rajnagar site due to land filling at homestead platform by sandy sediment. Except this site, plant health status has been more or less unchanged at all the sites than previous monitoring period. In the case of Rajnagar site, Coconut (*Cocos nucifera)* is the mostly affected species than Rain Tree (Albizia saman) and most of them are signed with lethal bole rot, narrowing upper trunk and radish brown leaves. Land development caused anaerobic situation of the site and death all of the undergrowths (**Figure 310**). In addition to this, the home owner logged most of the mangrove trees like Heritiera fomes and *Excoecaria agallocha* while starting the land filling just after last monitoring time. The number of disease affected unhealthy plants in the studied homesteads are represented in **Table 3.12**.

Figure 3.10: Land filling and death coconut plant at Rajnagar site

Table 3.12: No. of unhealthy plants in studied homesteads

Location	Plant Name	Total No. of Plant	No. of Unhealthy Plant																					
			Apr-14	Jun-14	Oct-14	Jan-15	Apr-15	Aug-15	Oct-15	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
Rajnagar	*Cocos nucifera*	**17***	NS	10	5	5	15	4	5	NS	3	4	6	6	9	4	4	3	2	3	10	3	7	11
	Phoenix sylvestris	**25**	NS	15	4	4	22	9	13	NS	10	2	5	4	7	6	8	9	5	3	4	4	5	2
	Manilkara zapota	**1**	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1	-
	Albizia saman	**2**	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Excoecaria agallocha	**55***	NS	-	1	1	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mangifera indica	**3**	NS	1	-	-	2	-	-	NS	-	-	1	-	-	1	-	-	-	-	-	-	-	-
	Psidium guajava	**2**	NS	2	-	-	2	-	-	NS	-	-	-	-	-		-	-	-	-	-	-	-	-
Borni	*Cocos nucifera*	**10**	7	3	-	-	3	1	2	NS	1	2	3	1	2		1	1	1	2	1	-	-	-
	Phoenix sylvestris	**12**	-	5	4	4	3	1	4	NS	4	3	4	2	1		-	1	1	-	-	-	-	-
	Borassus flabellifer	**6**	3	1	-	-	-	-	-	NS	-	-	-	-	-	1	1	-	-	-	-	1	-	-
	Mangifera indica	**6**	3	3	1	1	4	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Excoecaria agallocha	**18**	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-	-
	Swietenia mehogani	**11**	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Areca catechu	**10**	-	6	2	2	8	2	2	NS	-	1	-	3	-	-	-	-	-	-	-	-	-	-
	Manilkara zapota	**1**	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Psidium guajava	**2**	2	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kalekarber Dighi	*Cocos nucifera*	**56**	35	5	1	1	2	2	3	NS	1	1	-	6	3	-	1	3	1	7	4	2	-	-
	Phoenix sylvestris	**10**	-	3	-	-	1	-	1	NS	3	-	3	-	-	-	-	-	-	-	-	3	-	-
	Mangifera indica	**5**	1	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Manilkara zapota	**2**	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Borassus flabellifer	**8**	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Zizyphus sp	**1**	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1	-

Location	Plant Name	Total No. of Plant	No. of Unhealthy Plant																					
			Apr-14	**Jun-14**	**Oct-14**	**Jan-15**	**Apr-15**	**Aug-15**	**Oct-15**	**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**
	Psidium guajava	**8**	-	-	-	-	-	-	-	NS	-	-	1	-	-	-	-	-	-	-	-	-	-	-
	Tamarindus indica	**2**	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chalkghona	*Cocos nucifera*	**39**	25	19	5	5	34	20	-	NS	2	2	4	5	3	-	3	4	2	4	3	5	-	-
	Phoenix sylvestris	**24**	-	10	1	1	6	5	1	NS	1	-	5	2	3	-	-	1	2	2	1	3	-	1
	Albizia saman	**3**	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-	-
	Excoecaria agallocha	**36**	-	-	1	1	-	-	-	NS	-	-	-	-	2	-	-	-	-	-	-	-	-	-
	Manilkara zapota	**1**	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Psidium guajava	**17**	1	7	-	-	-	-	-	NS	-	-	-	-	-	1	3	-	-	1	-	-	-	-
	Mangifera indica	**7**	2	1	-	-	-	-	-	NS	-	1	-	1	-		-	-	-	-	-	-	-	-
	Borassus flabellifer	**2**	-	-	-	-	-	-	-	NS	-	-	-	-	-		-	-	-	-	-	-	-	-

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

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

Vegetation canopy cover has been slightly improved at Kalekarber site, unchanged at Rajnagar and deteriorated at another site. The improve site found newly plantations which found foliage expansion and contribute to increase whole canopy cover. In the case of Rajnagar site, the unhealthy condition is continuing due to post effect of land filling. Borni and Chalkghona sites have slightly deterioration due to dryness of the homestead soils. Comparing the data between Feb 2019 and this monitoring tier, canopy coverage has estimated more or less similar at all the three sites except Rajnagar where deterioration of canopy cover is still continuing T**able 3.13.**

Table 3.13: 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	Jul, 2020	Nov, 2020	Jan, 2021
Rajnagar	NS	19	19	17	20	20	20	20	21	23	19	15	18	14	11	22	19	18	16	14	11	8	8
Borni	NS	26	18	18	12	14	20	20	25	25	23	21	21	23	20	21	21	20	18	20	17	22	19
Kalekarber	NS	20	24	25	23	24	24	22	24	26	25	23	24	24	25	24	25	25	24	24	22	22	24
Chalkghona	NS	13	24	22	17	21	21	20	21	27	26	25	16	18	21	22	22	22	20	23	17	21	18

Note: NS = Not Surveyed

Bird Habitat

Local birds and their nesting behaviour

A number of local birds 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. Asian Pied Starling, Green Bee Eater, Common Tailor Bird, Spotted Dove, Jungle Babler, Magpie Robin, Black Drungo etc are mostly observed avifauna in this monitoring tier. 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

Two bird nests have been observed at Rajnagar site. The bird species were Asian Pied Starling and Common Tailor Bird. Both of the nests observed on *Excoecaria agallocha* tree. **Table 3.14** mentioned the data on observed bird nests

Table 3.14: Bird nest observation datasheet

Monitoring Tier	Location	Name of nesting Bird				
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret
1st QM	R	NS	NS	NS	NS	NS
	B	-	-	1	-	
	K	NS	NS	NS	NS	NS
	C	-	1	-	1	-
2nd QM	R	12	4	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C			11		-
3rd QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
4th QM	R	-	-	-		-
	B	-	-	-		-
	K	-	-	-		-
	C	-	-	-		-
5th QM	R	-	-	-		-
	B	-	-	-		-
	K	-	-	-		-
	C	-	-	-		-
6th QM	R	1	5	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
7th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
8th QM	R	10	5	-	-	3
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	1	1	-	-	-
11th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
12th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
13th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	1	-	-	-
18th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
19th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	1	-

Monitoring Tier	Location	Name of nesting Bird				
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret
20th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
21th QM	R	-	-	-	1	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
22th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
23th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
25th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
26th QM	R	-	-	-	-	-
	B	-	-	-	-	-
	K	-	-	-	-	-
	C	-	-	-	-	-
27th QM	R	-	-	1	1	-
	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 Shellduck, Little Grebe etc are common winter visitor of this area. In addition, local Ruddy Breasted Crake, Common Sandpper, Great Egret, Pond Heron, Little Cormorant are also found at most of the monitoring wetlands of the study area.

Most of the monitoring wetlands recorded the presence of local migratory birds except Putimari and Sukhriar Gher. Occurrence of local migratory birds was high at Koigar Daskati Gher. Overseas migratory birds have informed only at Koigar Daskati Gher like last monitoring time. But the population is very low as previous years. According to local knowledgeable persons, population of migratory birds are reducing day by day from these wetlands for illegal hunting, 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).

Following table **Table 3.15** show the presence of migratory birds at the important wetlands inside the study area.

Table 3.15: Presence of migratory birds at different wetland inside the study area

Wetland Name	Wetland type	Approximate distance from project Boundary (Km.)	Presence of Birds February 2020	
			LM	M
Choto Charargher	Saline Water Shrimp Farm	0.10	Yes	No
Boro Charargher	"	0.10	Yes	No
Putimari Gher	"	1.10	No	No
Golbunia Gher	"	0.1	Yes	No
Shukariar Gher	"	1.25	No	No
Koigar Daskati Gher	"	0.25	Yes	Yes
Badyamari Gher	"	1.00	Yes	No
Chalkghonar Beel	"	1.50	Yes	No

Note: 'LM'=Local Migratory, 'M'=Migratory, 'Y'=Yes

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 (Sailtakhali 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

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 the tributary like Maidara River near the Project site.

Dolphin occurrence in Passur and Maidara River

Dolphin occurrences have been monitored within about 10 km length of Passur and 1 km length of Maidara river surround the project area (From Digraz Kheya Ghat to Chalna Bazar including) through boat transact during full to mid ebb tide. A total of 7 dolphins were recorded during this survey within the Passur River near Project site. This survey transect was about 11 km and total time spend about two hours. The encounter rate was 0.39 individuals/km/hour. Another transect survey was conducted during spring tide within the 2 km reaches of Maidara and its upstream tributary's (Ichamati River). During this survey a total of 8 dolphin individuals were recorded which encounter rate was 8.0 individuals/km/hour (**Figure 3.11**).

Dolphin occurrence in Dhangmari Khal, Shella Gang and Bhadra khal

Dolphin occurrence also observed at the Dhangmari Khal, Chandpai Shella Gang Wildlife Sanctuary and Bhadra Khal. In the case of Dhangmari Khal, total transect length was 14.6 km during spring Tide, medium wave and sunny sky condition from Dhangmari-Passur confluence to Gagramari Forest Patrol Post up and down (**Figure 3.12**). A total of 9 dolphins were recorded in Dhangmari Khal within about 2 hours transact time. The encounter rate was 0.30 individuals/km/hour.

In the case of Chandpai Shella Gang, the survey transact was bounded from Shela Gang to Passur River near Joymoni to Jongra Forest Patrol Post during mid neap tide. The transect length was about 8.5 km (**Figure 3.13**). A total of 5 dolphin individuals have been sighted during 70 minutes' survey. The encounter rate was 0.52 individuals/km/hour.

Dolphin survey transect length within Bhadra Khal was about 8 km (up-down within 4 km canal reach) and conducted during ebb tide. Total 21 dolphins were recorded and the encounter rate was 2.98 individuals/km/hour (**Figure 2.14**). The dolphin observation datasheet is presented in **Table 2.16.**

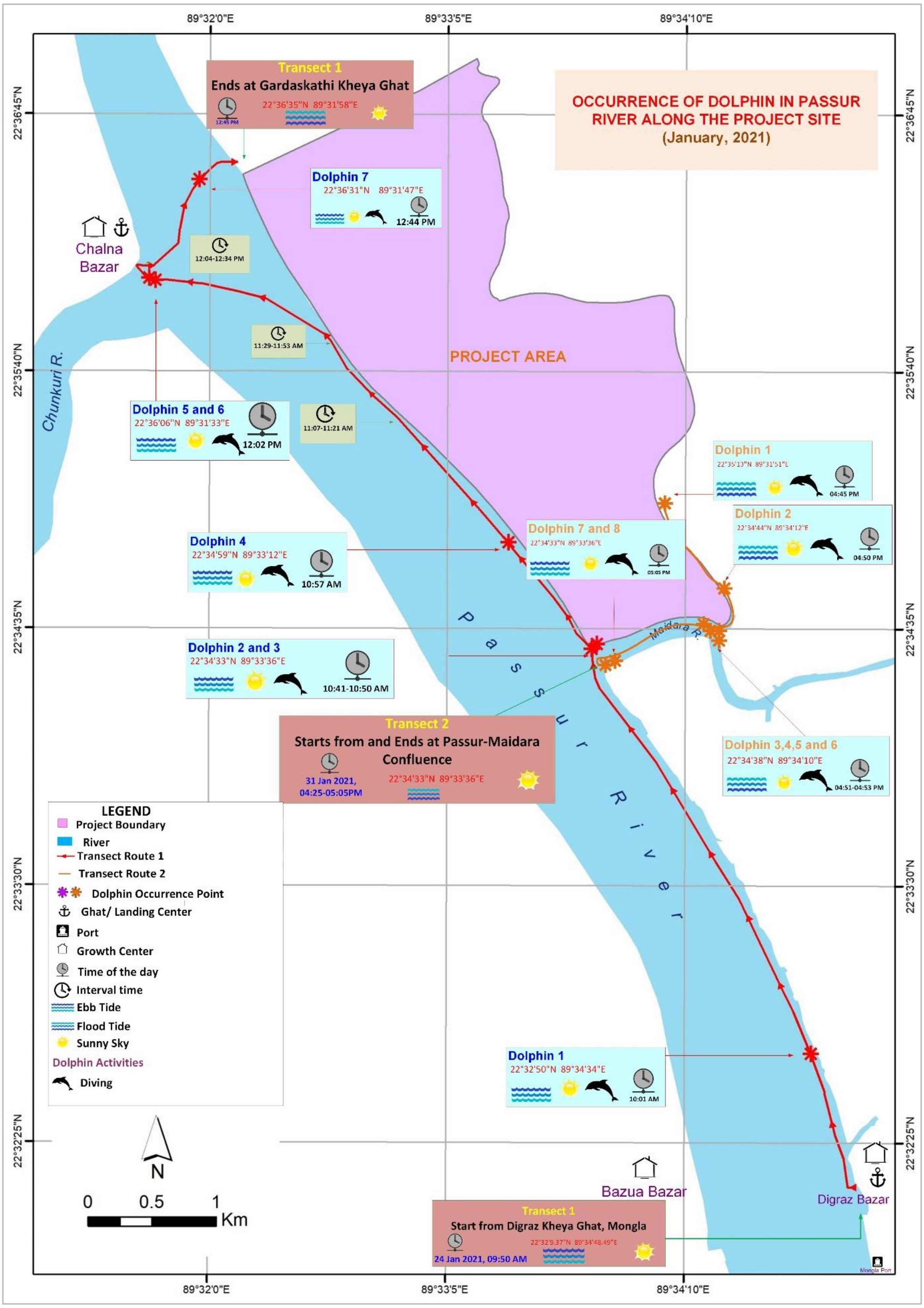


Figure 3.11: Occurrence of dolphin at Passur and Maidara River along the project site

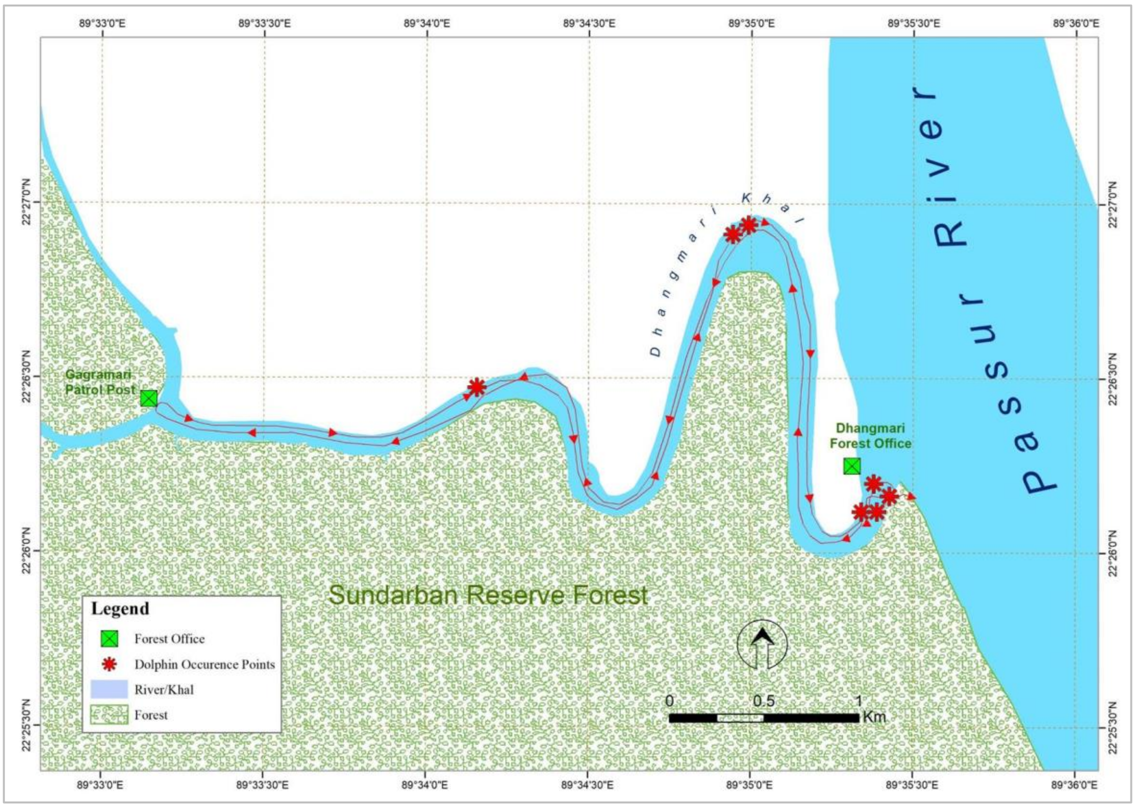


Figure 3.12: Location of dolphin Occurrence at Dhangmari Khal

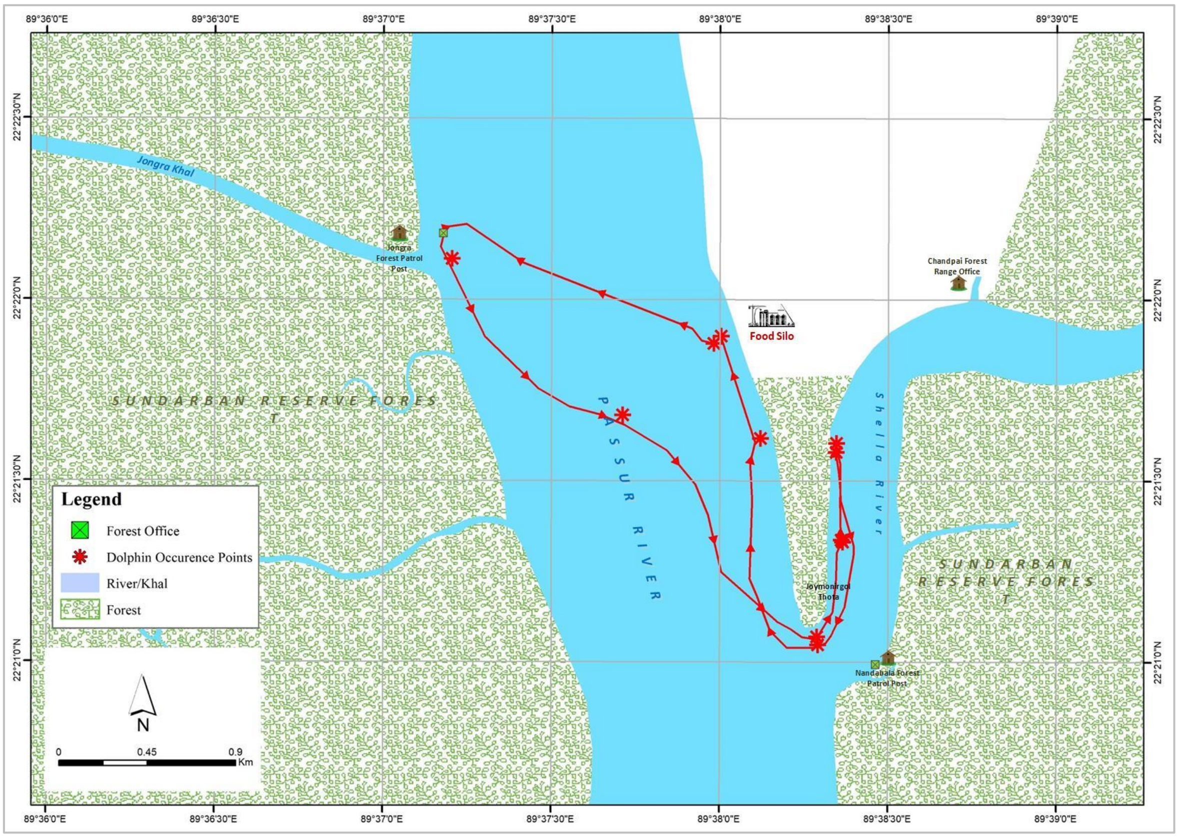


Figure 3.13: Location of dolphin Occurrence at Chandpai

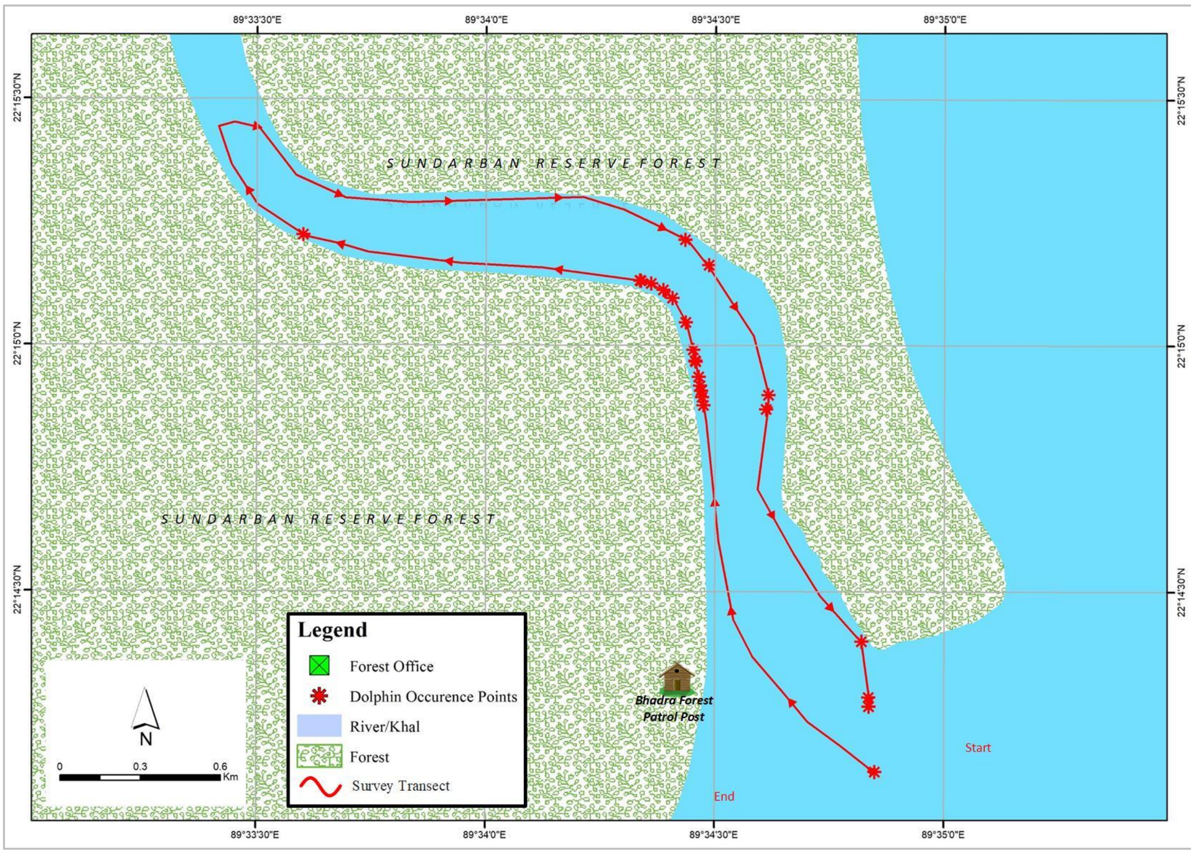


Figure 3.14: Location of dolphin Occurrence within Bhadra Khal

Table 3.16: 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

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Moidara River	Shella River at Chandpai
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
	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	Y	Y	NS	NS	Y	Y
	NT	NS	NS	Y	Y	N	Y

Note: FT=Flood Tide, NT=Neap Tide, NS=Not Surveyed,

Occurrence Status: Y = Occurred, N = Not occurred

3.3 Sundarbans Forest Health

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 forests healthy monitoring Bio-indicators is growth trend overtime and its relation with leaf are index (Beets and Whitehead 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). 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 at Harbaria plot. In additionally mortality rate of different species is very low in all PSP's

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 sulphur dioxide 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 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 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.

3.4 Methodology

3.4.1 Permanent Sample Plot (PSP) Establishment and Layout

To set up permanent sample plots, five plots were established (**Figure 3.15**). 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 3.17**). The sites were selected considering the distance from the proposed project site, wind directions, coal transportation route, river systems and vegetation types.

3.4.2 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.

3.4.3 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 3.16**). 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 3.17**).

Table 3.17: General Description of Permanent Sampling Plots (PSPs)

Transect	Plot	Range	Compartment No.	GPS ± (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
	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

Transect	Plot	Range	Compartment No.	GPS ± (m)		Soil Description	Plot Location Notes
				Latitude (N)	Longitude (E)		
Akram	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

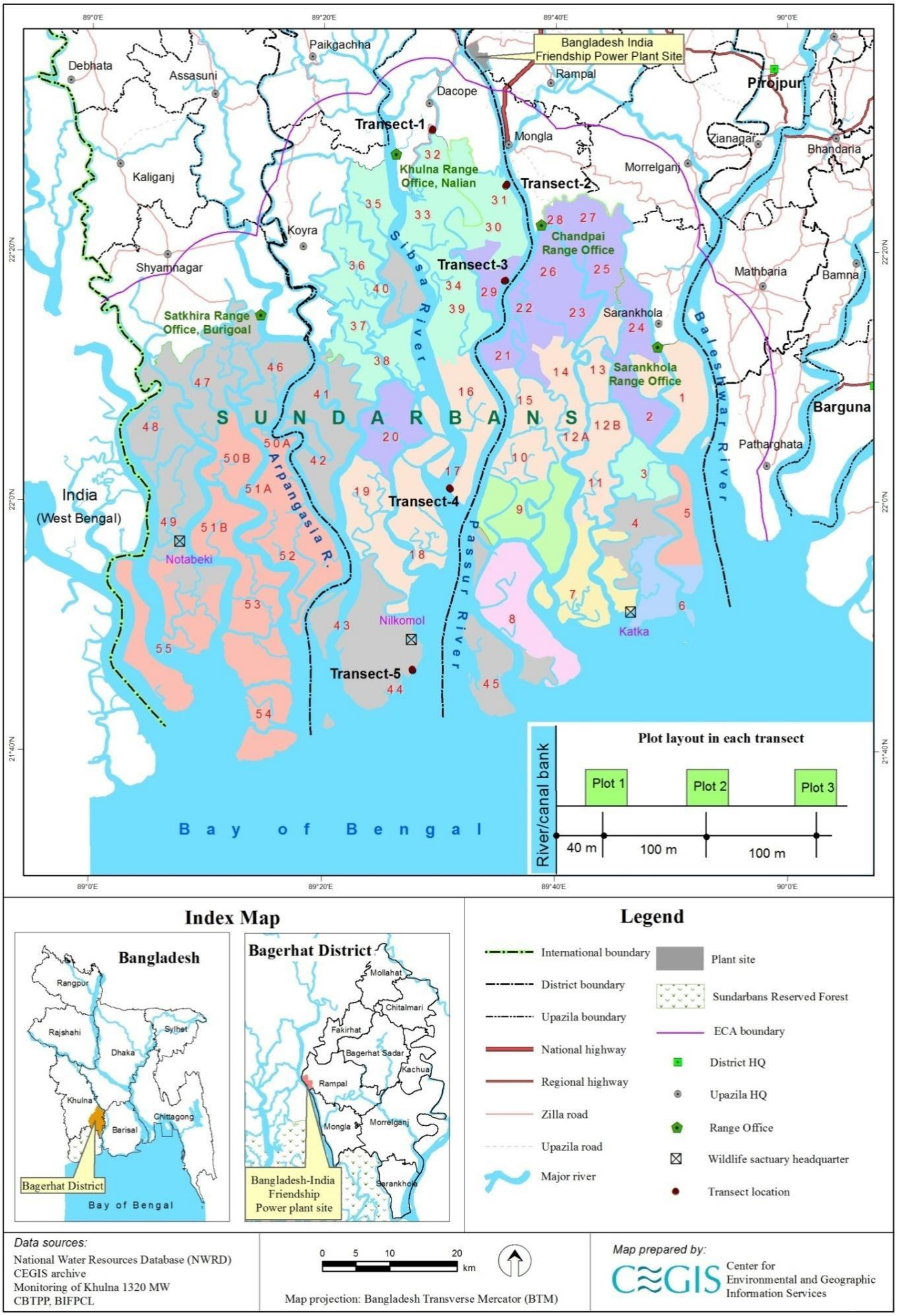


Figure 3.15: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)

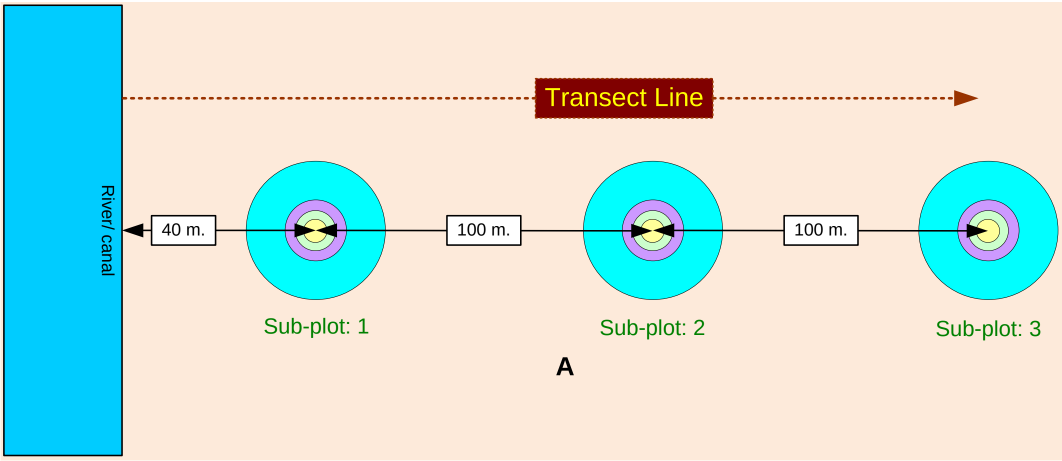


Figure 3.16: Layout of the Subplots and Transect Line Perpendicular from Ecotone (river or canal bank)

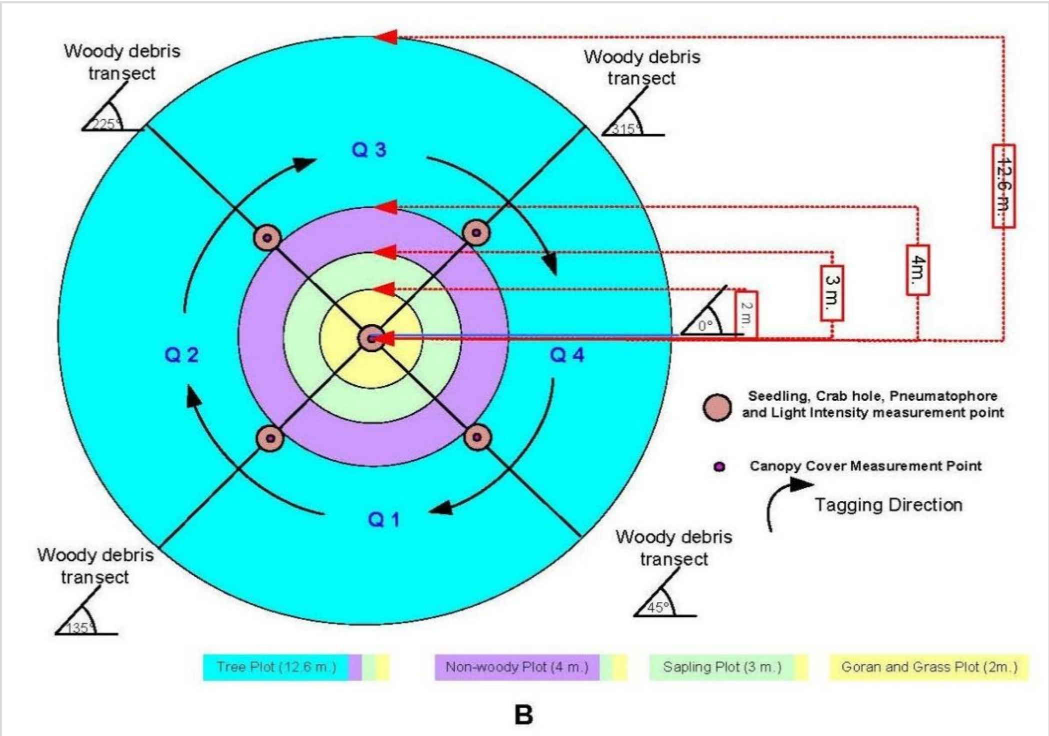


Figure 3.17: Layout of the Survey Activities in each Subplot

3.4.4 Methods

Tree growth

Tree species growth data were obtained from measured tree DBH. Individual tree DBH ≥5cm was considered for growth trend observation.

Vegetation Diversity

Tree species data were collected from the PSPs. Individual tree DBH ≥5cm was considered. Saplings (DBH<5cm and height 1.37m) and seedlings (height<1.37m) were assessed within 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.

Diversity analysis was calculated using the species richness, Shannon diversity (H′), and Simpson diversity (D′) and Evenness (E) indices (Magurran&Mcgill 2011). All the calculations were done using R package (Kindt& Coe 2005). Species accumulation curves (SAC; or species-richness curves, collector's curves, species effort curves) were used to estimate the number of vegetation species in the PSPs. Species accumulation curves shows the species richness for combinations of sites. Canonical Correspondence Analysis (CCA) was used to analyze the relationship between distribution of plants and environmental variables.

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) = $\log_e (I/I_o)/-K$ leaf area / area of ground (Where, I = Under Canopy Light Intensity, I_o = 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.

Pest and Diseases

Pest and disease type of the Sundarbans mangrove forest was investigated through literature review, which was then verified in the field through visual observation.

3.4.5 Results and Discussion

Vegetation Diversity, Richness and Compositional Variation

A species accumulation curve shows the species richness for combinations of sites. These curves portray the average pooled species richness when all sites are combined together. The output shows that the average richness for all possible combinations of 5 sites is 21 (*Hiron* Point data was obtained from last census) (**Figure 3.18**). Gewa was the dominant species among all the PSPs which was confirmed by the Rank-abundance curves followed by Sundari and Kakra (**Figure 3.19**). Vegetation species richness has been identified through Shannon, Simpson and evenness Index (**Table 3.18**). Considerable difference was noticed in the species richness in five PSPs. All the three indices show that transect 2 (Karamjal) has more diversity compare to other PSPs.

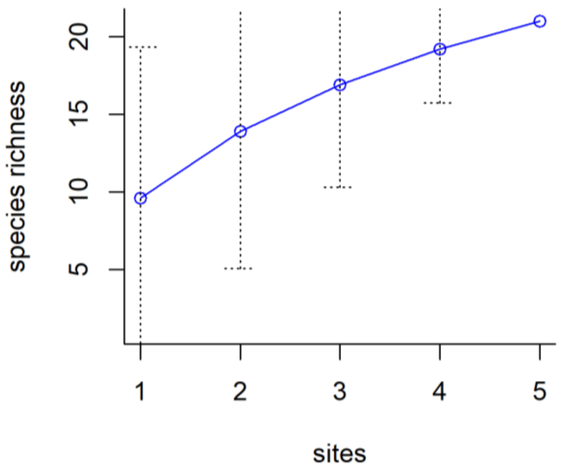


Figure 3.18. Species accumulation curve for the PSPs dataset.

The bars indicate +2 and -2 standard Deviations (N.B. 1=Sutarkhali, 2=Karamjal, 3= Harbaria, 4=Akram Point, 5=Hiron Point. Hiron point plot data was taken from last survey)

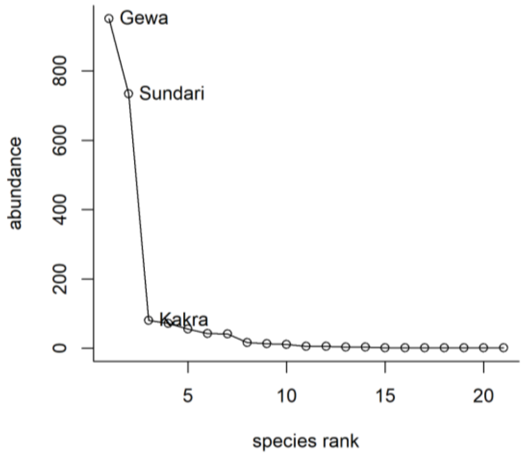


Figure 3.19. Rank-abundance curve for the sampled PSPs.

Hiron point plot data was taken from last survey.

Table 3.18: Diversity indices for vegetation in the Sampled PSPs

PSPs	Shannon Index	Simpson Index	Evenness Index
Sutarkhali (T1)	1.06	0.46	0.26
Karamjol (T2)	2.09	0.83	0.44
Harbaria (T3)	1.31	0.64	0.25
Akram Point (T4)	0.83	0.47	0.39
Hiron Point (T5)	0.47	0.22	0.23

Multidimensional scaling (MDS) is a popular approach for graphically representing relationships between objects (e.g. plots or samples) in multidimensional space. The samples are then usually represented graphically in two dimensions such that the distance between points on the plot approximates their multivariate dissimilarity as closely as possible. In the present study, Akram point (T4) and Hiron point (T5) were close to each other indicating similarity in species composition in these two PSPs. In contrast, T1 (Sutarkhali), T2 (Karamjal) and T3 (Harbaria) were far away from T4 and T5 indicating dissimilarity in species composition (**Figure 3.20**).

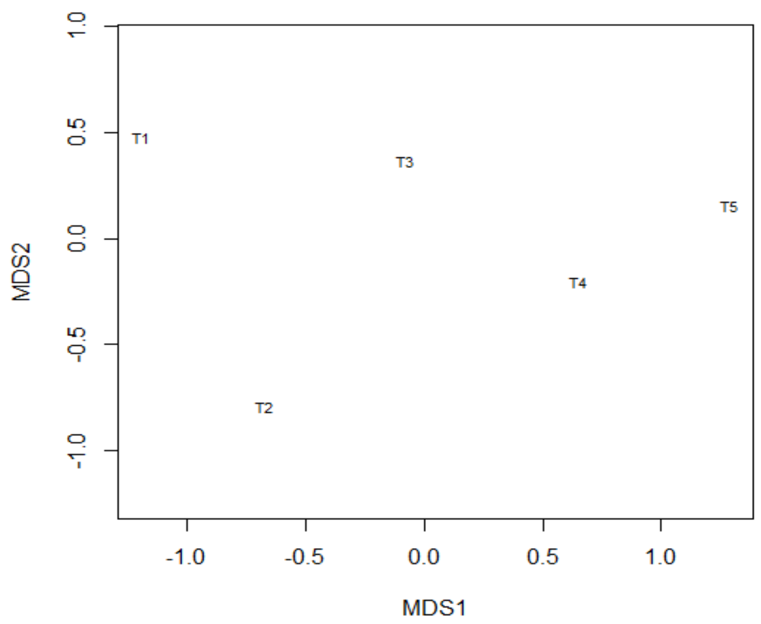


Figure 3.20: Ordination graph for a two-dimensional MDS based on the Bray-Curtis distance. The best configuration out of 500 is shown here

Carbon stock in trees:

Over the census period, there was no significant difference (P>0.05) in tree carbon stock for all the PSPs (Fig. 7). However, an increasing trend in carbon stock was observed in all PSPs except Akram point. Sundari has the highest amount of carbon stock (**Table:3.19**)

Table 3.19: Species Wise Total Carbon Stock (t/ha)

Species	T.C. 18th Q.	T.C. 19th Q.	T.C. 20th Q.	T.C. 21st Q.	T.C. 22st Q.	T.C. 23st Q.	T.C. 24th Q	T.C. 25th Q
Amoor	1.37	1.28	1.65	1.69	1.54	1.42	1.33	1.55
Baen	71.46	64.59	66.51	67.42	65.11	64.09	61.92	69.73
Bhutbutta	0.14	0.18	0.25	0.25	0.25	0.25	0.25	0.21
Bola	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.00
Gewa	125.00	121.15	124.69	126.15	125.01	126.62	101.69	244.92
Goran	0.66	0.69	0.77	0.78	0.75	0.68	0.62	1.16
Kakra	53.35	50.93	51.99	52.35	52.15	52.19	51.96	55.35
Lakur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Passur	62.60	71.33	74.16	67.63	70.50	71.19	62.04	80.60
Sundori	446.01	450.82	475.60	465.01	468.22	466.09	460.59	512.19
Urmui	0.41	0.36	0.40	0.44	0.41	0.39	0.43	0.32
Vaila	0.80	0.83	0.74	0.74	0.74	0.74	0.81	0.90

N.B. TC-Total Carbon

Status of Forest Health Indicator

The tag number of trees (DBH ≥ 5cm and lean angle greater than 45º) was monitored and rewritten if any new tree was found within 12.62 m radius circle of the Permanent Sample Plot (PSP).

There was significant variation (p>0.05) in tree growth over the monitoring period for all the PSPs. Though, the Hiron poin was subjected by sedimentation but an increasing trend of seedling survival was found in all PSPs. This is because of the time of seed germination and seedling survival in the observed PSPs. It indicates positive change in forest health condition.

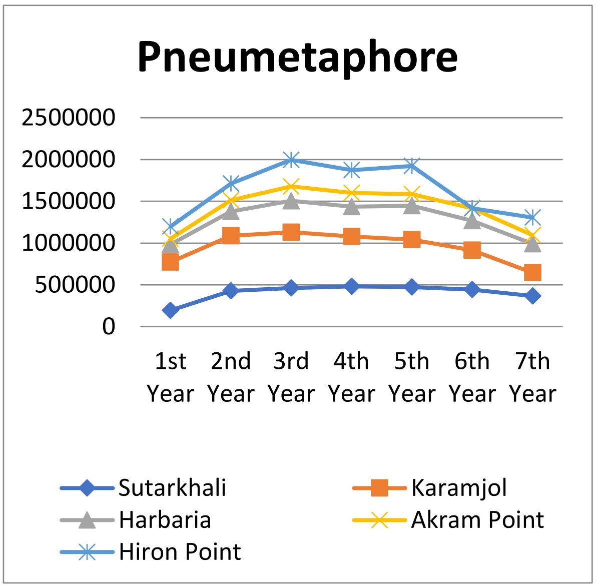
Average number of pneumatophores per hectare was comparatively very low in Akram point area whereas pneumatophores density was highest in Sutarkhali sample plots. There is a significant variation (p>0.05) in pneumatophores density over the monitoring period for each PSPs except Harbaria (**Figure 3.21**). This indicates that forest health condition is deteriorating in terms of deposit sedimentation or other forest condition.

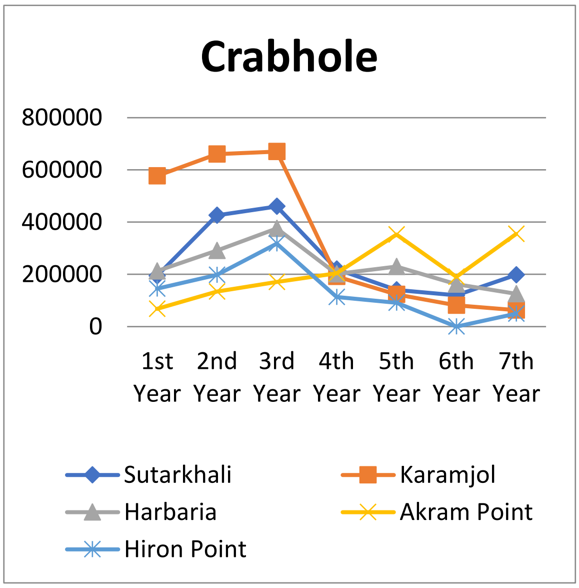
There is no significant variation (p>0.05) in crab density over the monitoring period for Harbaria, Sutarkhali PSPs (**Figure 3.21**). Karamjol plot shows less from the last tier. However, Akram point crab density was significantly different then the other tier due to take a new plot (p<0.05).

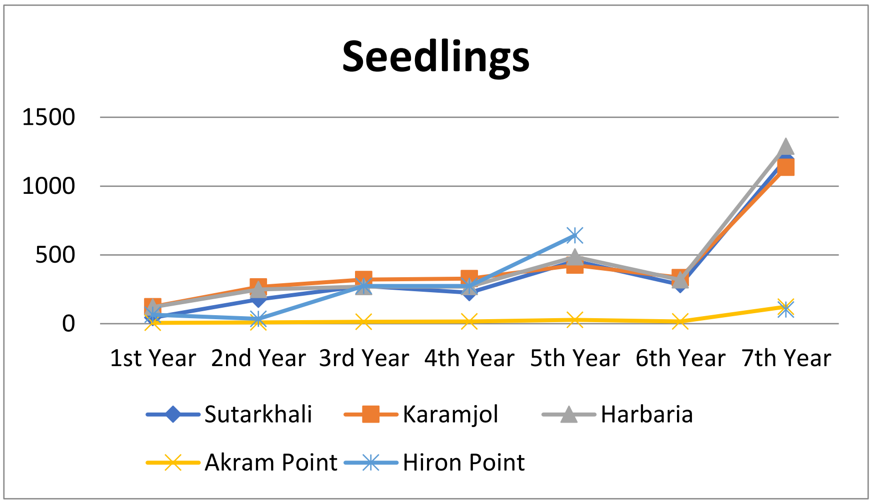
All the PSPs (Sutarkhali, karamjol, herbaria point) canopy cover doesn't vary significantly (P>0.05). Akram point PSP's permanent plot canopy cover was lower compare to the rest of PSPs canopy cover percentage (**Figure 3.21**).

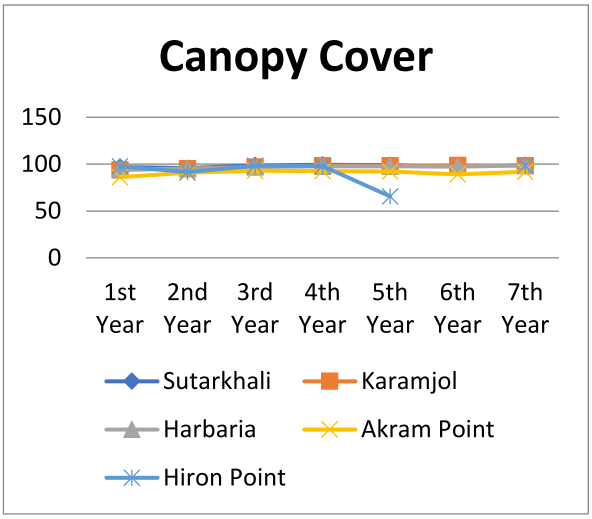
The LAI (Light Area Index) influences daily rate of net canopy photosynthesis which results in exchange of atmospheric CO_2. The minimum the ratio of under canopy to open canopy light intensity value indicates the maximum LAI. There was no significant prominent trend observed for all the PSP's (**Figure 3.21**).

There were no changes observed in phenological behavior of the dominant tree species during the monitoring period.









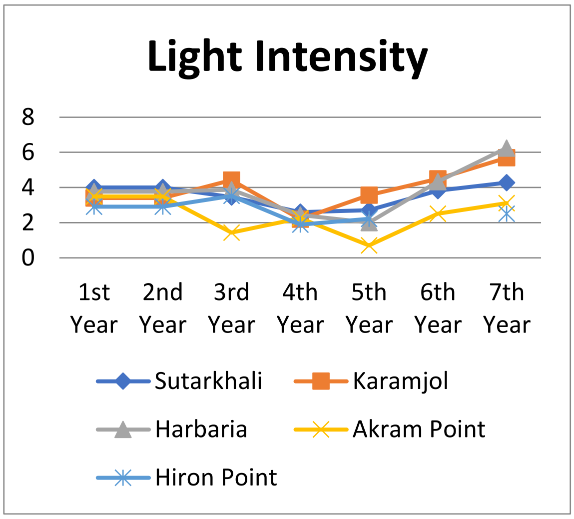


Figure 3.21: Pneumatophore, Crab Hole Density, Seedling Density, canopy cover and LAI over different census period (Each year represent average of 4 monitoring periods).

Figure 3.22: Measuring diameter at Hiron point

Figure 3.23: Measuring DBH at Karamjol site

Figure 3.24: Measuring Canopy cover at Sutarkhali

Figure 3.25: Measuring Sapling daimeter at Akrampoint

4. Social Environment

4.1 Introduction

This 27th social safeguard monitoring conducted for understanding the social safeguard status (during the construction phase) of the project, following the guidelines of DoE and Environmental Management Plan (EMP) of Environmental Impact Assessment (EIA). However, it is a regular monitoring which is conducted quarterly (after consecutive 3 months) in order to implement DoE' condition for the successful completion of construction activities. This social safeguard monitoring conducted (from November 2020 –January 2021), as a follow up of previous monitoring that taken place earlier. This monitoring was conducted to understand the status of impacts on livelihoods, working environment, community health and activities under the Corporate Social Responsibility (CSR). Data on the mentioned indicators collected applying different social tools and techniques.

4.2 Methodology

Physical observation was used as a data collection technique (during the field work) to understand the status of the following monitoring indicators. Besides, telephonic interview was conducted with the person concerned from Project Management Unit (PMU) to explore the recent Corporate Social Responsibility (CSR) activities. At the same time, pictures on CSR activities collected through online that represented the CSR activities of the PMU.

Additionally, face to face interviews were carried out with local people located at Kapasdanga, and Rajnagar Union. Additionally, consultation meeting was in presence of relevant professionals from the PMU for getting concerns on the social safeguard issues. The monitoring locations are shown in **Figure 4.2.**

4.3 Results of Social Safeguard Status

Impact on Employment and Livelihood

According to DoE's guidelines, local labors should be recruited more in the construction phase. However, local labors are not more viable to do the technical works but they were getting livelihoods opportunity according to their skills. In this regard, the rate of local labors were being increased from the adjacent unions (i.e. Gaurambha, Kapasdanga, Hurka and Rampal). Presently, local people have the more positive attitudes, and they opined that livelihoods options started to increase due to the project intervention. Due to people's gathering a new market expanded at the zero point of Hurka union. Local people opened up small shops here which is possible because of the project implementation. Besides, improved communication made a contribution to promote their business than the previous time. Local people got more income opportunities to do small business due to bazar development.

Additionally, about 200 people were registered (under the motor vehicle federation) to run motor vehicles at the approach road to carry both goods and passenger, as a result, it was helping people to involve earning opportunities. Furthermore, local people started thinking to be skilled more as they can join in future during the operation phase of the project.

Working Environment

During the pandemic situation due to Covid 19, the PMU trained the labor force to obey the health safety rules to keep them safe from the Coronavirus. In construction site, people have no entry without the masks. Labors who are working at the project site were maintaining social distancing; wearing masks to continue work smoothly. Besides, toolbox meeting is held every day with the Safety Manager which is being monitored by the PMU, and observation of BHEL written in a document addressing as noncompliance issues. Moreover, debriefing session with the BIFPCL held in order to monitor the noncompliance issues. Furthermore, Labor sheds found clean with adequate toilet facilities, drainage, and waste management and drinking water facilities.

Community Health

During the period of study, no grievance found from the local community due to the project construction activities. Every day, water sprays four times for suppressing dust and protecting project site and local people around the site from dust pollution.

Local communities at Gaurambha and Rajnagar unions reported that they are not encountering noise related problems due to construction activities. Additionally, the PMU was trying to ensure the green environment planting 65,000 plants within the boundary wall of that project.

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 commited to organize different programs during the phase of construction. They have been conducting medical campaigns along with different socially demand-based programs including community development, capacity building and social mobilization. With the observance of CSR activities, community people are getting benefits and making positive attitudes towards the project.

Following activities were done under the CSR activities which were monitored in this stage of monitoring:

Community development

During the period of monitoring, it was found that a program on blanket distribution held in January 2020 as a part of the CSR activities at the Rajnagar, Gaurambha union, zero point of Hurka, and Burirdanga unions. A total of 4,250 pcs of blanket distributed among the poor people. In addition, a total of 750 blankets were distributed at the orphanage of Dhaka city.

As a part of community development, wheel chair distributed among the disable people. This program was organized by the BIFPCL in December 2020 at the project site. Honorable chairman, of Power Development Borard (PDB) Engineer Md Belayet Hossain, Project Director of MSTPP, Managing Director of BIFPCL and other personnel attended and distributed for supporting physically disabled people of adjacent unions from the project site (**Figure 4.1**).

Figure 4.1: Distribution of Wheel chair and Blanket to the disabled and poor peoples

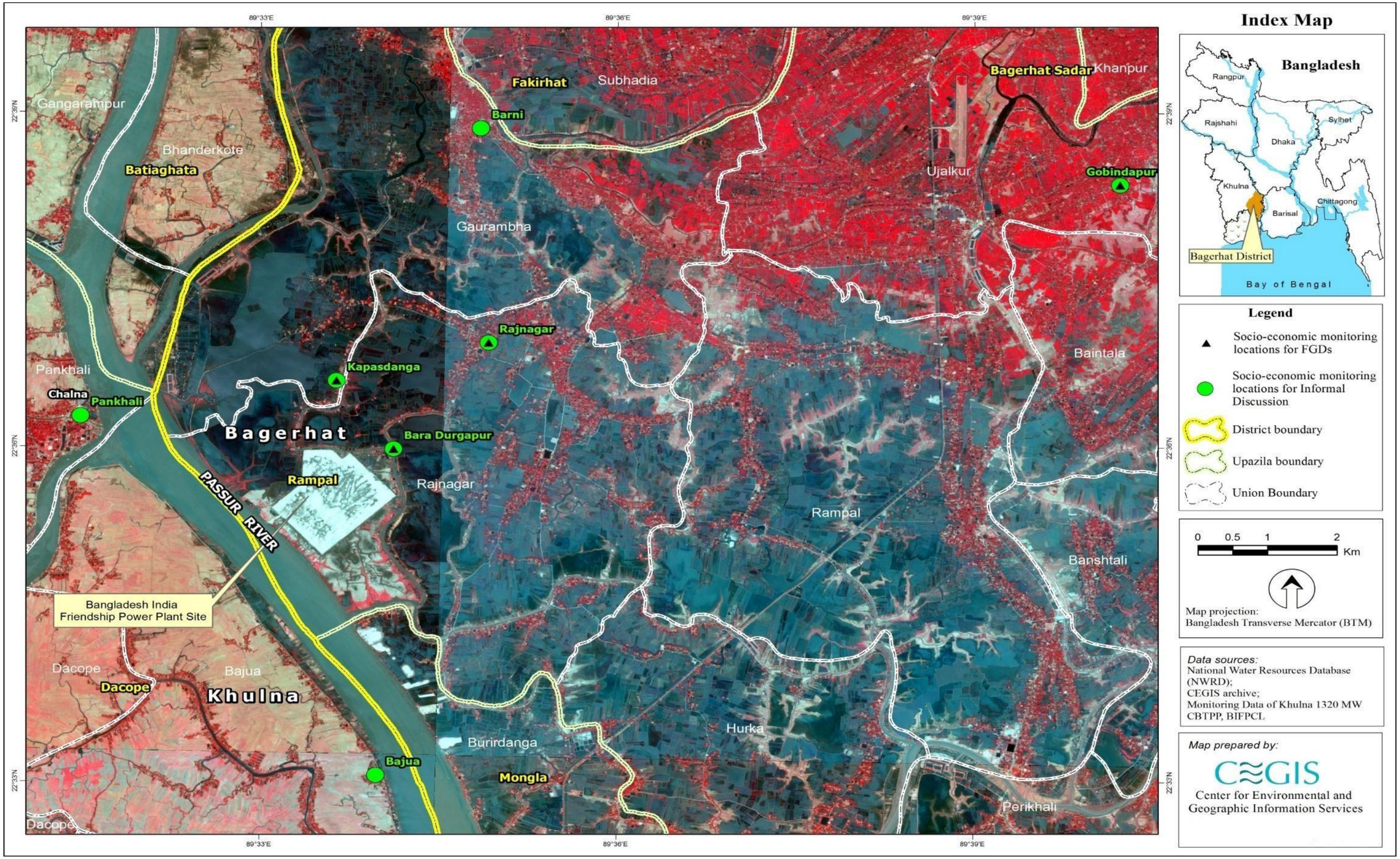


Figure 4.2: Socio-Economic Environment Monitoring Location

Medical Campaign

Monthly medical camp was held at Rajnagar and Burirdanga unions in November and December 2020 respectively. A total of 546 (298 at Rajnagar & 248 at Burirdanga) local people received free medical advice and medicines under the medical campaign. Besides, Labor colony medical camp was held in the month of November, December and January whereas a total of 588 labors received medical advice and medicines freely. Additionally, a boat medical camp was held on December 2020 at Laudop whereas a total of 172 people got freee medical service. Till now, about 55,000 received free treatment due to the campaign under the CSR activities.

Capacity Building Programs

Capacity building trainings were offered to the local people under the CSR program for making the local people skillful. Under the programs, about till now 261 persons received training on sewing, and about 265 persons received computer literacy skill development training (**Figure 4.3 and Figure 4.4**).

Figure 4.3: Computer training under the CSR activities

Figure 4.4: Sewing training under the CSR activities

Recommendations

a. 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;
b. Regular refilling is to be continued for making the desired and committed greenery effectively as per conditions of DoE;
c. Continuing regular health checkup and disease monitoring for the daily laborer at work place as well as for the laborer staying at labor colony;
d. Ensure proper safety equipments for battling against the COVID 19 virus;
e. Create awareness about the Coronavirus disease (COVID-19);
f. Wash hands and face immediate after entering the office substation from outside;
g. Ensure masks for everyone who are working at the Project site;
h. Health temperature should be checked before entering the Project site;
i. Avoid (as much as possible) public transports, if possible walk on foot;

j. Social distancing should be maintained in the labor shed as well as in the Project site;

k. Paste poster on how to work during the COVID 19 situation for raising more awareness;

l. Special attention should be given on `workers if they have any syndrome related to the COVID 19;

m. CSR activities should be performed primarily among the PAPs on equitable manner. This should be audited by a third party monitoring team;

n. Rehabilitees should be given preference in implementing CSR program as they are under serious threat of another shifting;

o. Dust suppression by spraying water should be continued on construction sites, and other places where necessary to suppress dust and minimize air pollution;

p. River water should be used for dust suppression activities and ground water use should be avoided completely;

q. The PMU should be active and efficient in maintaining vehicle speed limits in the Project site;

r. PAPs should be given priority in recruitment of manpower based on their skills;

s. Special attention should be taken to introduce new programs under the CSR;

t. Special attention should be taken care for assessing the needs to local schools and colleges for implementing different programs under the CSR.

5. Environmental Compliance

5.1 Introduction

The massive construction work has been running during the environmental compliance monitoring of Power Plant visit. Major construction of all of the key components has been touched. Most of the mechanical and electrical components were found stored on the vast open area of Block II. The civil construction activities at the Boiler, Turbine and Generator, cooling tower, Chimney and other heavy equipment, stack point, Jetty area, township area, internal road networks, permanent drainage networks are being continued. It was found that the equipment was transported to the Project site by road during this monitoring tier. On the other hand, the permanent jetty construction works are advancing for unloading the heavy machineries transported through the the Passur River.

Six lane approach road including extension part (5.5 km) from Babur Bari point at Khulna - Mongla Highway to the Project site was completed. Permanent structure for the security staff and visitors was constructed at the entrance point of the project area.

The main Administrative center of BIFPCL and EPC contractor were shifted to the newly constructed buildings and a number of professionals of BIFPCL were shifted to the newly constructed township. At the same time, the EPC contractor i.e. Bharat Heavy Electricals Limited (BHEL) employed different local specialized sub-contractor i.e. DIPON, KELLER, AFCON, POWER MAC etc. for progressing the construction works simultaneously.

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 may delay the project commencement. The project work was almost halted at the end of the March 2020. However, the project work was started gradually from July, 2020. The Engineering, Procurement and Construction (EPC) contractor tried to expedite the contractors and sub-contractors for completion of the project works within the stipulated timeframe maintaining the health safety guideline of the existing pandemic. The project completed task up to December 2020 has been pointed out.

Project completed task for Unit-1 up to December 2020

- Boiler Pressure Parts joints – All joints completed for DHT. DHT done on design pressure on 31.12.20. Balance joints for Non-drainable hydro test in progress, 6002/17021 no's completed.
- HP and IP turbine erected, LP Turbine and lube oil piping work in progress in TG.
- Condenser tube insertion in Condenser-2 completed. Condenser -1 erection in progress.
- Structural erection work in progress in FGD
- Chimney shell casting completed up to 144 Mtrs

Project completed task for Unit-2 up to December 2020

- Boiler Structure erection – 9609/19800 MT completed.
- Boiler Pressure Parts joints-6727/47000 completed.
- MPH Structure – 3821/9800 MT erected
- TG erection commenced on 28.12.20, condenser preassembly work started on 26.12.20

Safety and Manpower Allocation up to December 2020

- Zero Fatal accident in FY 20 -21
- Manpower available at site - 7593
- Bangladeshi manpower - 5825 (573 nos under quarantine out of 5825)
- Expat manpower - 1768
- Support from GoB is sought for expediting issuance of A3/E - visa for expat manpower

The present environmental compliance monitoring includes the status of EMP implementation for this quarter (December 2020-February 2021) based on physical observation, investigation and interviews/discussion to the proponents, EPC contractor, labors and 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.

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.	• Switch off / throttle down all site machinery, vehicles, water vessels, and generator when not in use • No construction activities at night • Use noise damper within the project boundary, Limit vehicle speed and monitor it at every suitable point.	• Noise data are being monitored periodically on daily basis both night and day time at different potentially sensitive areas (Labour colony) and compared with the ECR-1997 Standard and are being documented.by EPC contractor. • Noise levels were found within the permissible limit near the project boundary noise monitoring • 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. • Idle machines / equipment / generators are switched off/throttled down. • Generators with acoustic enclosures are only being used as and when required.	Complied	• If construction activity would extend at night, additional measures like enclosure of the areas to limit noise (within permissible standard) should be taken. • Communicate with the nearby community beforehand about activities and possible heavy noise generation.
2	Dust generation from construction works	• Limiting activities for producing fugitive dust particle within project area • Vegetation clearance and base stripping should be minimized.	• Monthly and periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR, 2005 standard. • Mixing machine may generate localized dust during cement and concrete	Partially Complied	• Increase the frequencies of water spraying to the potential dust generating sources for this season.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Vehicle speed restriction must be enforced to control dust generation. • Earthen roads and undeveloped roads should be avoided to minimize dust generation • Construction materials must be covered to protect from wind action • Spray water regularly for suppressing fugitive dust • Dust particle generated from access road must be controlled by spraying water during dry season. • Stock piles of construction materials must be covered in order to protect from wind action. • An appropriate freeboard must be maintained in trucks hauling construction materials.	mixing. But all the crashing and storage of materials were recorded wet during field investigation • Monitoring the vehicular speed (less than 20km/hr inside the project boundary) and load • Regular water spraying is being conducted at least four to five times in a day by three water tankers or as per requirement are being done to suppress fugitive dust. • Now-a days, heavy construction works, roads for block – B, dry weather, wind blow and loose soil are being suppressed by watering but immediate soak with the soil and dust emits at the construction/road side in the project. • Water is also being sprayed regularly on the stockpiles and registered. • Substantial warning sign, speed limit and convex mirror have been displayed at the strategic locations.		• Check the labor must use face mask throughout the workplace • Clear the mud over the paved roads
3	Water Quality	• Surface water must be saved from any harmful effluent emission and waste dumping from project site • Provide closed system facilities and wastewater treatment plant to minimize discharge of effluents from worker's colony. • Good housekeeping at workshop and construction site	• Surface concreting is being done at places where equipment is coming. Large surfaces area is available as for natural recharge. • Ground water is not used for construction purpose. • Construction waste water discharge is minimum and need based only. But not	Complied at present	• Good housekeeping at workshop and construction site should be continued • Cleaning of vehicle and plant before leaving should be done on a regular basis.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Appropriate equipment with safety measures should be used for storage and handling of lubricant • Provide training and awareness building program to the workers during construction. The training and awareness programs are: a) Arrange weekly consultation session among the workers through plant site managers. The duration of consultation is one hour according to ISO-14001 standard, b) Arrange monthly environmental meeting among the mid-level officers through top management when those issues will be discussed under guidance of ECR 1997.	treated. Overall they are also meeting effluent norms. • The same is being discharged through north-east corner of the project & also monitored regularly. • Water from labor shed is stored in a pond for initial settlement and finally discharged to the drainage. • Samples of same are analyzed by CEGIS and report is being submitted through monthly report. • Training and awareness program are being conducted regularly through PEP talks, lectures, one to one talk etc.		

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
4	Waste Generation	• Limiting site clearance and base stripping activities within the project boundary. • Gathering and stocking of construction materials and machinery must be within a limited area in the project boundary. • The project area has to be fenced prior to initiation of construction activities. • Stock piles of construction materials requiring cover up in order to protect them from wind and weathering action. • The existing right of way have to be used for material transportation without creating any block • Location of spoil stock pile ought to be located in safe area and protected from wind and rain action. • No spoil store on River bank/slope • Construction wastes must be reused or recycled as and where possible • Burning of waste material should be restricted • Quality housekeeping practice must be maintained by regular inspection and checking.	• Construction wastes are being collected, and put at demarcated places. • Heavy / mechanical equipment is kept at demarcated places. • Waste segregation is done at the source level • Burning of waste materials has not been recorded inside plant. • Proponent has engaged one of the contractor (Khulna City Corporation (KCC) for safe disposal of waste materials form site. • Waste management training has been included in induction training of the labor. • Local languages (Bengali) and English are being included in the signboards. • 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. • SWM will have provision of segregation and reuse of waste as possible. • 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	Complied	• The number of Waste Disposal Bin/s with labelling should be increased at labor shed, and at working area. • Scrubbing materials should be managed within the designated places. • Litter, foam and other objectionable matters in nearby water drain/ sewer should be cleaned.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Keep onsite waste collection and disposal facilities • Keep provision of different colored waste bin for dumping biodegradable, reusable and recyclable wastes. • Keep provision of awareness building meeting and training for employees	source, recycling, treatment and disposal of waste will be done. • Location of the stock pile in a safe area and protection from wind and rain is being ensured. • High restriction on spoil storage on the river bank/ slope has been ensured.		
5	Compensation and Resettlement	• 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 • Compensation for movable structures	• 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' started in 2011 • Compensation was paid by the local DC office. • Local DC office facilitates to obtain house of the PAPs (settlers of the project area) in cluster villages provided by the GoB. • Almost 32 affected families are now having their houses at Foyla cluster villages. • BIFPCL is giving priority to affected people in Project related employment.	In the process of Compliance	• The CSR activities should be oriented towards the affected people or household; • Trained to the Sundarbans dependent livelihoods group as a part of CSR activities • The proponent may initiate cooperatives for the PAPs along with training

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• 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? • Human 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	• A significant number of affected people (especially who deserve) are working at the construction site. • 136 indirectly affected people were given compensation by the DC Office, Bagerhat. • About one third of the labor has been recorded from the locals. • The project authority has given training on computer and swing to the nearby villagers including PAPs which is stopped at present due to COVID. • 17 families got their residence who have shifted their houses from project area to Kapashdanga.		
6	Livelihood and living condition	• The labor recruitment policy must be formulated in such a way that the local laborers can easily get the chance of employment in the project work force. • Govt./NGOs need to provide support the skill development program and	• BIFPCL are recruiting the local people especially PAPs with the help of local government (UP Chairman and members). • Accidental log sheet or injury log book are being maintained.	Complied	• Health and financial support should be available for the labour in case of COVID affected. • Evaluate the emergency preparedness and monitoring of the

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		income generation activities to local people; • For the increased movement of people and heavy vehicles, the road networks must be developed. • Keep provision of sanitary toilet, one toilet for 10 persons.	• Provisions has been kept for health facilities to the labors as well as for the communities. • Proponent has taken numbers of potential measures for COVID protection • The wage of the labor was found compatible with the national standard. • Available drinking water, sanitation facilities, prayer room are provided at site. • No incident has been recorded in this quarter as though around seven thousand works at the site at present.		workplace safety situation.
7	Green House Gas Controlling Measures	• Restriction of any kind of solid waste disposal • Approved pollution control devices to be fitted in equipment and machinery. • Transport vehicles must not be overloaded. • Avoid queuing of vehicles in areas adjacent to site, particularly near sensitive receptors including housing.	• Fitness certification of vehicles and equipment are ensured for the construction works • The EPC Contractor using relatively new equipment and vehicles to reduce the GHGs emission. • Energy efficient component like light, AC and other equipment are used. • Equipment, generators and vehicles were observed switched off during non-operation period.	In the process of Compliance	• GHGs inventory checklist should be prepared immediately at this stage; • Introduce vehicular registration for the construction site.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Switch off / throttle down all site vehicles, water vessels, generator and machinery when not in use. • Regular maintenance of water vessels, vehicles, generator and machinery in accordance with manufacturer's	• Vehicles are maintaining the road safety regulations and • No GHG inventories were prepared yet.		

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	• Preparation of Human Resources Policies and Procedures for Direct workers; • Defined Working condition and Terms of Employment for direct worker; • Sustainably equivalent terms and condition for migrant workers; • Compliance to national law of forming workers' organization; • No discrimination and equal opportunity for all; • Grievance Redress Mechanism.	• BIFPCL is run through the HR polices and switching their professionals as per demand of the project. • Massive work has been continuing maintaining the EHS guideline and regular monitoring of the occupational health safety issues carefully. • No accident has been recorded in this quarter except few injuries like cutting, • No discrimination was recorded among at labor level between local or migrating labor in Bangladesh • EPC contractor deployed an OHAS Company named Cholamandalam for ensuring occupational safety. • The OHAS company trained the hire management, audit the existing safety	Being Complied	• OHAS must be monitored the training for construction workers to protect from- • Falls (from heights); • Trench collapse; • Scaffold collapse; • Electric shock and arc flash/arc blast; • Failure to use PPE • Repetitive motion injuries. • To develop labour association protecting labour interest

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			practices and recommended about how to reduce the indecent up to zero level. • BIFPCL has ensured minimum wage and working hours for the labor as per GoB rules and regulation. • Induction training and regular training of first aid, toolbox are being Continued in association with COVID management guideline. • Contractor has taken insurance policy for engaging labors as per labor policy of Bangladesh.		• Create fund to support the labour/his families in case of any fatalities • Health and financial support should be provided if any labour affected by COVID
2	Protecting Work Force	• 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. • No Forced Labor	• EPC contractors and sub-contractors are not employing any child labor in the project area. • No forced labor has been recorded in the project. • Proper documentation of contract with the worker is being maintained which includes working hour, wage and benefit. • First Aid support is provided to the labors as required. • Thermal scanning of workers is being done at regular frequency for checking any condition of fever. • Workers must get the safety clearance before initiating any work like – routine checkup of the work places and administrative clearance	Being complied	• The insurance policy should cover the accidental case or injuries of the labors; • Awareness work should be continued regarding the local cultural values, STD, redressing of workers grievances,

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			• Work in hot condition and height need another permission • Sanitization is being done at regular intervals at Offices and labor sheds • Awareness about Covid-19 is being spread among workers and office support staff.		
3	Safety at site	• Installation/Construction of Safety Fence around the Project area • Use of Personnel Protective Equipment's (i.e. safety vest, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.); • Safety trainings for workers (i.e. fire control, working at height, working in heat, first aid etc.); • Practice of Tool box meeting, safety talks • Safe Storage of Hazardous Chemicals (e.g. fuel, flammable chemical, toxic chemicals, etc.); • Maintaining Material Safety Data Sheet (MSDS); • Provision of Health care facilities such as doctor, hospital etc. available at/nearby the Plant construction site; • Availability of First Aid at work place;	• Thermal scanning of workers is being done at regular frequency for checking any condition of fever. • BIFPCL has demarcated the specific construction site with warning sign; • Basic Medical care with free medicine and counseling is being provided to workers on regular basis. • Most of the Labor and Project personnel are using appropriate PPEs like reflecting vest, helmet, and safety shoes etc. and most important the face musk. • Increased the capacity of temporary hospital, doctors and 24hr availability of ICU supporting ambulance at the Project site; • Emergency contact address was found on the board at the site for any kind of sudden incident; • EPC has made a contract with the Gazi Medical of Khulna city for emergency medical support. • Sanitization is being done at regular intervals of the labors	Being Complied	• Monitoring about the use of face musk and COVID symptom of the labors • Try to develop the habit of the worker for safety worker like protecting the dangerous part of machine, vigilant for moving cranes, hooks or other lifting equipment, fall protection, extra-attention on electrical works etc. • Increase the safety professionals at the site

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		• Preparation and Follow of Emergency Response Plan (ERP); • Adequate fire precautions in place (e. g., fire extinguishers, escape routes etc.); • Documentation and reporting of occupational accidents, diseases, and incidents; • Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS	• ▪ Awareness about Covid 19 is being spread among workers and office support staff. • The major construction work at site has been performed in presence of safety officer. • Fire extinguisher was found at required places. • Weekly checking of all the safety records and implementation of HIRA at site. • 2 Ambulances, 1 MBBS doctor, 2 paramedical doctors and two medical checkup system are amiable for the workers as well as officials		
4	Occupational Health and Safety procedure	• Provision of complete EHS division in the Human Resources Planning/ Organogram • Preparation of Safety Policy to be adopted during Plant operation	• Adequate number of safety officers have been employed by the EPC contractor and Sub-contractors. • One safety park has been established for continual training as well as training during induction. • PPE has been displayed to make them aware. • Medical aid, fire extinguishers, PPEs are being provided adequately. • Induction trainings and awareness programme were given all the worker who are working at the site. • Regular Safety talk, safety meetings are being organised at site and also in class rooms. Photo are being attached.	Being Compliance	• Safety habit should build-up, Use dust musk to the labour at work site • Safety signboard should be displayed with Bengali script.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			• Adequate safety bill-boards etc. have been displaced all over the construction area. Photo are being attached here. • Speed barriers are being augmented • Substantial warning sign, speed limit and convex mirror have been displayed at the strategic locations.		
5	Workers Well Being	• Provision of Welfare facilities for Worker/Labor such as, timely bonuses, wage, overtime, sick leaves, vacations etc.; • Routine medical check-up and emergency medical care for the sick and injured; • Appointment of a leader amongst the labor group, who will look into workers' well- being.	• Workers are generally satisfied with the residence facilities. BIFPCL has developed apps https://bifpcl.com/safety.aspx for stepping up the safety issues well. • BIFPCL has ensured the benevolent grant developed by the contractor for the victim's family as per Government' rule. • Basic amenities like food, medicines, hygiene etc. are being ensured in labor colony • Workers get lemon or saline water during work period in the summer. • Basic Medical care with free medicine and counseling is being provided to workers on regular basis. • Vitamin-C rich fruits, ORS distribution being done to contract workers in this COVID situation • Grievance of the workers were usually addressed especially for safety issues.	Being Complied	• Freedom of Association, Rights & scope of bargaining should be open for the workers. • Support to the COVID-19 affected labors urgently (if any)

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	• Construction of boundary wall around the Project area; • Installed water spraying system to control dusts; • Conducting dust monitoring and visual inspection around the site boundary; • Adopted noise management plan.	• Boundary wall has been re-constructed as per need • Water spraying has been conducted at least 4-5 times in a day by three no of water tankers or as per requirement for dust suppression. • CEGIS is routinely communicating with the nearby communities for assessing impacts and related complaints on dust generation issue. • Regular communication and consultation are taken places with the local government and local administration officials maintaining the COVID guideline of Bangladesh • Environmental parameters are continuously monitored as per the environmental monitoring guideline in and around the project site by separate entities except (April to June 2020).	Being complied	• Any complaint regarding noise and dust from local people must be addressed immediately and recorded accordingly in the register.
2	Grievance of local people	• Availability and operation of Grievance Redress Mechanism; • Maintaining open communication channel with the local community.	• Social liaison officer is working for maintaining relation with local communities especially the CSR activities. • BIFPCL regularly display the progress of the development through their website (https://www.bifpcl.com/) and	Being complied	• Put the grievance register outside the project boundary so that the local community could easily state any grievance properly.

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			disclosure meeting at the local government • Grievance register has been placed at the BIFPCL main office inside the project boundary. • BIFPCL is also receiving grievance from local community through local government like Union Chairman or Local Administration • Proponent is observing the community grievance or quarries though the monitoring study conducted by CEGIS or local government		
3	Risk of breaching Community Safety	• Construction of boundary wall/safety fence around the Project area; • Practicing Risk Assessment and Evaluation Process; • Practicing safe management for hazardous materials which may pose threat to the community; • Availability and operation of Emergency Response Plan; • Maintaining open communication channel with the local community; • Training and instruction to the security personnel about	• Implement numbers of pollution mitigating system for protecting the dust and other pollution outside to the project area • Strictly prohibited to enter outsider to the project site or labor camp. • Health check-up is mandatory to every labor during the induction training on which they get pass for work. • Sanitization and temperature scanner are being done at regularly • No conflict has been noticed between local communities and project authorities or workers	Being complied	• Maintain social distancing with the communities • Facilitate sanitary facilities and raise awareness for COVID management • Trained to the Sundarbans dependent community to shift their livelihoods

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		their behavior and communication with the local people; • Aware the security personnel about the right of the community people.	• Maintaining communication with local community regarding their grievance about the worker and work facilities. • Routine medical camp has been conducted each of the months of this quarter. • Distribution of essential food items, soaps to nearby villages and contract workers is done. • The proponent is also contributing fund from CSR for training, lab development at Digraj college, RO drinking water supply at Mongla which is supplying 1000-liter fresh water per hour and arranged football tournament, gift to the bright student, school lab development etc. to make a congenial relation with the communities.		
4	Community Health and Risk	• Provision of providing health service facilities to community if the Project poses any health risk like sexually transmitted disease, contract disease, vector-borne diseases; • Implement all pollution mitigation measures to	• Adopt a number of measures like thermal scanning, sanitization, face mask, isolation bed for COVID management • Developed the medical facilities (consisting medical officer, medical assistant, office assistant) at Plant site for checkup the communicable diseases of the workers and staffs;	Being Complied	• BIFPCL shall communicate regularly with the community to aware them about the COVID pandemic

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		ensure safeguarding to community.	• Distribution of essential food items, soaps to nearby villages and contract workers is done. • BIFPCL is going to arrange again the weekly health service program (medical consultation and free medicine) for the local community considering the COVID situation • Total 546 patients have been given treatment during November – December, 2020. . • Treatment facilities have been given to the patients – November – 227 December – 111 January – 251 • Boat Medical Camp- 172 (in this quarter) • Office medical Centre around 260 No of official patients in this quarter. • EPC contractor is educating to the labors about protective action taken to avoid vector borne diseases and HIV positives and COVID pandemic		
5	Youth Employment (Local)	**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	• Regular communication is being maintained with the local government and community representatives for labor recruitment;	Being Complied	• Training related to construction work i.e. masonry, rod binding, plumbing, carpenter, electrician, lineman, elevator mechanic, glazier, iron worker, driving, heavy

Sl. no	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		local labors according to their skills and capacities.	• The proponent took a number of initiatives to encourage local students through awarding them scholarships		equipment operator or laborer etc. should be introduced immediately;
6	Public Communication, Consultation and Awareness	• Arranging public communication/consultation meeting; • Sharing of Project information with local people; • Organizing environmental and social awareness programs/meetings.	• One social liaison officer is working (24x7) for developing relation with local communities. • Regular consultation meetings are carried out with the local government and administration. • BIFPCL regularly display the progress (through Video) of the development through their website (https://www.bifpcl.com/) and also disclosure meeting at the local government. • The local people are aware regarding the project activities from multiple sources like consultation, display board, website etc • The stakeholder consultations have not been conducted with the community people due to COVID situation.	Being Complied	• BIFPCL may use print media, social media, digital media might be used for spreading the project right information • The proponent should aware the local people about the rumor regarding the project;

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.	• Installation of proper runoff drains; • Use of sediment fences, traps and basins for trapping the sediment, if required.	• Construction of permanent drainage system to discharge water from the project area. • No such disturbance observed that may impact terrestrial flora. • The connectivity of Maidara River is being maintained. • EPC Contractor is monitoring the water quality on monthly basis at every outlet of the project site and comply with the ECR 1997 standard • Bank protective works has been rearranged of the western bank of Maidhara River especially the project eastern part. • Solid waste has been managed by third parties and finally disposed to the KCC disposal areas • Construction waste water discharge is minimum and need based only. They are also meeting effluent norms. • Waste water is being recycled and used for dust suppression.	Being complied	• Manage the drainage system beofre the monsoon season
2	Disturbance to nearby ecosystem due to	• No cutting/ felling of trees along the river bank;	• Main project activities (Construction and erection) are limited within the	Being Complied	• Regular monitoring of the planted trees.

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
	different construction activities	• Implementation of onsite waste and air quality management plan; • Limiting soil extraction activities within the defined area; • Limiting the vegetation clearance and base stripping process within the Project boundary; • Safety fence around the construction site; • Limiting the use of night light; • Using shade (directed downwards) around the outdoor lights; • Provision of cut-off time to switch off unnecessary lights at night; • Initiate Green plantation; • No plantation of non-native species; • Retaining top soil for future habitat restoration; • No degradation of sensitive habitat.	project boundary though some of the project activities (Gathering of stockpiles, concrete mixing activities) are being conducted in the south western side of the project and near bank of the Passur River (Jetty construction). • The project construction works were curtailed temporarily due to COVID situation but has been revived gradually. • Limiting the vegetation clearance within the Project boundary especially around the ash impoundment. • Plantation program is in progress with the help of forest department. • The client is going to plant 50000of fruits and medicinal plants as per the greenbelt position of layout by 2019-2020 • Local plant species like Goalpata, Sundori, Bain, Keora for green plantation are being planted • They are maintaining the EMP for protecting the adjacent ecosystem • No alien species has been recorded		• Reduce the rate of mortality at the sapling stages. • Bird sheds shall be created at the green belt areas.

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
			• Wild species like avifauna and mammals are now recorded in the greenery areas • Employees are aware about the rescues of species and no harm to wild species		
3	Disturbance to river, inter-tidal areas and wet lands	• No encroachment of inter-tidal flood plain area; • No disturbance to Dolphin community; • Monitoring of Ecosystem Health and Monitoring of Sundarbans Forest Health; • If required, embankment should be constructed considering a setback distance from river/canal bank; • Slope protection work along the Maidara River should be completed on an urgent basis before rainy season come, and; • 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	• Monitoring of ecosystem health of Sundarbans, and around the Project site is being continued; • The project is not obstructing the surface water flow. • BIFPCL has been started maintenance of the slop protection works • EPC Contractor is monitoring the discharged water quality at each of the outlet from this project on a monthly basis. • The project authority is constructing the permanent jetty as per approved layout. • The Maidara river is showing its natural phenomena.	Being Complied	• Initiatives should be taken to facilitate proper functioning of Maidara River

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 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 and plant 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 including ESP, FGD, ETP etc as per the contracted technical specification. Moreover, environmental	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
		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.	
6	Proper and adequate mitigation measures shall be ensured throughout preparation, construction and operation period of the proposed Khulna 1320 MW Coal based Thermal Power Plant Project activities.	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.
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 progressing well amid Covid-19. Working activities are restricted to daytime and sometimes extends to 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.	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. Adequate sanitation facilities	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
		for health safety from COVID-19 are supplied by the Contractor at the labor camps as well as in the work areas.	
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 night time and locating machinery close to sensitive receptor like near the labor camps are being avoided or managed through appropriate measures as observed during the monitoring span.	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 prohibited inside the project area. Now, solid waste is being managed with systematic processes. A solid waste management company is now collecting the solid waste from the project and dump it to the 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
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 noting any harmful air pollutant emission or waste discharge form 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 contactor has established their own Medical facilities for the labors. In case of emergency situation for both BIFPCL and EPC contractor contract was signed with a private hospital (GAZI medical, Khulna) for medical services. EHS team of BIFPCL, BHEL and Cholamandalam are compelling to ensure the safety mitigation measures as per EIA and EHS	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
		guideline. Moreover, Periodic training has been made as mandatory for the workers.	
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. water spraying at least 4-5 times in a day by three no of water tankers or as per requirement are being done to suppress fugitive dust. But the dust concentration inside the project boundary breach the standard limit during this dry season.	Partially 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, BIFPCL has already earthen stock piles are covered by natural green tiny grasses. These are acting as shield cover for fugitive dust	Being Complied
17	Adequate considerations should be given to facilitate drainage system for runoff water from rain/tidal surge.	Adequate attempt has been adopted to facilitate drainage system for runoff water from rain/tidal surge as BIFPCL has already constructed the permanent drainage system for discharging water from the project area.	Being Complied.
18	Adequate facilities should be ensured for silt trap to avoid clogging of drain/canal/water bodies	The drainage systems are functioning well to drain out the storm water systematically from the project area. Outlet trash screens to be constructed at the end point of each of the drain.	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 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.
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	Compliance action initiated.

Sl. No	Condition of DoE	Compliance Status	Remarks
		Specification (Clause no B4.3.1.4). High-efficient ESP is now at construction stage.	
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).	Compliance action initiated.
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).	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 well which is now visible at site.	Compliance action initiated
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).	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	Compliance action continued

Sl. No	Condition of DoE	Compliance Status	Remarks
		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. Moreover, DC office has rehabilitated around 32 families at Foyla and 17 families at Koigardaskati so far now.	
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 form 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	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
		been prepared, submitted and shared with DoE, which are also available at BIFPCL web site.	
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 relevant stages. BIFPCL is taking appropriate actions based on EMP monitoring report. BIFPCL regularly updates the EMP and OHAS which assist to reduce the impacts and 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
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.

Sl. No	Condition of DoE	Compliance Status	Remarks
35	There should be regularly disclosure of the report through workshops and websites and responses should be taken care accordingly.	CEGIS is regularly carrying out public consultation at different levels. There are no consultation workshops conducted in this quarter due to COVID situation. All the monitoring reports are being kept available on website of BIFPCL (www.bifpcl.com)	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 and will continue throughout the life time of the 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 Plant. The consultant for developing MIS 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
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 as like every time.	Being complied
39	No ground water should be allowed to use for plant purposes.	In compliance of the DoE approval condition no. 39 of EIA Report, "No ground water should be allowed to use for plant purposes". The Power Plant has been designed considering use of surface water only during all stages of project development and operation.	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
		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 being operated recently for supplying fresh water. There two RO plant jointly fulfill the fresh water demand for construction works.	
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 as environmental monitoring consultant, is also carrying out consultation with the local people with interviews on regular basis for better performance of the Project as a whole. No stakeholder consultation meeting has not been conducted in this quarter due to COVID situation.	Partially 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: • The date(s) on which the sample was taken; • The time(s) at which the sample was collected; • The point at which the sample was taken; and • 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 be 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 happened during the last 3 months (July, 2020 to October, 2020). With the spread of the COVID-19 outbreak, the construction works was nearly stopped from April, 2020 to June 2020. In the beginning of July 2020, the labors are joining to this project with proper COVID safety measures ensured by BHEL. Now, the construction works are running with full swing with around 7 thousand workers. 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 which have collectively reduce the incident in this quarter. Any	Complied at present

Sl. No	Condition of DoE	Compliance Status	Remarks
		noticeable environmental and anthropogenic incident did not recorded for the last 3 months.	
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. With the increasing construction activities from July 2020, the proponent as well as the EPC have given high priority on health and safety issues. EPC have already revised the health and safety management manual and reshaped for pragmatic practicing. Moreover, CEGIS is monitoring the EMP implementation as a whole.	Complied at present.
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 in association with Disaster Management Plan of Bangladesh Government.	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 which is progressing.	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
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. Therefore, no incident has been occurred from March 2020 to July 2020. 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.	Being Complied
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
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),	At present, the Plant is in construction phase. The functional and technical specification of 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),	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
	'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.	'closed-loop' Flue Gas Desulfurization (FGD), Low NOx Burner, online air and water quality monitoring system for preventing pollution. All these stipulations have been included in the technical specification of Main Plant EPC contract package which is being constructed now. Moreover, BIRPCL has got the Environmental Renewal Certificate each of the year through maintaining the conditions of DOE.	
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	The project proponent has included all the mitigation measures in their BID document of Coal	Suggested to comply at operation phase.

Sl. No.	Conditions	Compliance status	Remarks
	throughout the operation period of the Project	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.	
6	Any heritage site, ecologically critical areas, and other environmentally, religious and archeologically sensitive places shall be kept protected during project operation.	There is no Religious and Archaeological place in and around the Project site. As a third party, CEGIS is now monitoring the potential impact locations and indicators which are sensitive to coal transportation in the Sundarbans ECA, Sundarbans Reserve Forest and Sundarbans World Heritage Site. Those information and data assist to protect the ecological critical areas in future operation period.	Suggested to comply at operation phase.
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 mechanical construction of the Project including Jetty construction activities are progressing. The jetty construction works is running even under this COVID situation. BIFPCL, EPC contractor and sub-contractors are providing sufficient safety materials and component for protecting from 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	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
		reflect any significant changes of the habitat of flora and fauna of the project influenced Passur river and Sundarbans ecosystem	
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 are tried build up awareness about Covid-19 among workers and office support staff. Thermal scanning of workers is being done at regular frequency for checking COVID symptom.	Being Complied
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 4-5 times in a day by three no of water tankers or as per requirement are being done to suppress fugitive dust in this dry period.	Partially 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 contract package, Section V, B4 of Technical Specification (Clause No B4.3.1.6). The Covered coal stockyard is now under construction stage.	Compliance Action initiated.
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	Compliance Action initiated.

Sl. No.	Conditions	Compliance status	Remarks
		coal stockyard is now under construction stage.	
15	Construction material should be properly disposed of after the construction work is over.	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. 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.	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	Being Complied.

Sl. No.	Conditions	Compliance status	Remarks
		with the quarterly compliance monitoring report.	
19	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 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 CEGIS website at present.	Being Complied.
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 (www.bifpcl.com). BIFPCL as well as CEGIS is regularly carrying out public consultation at local level to get the responses from the community except under this COVID situation.	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	Not applicable in this stage	Suggested to Comply as and when required.

Sl. No.	Conditions	Compliance status	Remarks
	prevention of pollution by garbage from ships.		
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.e.* 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 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 jetty construction works is now going on. Beforehand, BIFPCL has submitted the detailed work plan seven (7) days before 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.	Being complied
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 d) The name of the person who collected the sample.	The Monitoring report of CEGIS keeps all the records as suggested.	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
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 e. 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 precautious 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.
33	National Oil Spill Contingency Plan (NOSCOP) 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.	BIFPCL has strengthened 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. The institutional arrangement for managing the incident during coal transportation system based on the EIA and DoE recommendations. Moreover, monitoring activities is continued for checking any	Complied at Present.

Sl. No.	Conditions	Compliance status	Remarks
		significant changes in natural ecosystem.	
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

5.3 Progress of project activity


Figure 5.1: work progress of Chimney and FGD


Figure 5.2: Work Progress of MPH and TG


Figure 5.3: Work Progress of Switch Yard and Fuel Oil Complex

Figure 5.4: Work Progress of Coal Covered Shed and CHP

Figure 5.5: Environmental Monitoring

Figure 5.6: Safety Initiatives

Figure 5.7: Medical Camp

CSR activites

High Official Visit (Indian High Commissioner and German Ambesedor)

Figure 5.8: Activities at Maitree Super Thermal Power Plant Project

References

"Assessing the oil spill's impact on Bangladesh's Sundarbans forest". Deutsche Welle. December 17, 2014.

Ali, M.M; M.L. Ali; M. S. Islam and M. Z. Rahman. 2018. Assessment of toxic metals in water and sediment of Pasur River in Bangladesh. *Water Sci Technol.* 77 (5): 1418-1430.

Awashthi, S.K. 2000. Prevention of Food Adulteration Act No. 37 of 1954. Central and State rules as amended for 1999 (3rded.). New Delhi: Ashoka Law House.

Badran M (2001) Dissolved oxygen, chlorophyll a and nutrient seasonal cycles in waters of the Gulf of Aqaba, Red Sea. Aquat Ecosys Health Manag 4(2):139–150.

BARC (Bangladesh Agricultural Research Council). 2012. Fertilizer Recommendation Guide, Bangladesh Agricultural Research Council, Farmgate, Dhaka.

Bartram J and Balance R (1996), Water Quality Monitoring - A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programmes, UNEP/WHO, Chapter 2.

Bates, J. W., Mcnee P. J. and Mcleod. A. R. 1996. Effects of Sulphur Dioxide and Ozone on Lichen Colonization of Conifers in the Liphook Forest Fumigation ProjectThe New Phytologist 132,653-660.

Beets, P.N., Bulman L.S., Pearce S.H. 2008. Relationships between leaf area, growth, tree health attributes and LiDAR. Client Report No. 12713.

Beets, P.N., Whitehead, D. 1996. Carbon partitioning in *Pinus radiata* stands in relation to foliar nitrogen status. Tree Physiology 16:131-138

Brown S. 1997. Estimating biomass and biomass change of tropical forests: a primer. FAO Forestry Paper 134. FAO, Rome, Ital

Brown SAJ, Gillespie JR, Lugo AE. 1989. Biomass estimation methods for tropical forests with application to forest inventory data. For. Sci. 35 (4):881–902

CEGIS. (2013). Environmental Impact Assessment of 2X (500-660) MW Coal Based Thermal Plant to be Constructed at the Location of Khulna (p. 456). Bangladesh.

Chave J, Andalo C, Brown S, Cairns M. A., Chambers, J. Q., Eamus D et al (2005) Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecologia 145: 87–99

Chave J, Rejou-Mechain M, Burquez A, Chidumayo E, Colgan MS, Delitti WBC, Duque A, Eid T, Fearnside PM, Goodman RC, Henry M, Martinez-yrizar A, Mugasha WA, Muller Landau HC, Mencuccini M, Nelson BW, Ngomanda A, Nogueira EM, Ortiz-malavassi E, Pelissier R, Ploton P, Ryan CM, Saldarriaga J, Vieilleden G. 2014. Improved allometric models to estimate the aboveground biomass of tropical trees. Glob. Change Biol. 20: 3177–3190.

Das, S., M. De, D. Ganguly, T.K. Maiti, A. Mukherjee, T.K. Jana and T.K. De, 2012. Depth integrated microbial community and physico-chemical properties in mangrove soil of Sundarban, India. Adv. Microbiol., 2: 234-240.

Donato, D.C., Kauffman, J.B., Stidham, M.A. (2009) Protocols for measuring and reporting carbon stocks in mangrove forests. Unpublished report prepared for the workshops on Global Climate Change and Carbon Financing: Opportunities for Bangladesh. Dhaka, Bangladesh, 28, October–9 November 2009.

Eckman, J.E., (1979) Small-scale patterns and processes in a soft-substratum intertidal community. J. Mar. Res.37:437–457.

Eckman, J.E., (1983) Hydrodynamic processes affecting benthic recruitment. Limnol. Oceanogr. 28: 241–257

FAO 1997. Estimating biomass and biomass change of tropical forests: a primer, Rome, Italy: FAO Forestry Paper No. 134

Ferreira, T.O., X.L. Otero, V.S. de Souza Jr., P. Vidal-Torrado, F. Macias and L.P. Firme, 2010. Spatial patterns of soil attributes and components in a mangrove system in Southeast Brazil (Sao Paulo). J. Soils Sediments, 10: 995-1006.

Gleick, P.H. (Ed.), 1993. Water in Crisis: A Guide to the World Fresh Water Resources. Oxford University Press, New York

Goldman, S. 2005. Information theory. Dover, New York.

Greenleaf Forestry and Wood Products Inc. 2010. “Forest Health Checklist.” http://www.greenleafforestry.com/greenleafservices_006.htm

Harmon, M. E. and J. Sexton (1996). Guidelines for measurements of woody detritus in forest ecosystems. U. S. LTER Publication No. 20.

Heath, R.C., 1989. Basic Ground-Water Hydrology. U.S. Geological Survey Water-Supply Paper 2220, 84p.

Hossain M.D., Nuruddin. A.A. 2016. Review Article Soil and Mangrove: A Review. Journal of Environmental Science and Technology. 9: 198-207.

Hossain, M., Siddique M. R. H., Bose, A., Limon, S.H., Chowdhury, M.R. K., Saha, S. (2012) Allometry, above-ground biomass and nutrient distribution in Ceriops decandra (Griffith) Ding Hou dominated forest types of the Sundarbans mangrove forest, Bangladesh. Wetlands Ecol Manage DOI 10.1007/s11273-012-9274-2

Hossain, M.Z., C.B. Aziz and M.L. Saha, 2012. Relationships between soil physico-chemical properties and total viable bacterial counts in Sunderban mangrove forests, Bangladesh. Dhaka Univ. J. Biol. Sci., 21: 169-175.

Kabata-Pendias, A. and H. Pendias, 1992. Trace Elements in Soils and Plants, 2nd ed. CRC press, Boca Raton, 365pp

Kauffman, J.B. and Donato, D.C. (2012) Protocols for the measurement, monitoring and reporting of structure, biomass and carbon stocks in mangrove forests. Working Paper 86. CIFOR, Bogor, Indonesia.

Khan, H.R., S. Rahman, M.S. Hussain and T. Adachi, 1993. Morphology and characterization of an acid sulfate soil from mangrove flood plain area of Bangladesh. Soil Phys. Cond. Plant Growth, 68: 25-36.

Kinne, O. (Ed.), 1984. Marine Ecology. John Wiley and Sons, London

Komiyama A, Ong JE, Poungparn S (2008) Allometry, biomass, and productivity of mangrove forests: A review. Aquat Bot 89:128–137

M. H. Rahman and H. Ishiga, “Arsenic pollution in soil and groundwater of Bangladesh,” in Proceedings of the International Conference on Energy and Environment, vol. 2, pp. 1626–1632, 2003.

M. M. Rahman, B. K. Mandal, T. Roy Chowdhury et al., “Arsenic groundwater contamination and sufferings of people in North 24-Parganas, one of the nine arsenic affected districts of West Bengal, India,” Journal of Environmental Science and Health A: Toxic/Hazardous Substances and Environmental Engineering, vol. 38, no. 1, pp. 25–59, 2003. View at Publisher · View at Google Scholar · View at Scopus

MacArthur, R.H. & MacArthur, J.W. (1961) On bird species diversity. Ecology, 42: 594–598.

Macdicken K.G. 1997. A guide to monitoring carbon storage in forestry and agroforestry projects. Specialist, 3: 1– 87.

Margalef, R. (1958) “Information theory in ecology,” General Systems Yearbook, vol. 3, pp. 36–71,

Marowsky, G. and K.H. Wedepohl. 1971. General trends in the behavior of Cd, Hg, Tl and Bi in some major rock forming processes. Geochimica et Cosmochimica Acta. 35(12): 255-267.

Moore, P.D. & Chapman, S.B. (Ed.) (1986) Methods in Plant Ecology. Blackwell Scientific Publications. 581.5 MET

Moreno, A.N.M. and J.H.M. Calderon, 2011. Quantification of organic matter and physical-chemical characterization of mangrove soil at Hooker Bay, San Andres Island-Colombia. Proceedings of the Global Conference on Global Warming, July 11-14, 2011, Lisbon, Portugal, pp: 1-7.

Nelson D., 2002; Natural Variations in the Composition of Groundwater; Groundwater Foundation Annual Meeting; Oregon Department of Human Services Springfield, Oregon; oages 1-8.

Odum, E. P. (1971) Fundamentals of Ecology, WB Saunders, Philadelphia, Pa, USA, 1971.

Pearson T, Walker S, Brown S (2005) Sourcebook for land use, land-use changes Forestry Projects. Report from BioCF and Winrock International. Available at: http://www.winrock.org/ecosystems/tools.asp?

Phillips, Tom (13 December 2014). "Fears for rare wildlife as oil 'catastrophe' strikes Bangladesh". The Daily Telegraph. Retrieved 15 December 2014.

Pielou, E.C. (1969) an Introduction to Mathematical Ecology. John Wiley & Sons, Inc., New York, 286 pp.

Rabalais, N.N., 2002. Nitrogen in aquatic ecosystems. Ambio 31, 102–112.

Rahman M., Rahman M T., Rahman M S., Rahman F., Ahmed J U., Shakera B., Halim M A., 2013; Water quality of the largest mangrove forest; Canadian Chemical Transactions; Volume, Issue 2., Page 141-156.

Rahman MM, Islam SkA. 2015. Phenophases of Five Mangrove Species of the Sundarbans of Bangladesh. Int. J. Bus. Soc. Sci. Res. 4(1): 77-82.

Rahman MM, Rahman MM, Islam KS. 2010. The causes of deterioration of Sundarban mangrove forest ecosystem of Bangladesh: conservation and sustainable management issues. AACL Bioflux 2, 77-90.

Rahman, M. M. (2012) Relationship between carbon storage, vegetation type and salinity in Sundarbans Reserved Forest. M. Sc. Thesis. Forestry and Wood Technology Discipline, Khulna University, Khulna-9208, Bangladesh.

Rajasegar, M. 2003. Physico-chemical characteristics of the Vellar estuary in relation to shrimp farming. J. Environ. Biol. 24: 95-101.

Raman S M B, Sarder L, Rahaman M S, Ghosh A K, Biswas S K, Siraj S S, Huq K A, Hasanuzzaman A F M and Islam S S (2013), Nutrient dynamics in the Sundarbans mangrove estuarine system of Bangladesh under different weather and tidal cycle, Ecological process, springer, page 5.

Rambok, E., S. Gandaseca, O.H. Ahmed and N.M.A. Majid, 2010. Comparison of selected soil chemical properties of two different mangrove forests in Sarawak. Am. J. Environ. Sci., 6: 438-441.

Rompas, R. M. (2010). Marine Toxicology. Indonesian Marine Council. Jakarta.

Rudnick, R.L. and S. Gao. 2014. Composition of the Continental Crust. Treatise on Geochemistry, Second Ed., Chapter 4: 1- 64.

S. A. Haque, 2006. Review article, salinity problems and crop production in coastal regions of Bangladesh. Department of Soil Science, Bangladesh Agricultural University, Mymensingh, Bangladesh. Pak. J. Bot., 38(5): 1359-1365.

Sah, K.D., A.K. Sahoo, S.K. Gupta and S.K. Banerjee, 1989. Mangrove vegetations of sunderbans and their effect on the physicochemical and nutrient status of the soils. Proc. Indian Nat. Sci. Acad. Part B: Biol. Sci., 55: 125-132

Schnitzer SA, DeWalt SJ, Chave J (2006) Censusing and measuring lianas: A quantitative comparison of the common methods. Biotropica 38(5): 581-591

Senthilkumar, S., P. Santhanam and P. Perumal 2002. Diversity of phytoplankton in Vellar estuary, southeast coast of India. In: Proc. 5th Indian Fisheries Forum (Eds. S. Ayyappan, J.K. Jena and M. Mohan Joseph). Published by AFSIB, Mangalore and AeA, Bhubanewar, India. pp. 245-248

Shukla, S.R. and Chandel, S. P. (1980) Plant ecology. 4th Edn. S. Chandel and Co. Ramnagar, New Delhi – 110055. 197

Sivasubramanium R (1999). Water quality of river Periyar (River Suruliyar) in Tamil Nadu. In: Mishra SR (Ed.). Limnological Research in India. Daya publishing house, Delhi

Skilleter, G.A., Warren, S. (2000) Effects of habitat modification in mangroves on the structure of mollusc and crab assemblages Journal of Experimental Marine Biology and Ecology, 244: 107–129

Smith, Gregory L., and Thomas R. Baker. 2003. "Lichens as Bioindicators." In The Middle School Science Classroom, NSTA ScienceScope, 16–19. http://tbaker.com/tbaker/academics/papers/published/sciscope_lichens/released_byNSTA/Lichens%20as%20Bioindicators.pd

Spencer, C., 1975. The micronutrient elements. In: Riley, J.P., Skirrow, G. (Eds.), Chemical Oceanography, vol. II, seconded. Academic Press, London

Sukardjo, S., 1994. Soils in the mangrove forests of the Apar Nature Reserve, Tanah Grogot, East Kalimantan, Indonesia. Southeast Asian Stud., 32: 385-398.

Sukumar, R., Dattaraja, H. S., Suresh H. S. et al. 1992. "Long-term monitoring of vegetation in a tropical deciduous forest in Mudumalai, southern India," Current Science, 62:608–616,

Tareq M S., Rahaman S M., Rikta Y S., Islam S M N., Sultana M S 2013; Seasonal Variations in Water Quality of the Ganges and Brahmaputra River, Bangladesh; Jahangirnagar University Environmental Bulletin, Vol.2; pages (71-82)

USDA Forest Service. 2007. "Soil Vital Signs: Soil Quality Index (SQI) for Assessing Forest Soil Health." http://www.fs.fed.us/rm/pubs/ rmrs_rp065.pdf.

Warren, J.H., (1990) Role of burrows as refuges from subtidal predators of temperate mangrove crabs. Mar. Ecol. Prog. Ser. 67:295–299

Weiss R (1970) the solubility of nitrogen, oxygen and argon in water and seawater. Deep Sea Res Oceanogr Abstr 17(4):721–735

Wetzel, R.G., 2001. Limnology, 3rd ed. Academic Press

WHO (World Health Organization), Guidelines for drinking water quality, 2nd Edition; 1993

WHO, the International Network to Promote Household Water Treatment and Safe Storage 2007

Zhu Y G., Chen, S. B., & Yang, J. C., 2004; Effects of Soil Amendments on Lead Uptake by Two Vegetable Crops from a Lead-Contaminated Soil from Anhui, China. Environ Int., 30(3), 351-356. http://dx.doi.org/10.1016/j.envint.2003.

Appendices

Appendix I: Checklist of Monitoring Environmental Compliances

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

Sl 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 Tarjja 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			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
5	Compensation and Resettlement	• Prepare Proper resettlement action plant 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 • 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?			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• 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

Sl 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

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Working Conditions and Management of Worker Relationship	• Preparation of Human Resources Policies and Procedures for Direct workers • Defined Working condition and Terms of Employment for direct worker • Sustainably equivalent terms and condition for migrant workers • Compliance to national law of forming workers' organization • No discrimination and equal opportunity for all • Measures for diminishing past discrimination • Grievance Mechanism			
	Protecting Workforce	• 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. • No Force Labor			
2	Safety at site	• Installation/Construction of Safety Fence around the Project area • Use of Personnel Protective Equipment (i.e. safety suit, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.) • Safety trainings for workers (i.e. fire control, working at height, working in heat, first aid etc.) • Practice of Tool box meeting, safety talks, • Safe Storage of Hazardous Chemicals (e.g. fuel, flammable chemical, toxic chemicals, etc.) • Maintaining Material Safety Data Sheet (MSDS) • Provision of Health care facilities such as doctor, hospital etc. available at/nearby the plant construction site • Availability of First Aid at work place • Preparation and Follow of Emergency Response Plan			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• Adequate fire precautions in place (for example, fire extinguishers, escape routes etc.) • Documentation and reporting of occupational accidents, diseases, and incidents • Policies and procedures for managing and monitoring the performance of third-party employers in relation to OHS			
3	Occupational Health and Safety Procedure	• Provision of complete EHS division in the Human Resources Planning/Organogram • Preparation of Safety Policy to be adopted during plant operation			
4	Worker’s Well Being	• Establishment Grievance Mechanisms • Ensuring fair treatment, non-discrimination and equal opportunity • Compliance of Project’s labor policy with the national labor law • No Child Labor • No incident of forced labor • Provision of Welfare facilities for Worker/Labor			

Table C: Checklist of Monitoring ESMP Implementation (During Construction phase)

(Community Health, Safety and Security)

Sl 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	• Construction of boundary wall around the Project are • Installation of water spraying system to control dusts • Conducting dust monitoring and visual inspection around the site boundary • Adoption of Noise management plan			
2	Grievance of local people	• Availability and operation of Grievance Redress Mechanism • Maintaining open communication channel with the local community			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
3	Risk of breaching Community Safety	• Construction of boundary wall/safety fence around the Project area • Practicing Risk Assessment and Evaluation Process • Practicing safe management for hazardous materials which may pose threat to the community • Availability and operation of Emergency Response Plan • Maintaining open communication channel with the local community • Training and instruction to the security personnel about their behaviour and communication with the local people • Aware the security personnel about the right of the community people			
4	Community Health Risk	• Provision of providing health service facilities to community if the Project possess any health risk like sexually transmitted disease, communicable disease, vector-borne diseases • Implement all pollution mitigation measures to ensure safeguarding to community			***(Continued)***
5	Youth Employment	• Providing training/awareness program for the local youth to let them aware about the required qualification to get involved in the Project related activities			
6	Public Communication, Consultation and Awareness	• Arranging public communication/consultation meeting • Sharing of Project information with local people • Organizing environmental and social awareness programs/meetings			

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.	• Installation of proper run on/runoff drains • Use of sediment fences, traps and basins for trapping the sediment, if required			
2	Disturbance to nearby ecosystem due to different construction activities	• No cutting/ felling of trees along the river bank • Implementation of on-site waste and air quality management plan • Limiting soil extraction activities limited within the defined area • Limiting the vegetation clearance and base stripping process within the Project boundary • Safety fence around the construction site • Limiting the use of night light • Using shade (directed downwards) around the outdoor lights • Provision of cut-off time to switch off unnecessary lights at night • Initiate Green plantation • No plantation of non-native species • Retaining top soil for future habitat restoration • No degradation of critical habitat?			
3	Occupation of river, inter-tidal areas and wetlands	• No encroachment of inter-tidal flood plain area • No disturbance to Dolphin community • Monitoring of Ecosystem Health and Monitoring of Sundarbans Forest Health • If required, embankment should be constructed considering a setback distance from river/canal bank			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• Slope protection work along the Maidara River should be completed on an urgent basis before rainy season come and • 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			

Appendix II: Photo Album

Environmental and Socio-economic Monitoring of Khulna 2×660 MW Power Plant for 26th monitoring program (November, 2020)

Monitoring team

Ambient Noise level acquisition

Measuring the light intensity

Measuring tree height

Measuring tree DBH

Collection of Forest soil sample

Data acquisition for forest health

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

Project Location:	Upazila: Rampal, District: Bagerhat Site is located at 23 kms Southward of Khulna City and 14 kms. North-Eastward from Mongla Port. 
Project Capacity:	1320 MW (2x660 MW), based on Ultra Super-critical Technology
Mode of Operation:	Base Load
Fuel:	Imported Coal
Fuel Transportation:	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.

Land& Land Development:	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).
Evacuation of power:	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.
Expected Timeline for project implementation	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 though 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
	Total Hardness, Hg, NO_3 and PO_4
	River Morphology,
	Tidal inundation
	Drainage Network
	Erosion and Accretion
	Ground water quality
Air quality	SOx

Monitoring Parameter	Indicators
	NOx
	SPM (PM_{10} and $PM_{2.5}$)
	CO

Air quality monitoring progress

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

- SOx: measured by Fluorescent signal generated by exiting SO_2 with UV light
- NOx: measured by Chemilumiscent reaction between NOx & O_3
- O_3: 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_{10}, $PM_{2.5}$): 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_{10} or $PM_{2.5}$ 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	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 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	
			Concentrations are in µg/m³																									
SW Corner of the PP area	$PM_{2.5}$	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	65^{24hr}
	PM_{10}	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	127.65	68.12	80.28	107.16	106.13	150^{24hr}
	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	108.48	98.26	149.73	163.48	200^{8hr}
	SO_2	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	365^{24hr}
	NOx	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
Shapmari area	$PM_{2.5}$	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	65^{24hr}
	PM_{10}	814.69	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	150^{24hr}
	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	106.35	95.24	119.22	170.33	200^{8hr}
	SO_2	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	365^{24hr}
	NOx	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	33	26	26	23	21	16	1	1	1	0	0	1	08	25	04	4	8	6	4	1	34	22	9	6	2	6	157^{8hr}
NW Corner of	$PM_{2.5}$	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	65^{24hr}

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 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	
			Concentrations are in µg/m³																									
the PP area	**PM_{10}**	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
Barni, Gaurambha	**$PM_{2.5}$**	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	65^{24hr}
	PM_{10}	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
Chunkuri-2, Bajua Dacope	**$PM_{2.5}$**	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	65^{24hr}
	PM_{10}	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
	$PM_{2.5}$	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	65^{24hr}

Locations of Monitoring	Pollutants	1^{st} QM, Apr 2014	2^{nd} QM, Jul 2014	3^{rd} QM, Oct 2014	4^{th} QM, Jan 2015	5^{th} QM, Apr 2015	6^{th} QM, Jul2015	7^{th} QM, Oct 2015	8^{th} QM, Jan 2016	9^{th} QM, Apr 2016	10^{th} QM, Jul 2016	11^{th} QM, Oct 2016	12^{th} QM, Jan 2017	13^{th} QM, April, 2017	14^{th} QM, Oct, 2017	15^{th} QM Jan, 2018	16^{th} QM April, 2018	17^{th} QM, Jul 2018	18^{th} QM, Nov, 2018	19^{th} QM, Feb, 2019	20^{th} QM, Apr, 2019	21^{st} QM, Jul, 2019	22^{nd} QM, Jul, 2019	23^{rd} QM, Feb, 2020	25^{th} QM, July, 2020	26^{th} QM, Oct, 2020	27^{th} QM, Jan, 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	
			Concentrations are in μg/m³																									
Pankhali, Dacope	**PM_{10}**	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
Mongla Port area	**$PM_{2.5}$**	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^{24hr}
	PM_{10}	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
Harbaria, Sundarbans	**$PM_{2.5}$**	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	65^{24hr}
	PM_{10}	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
Akram Point,	**$PM_{2.5}$**	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	65^{24hr}

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 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	
		Concentrations are in μg/m³																										
Sundarbans	**PM_{10}**	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	NOx	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
Hiron Point, Sundarbans	**$PM_{2.5}$**	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	65^{24hr}
	PM_{10}	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	NOx	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
	$PM_{2.5}$	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	65^{24hr}

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 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	
			Concentrations are in µg/m³																									
Khulna City, near Khan Jahan Ali Bridge	**PM_{10}**	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	NOx	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
Township area	**$PM_{2.5}$**	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	65^{24hr}
	PM_{10}	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	NOx	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}
Access road bridge	**$PM_{2.5}$**	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	65^{24hr}
	PM_{10}	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	150^{24hr}
	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	200^{8hr}
	SO_2	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	365^{24hr}
	NOx	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	100^{Annual}
	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	$(10000)^{8hr}$
	O_3	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	157^{8hr}

Note(s): Concentrations are in µg/m³

- DoE- Department of Environment, NF- Not found; NO-Not observed; x-not measured at pre-construction stage.
- Fine Particulate Matter ($PM_{2.5}$), Respirable Dust Content (PM_{10}), Suspended Particulate Matter (SPM), Oxides of Nitrogen (NO_X). Sulfur dioxide (SO_2), Carbone Monoxide (CO) & Ozone (O_3);

- 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	√

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	√
Pankhali, Dacope	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	√
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
	PM	√	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
Khulna City, near Khan Jahan Ali Bridge	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	√	√	√	√
	SOx	X	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	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	√	√	√	√
	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	√	√	√	√

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

Sl	Sampling Locations	pH Values																									
		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	
		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	
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	
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	
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	
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	
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	
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	
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	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	6.5–8.5
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	
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	
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	
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	
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	
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	
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	

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 in Passur River

Sl. No.	Sampling Locations	Temperature (°C)																									
		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	
		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	
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	
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	
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	
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	
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	
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	
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	
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	20°C – 30°C
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	
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	
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	
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	
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	
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	
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		29.02	22	

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	Salinity (ppt)																										
		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	
		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	
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**	**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**	
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**	
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**	
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**	
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	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**	
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**	
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**	
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**	
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**	
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**	
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**	
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**	
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		2.6	**8.2**	

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.4: Dissolve Oxygen in Passur River

SL	Sampling Locations	Dissolve Oxygen (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	July	Oct	Jan	
		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	
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**	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**	
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**	
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**	
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**	
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**	
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**	
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**	
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**	
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**	
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**	
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**	
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**	
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**	
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		8.2	**9.0**	

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_5 of Passur River Water

SL	Sampling Locations	Apr 1QM	Jul 2QM	Oct 3QM	Jan 4QM	Apr 5QM	Jul 6QM	Oct 7QM	Jan 8QM	Apr 9QM	Jul 10QM	Oct 11QM	Jan 12QM	Apr 13QM	Oct 14QM	Jan 15QM	Apr 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	
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	5 or more (standard for sustaining fisheries)
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 of Passur River System

Sl	Sampling Locations	COD (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	July	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
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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 concentration of Passur River System

Sl	Sampling Locations	Oil and Grease (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	
		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	
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	Passur-Ghasiakhali Confluence	<5	<5	<5	>15	13	7.63	9.87	21	30.3	13.5	<5	15.6	<5	<5	<5	<5	<5	<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	<5	<1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**<2.0**	10
4	Passur river at Hiron 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**	
5	Akram 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**	

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 of Passur River System

SL	Sampling Locations	TDS (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
		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
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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 Passur River System

SL	Sampling Locations	TH (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
		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
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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 Passur River System

SL	Sampling Locations	TSS (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
		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
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**
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**
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**
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**
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	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**
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**
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**
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**

SL	Sampling Locations	TSS (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
		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
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**
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**
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**
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**
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**
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		**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.11: Nitrate (NO_3^{2-}) concentration of Passur River System

Sl	Sampling Locations	NO_3^{2-} (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
		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
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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 (SO_4^{2-}) concentration of Passur River System

Sl	Sampling Locations	SO_4^{2-} (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
		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
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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_4^{2-}) concentration of Passur River System

Sl	Sampling Locations	PO_4^{2-} (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
		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
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**
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	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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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) concentration of Passur River System

Sl	Sampling Locations	As (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
		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
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**
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**
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**
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	0.001	0.002	0.002	0.002	0.005	0.002	0.001	0.003	0.002	0.003	**0.003**	0.002	**0.003**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**

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 concentration of Passur River System

Sl	Sampling Locations	Pb (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
		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
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**
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**
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**
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**
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**
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**
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**
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**
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**

Sl	Sampling Locations	Pb (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
		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
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	**0.008**	0.013	**0.003**
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	**0.006**	0.005	**0.006**
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	**0.005**	0.003	**0.007**
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	**0.007**	0.009	**0.004**
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	**0.043**	0.011	**0.020**
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	**0.056**	NS	**0.013**

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 concentration of Passur River System

Sl	Sampling Locations	Hg (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
		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
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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	< 0.001	**NS**	**<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 of Ground Water

Sl	Locations	Tube Well Type	pH value																									
			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
			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
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	MF	7.1	8.3	8.2	7.2	7.8	**8.1**	7.4	**7.2**
n2	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**
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**
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

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	Temperature (°C)																								
		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
		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
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**
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**
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**
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

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 and DO in Groundwater

Sl	Locations	Tube Well Type	Salinity (ppt)																									
			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
			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
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	0.1	0.18	**0.1**
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**
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**
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

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	DO (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	July	Oct	Jan
			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
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**
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**
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**
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

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 and TSS concentrations in Groundwater

SL	Locations	Type of tube wells	TDS (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
			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
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**
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**
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**
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

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	TSS (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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22nQM	23rd QM	25QM	26QM
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**
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**
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**
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

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 concentrations in Groundwater

Sl No	Locations	Type of tubewell	TH (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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23rd QM	25QM	26QM
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**
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**
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**
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

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 concentrations of monitored ground water locations

Sl	Locations	Tube-well Type	COD (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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23rd QM	25QM	26QM
1	Township near project site	Deep (>600 ft)	32	32	34	20	NO	12	4	4	4	4	4	4	4	8	NF	NF	NF	NF	4	352	4	4	**4**	**4**	**4**
2	Rajnagar	Deep (>600 ft)	28	28	18	16	14	10	8	4	4	4	4	4	4	8	4	4	4	4	3	4	4	4	**4**	**4**	**4**
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**
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

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_3^- Concentrations in Ground Water

Sl	Locations	Type of tube well	NO_3^{2-} (mg/L) *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
			1QM	2QM	3QM	4QM	5QM	6QM	7QM	8QM	9QM	10QM	11QM	12QM	13QM	14QM	15QM	16QM	17QM	18QM	19QM	20QM	21QM	22QM	23rd QM	25QM	26QM
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	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**
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	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

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_4^{2-} Concentrations in Ground Water

Sl	Location	Typeof Tubewell	SO_4^{2-} (mg/L) *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
			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
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**
2	**Rajnagar**	**Deep (>600 ft)**	-	2	-	-	-	-	2	6	2	1	1	1	1	1	2	2	4	1	2	1	2	2	3	3	**3**
3	**Kapasdanga**	**Deep (>600 ft)**	-	10	-	-	-	-	2	2	8	1	1		3	2	6	4	6	1	1	4	1	1	2	4	**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

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.24: PO_4^{3-} Concentrations in Ground Water

Sl	Location	Typeof Tubewell	PO_4^{2-} (mg/L) *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
			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
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	**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**
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**
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

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	As concentrations (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**
		1QM	**2QM**	**3QM**	**4QM**	**5QM**	**6QM**	**7QM**	**8QM**	**9QM**	**10QM**	**11QM**	**12QM**	**13QM**	**14QM**	**15QM**	**16QM**	**17QM**	**18QM**	**19QM**	**20QM**	**21QM**	**21QM**	**22QM**	**23rd QM**	**25QM**	**26QM**
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**
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**
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**
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**

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	Pb (mg/L) *BD Standard (0.05 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**
		1QM	**2QM**	**3QM**	**4QM**	**5QM**	**6QM**	**7QM**	**8QM**	**9QM**	**10QM**	**11QM**	**12QM**	**13QM**	**14QM**	**15QM**	**16QM**	**17QM**	**18QM**	**19QM**	**20QM**	**21QM**	**22QM**	**22QM**	**23rd QM**	**25QM**	**26QM**
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
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
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
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

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	Hg (mg/L) *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**
		1QM	**2QM**	**3QM**	**4QM**	**5QM**	**6QM**	**7QM**	**8QM**	**9QM**	**10QM**	**11QM**	**12QM**	**13QM**	**14QM**	**15QM**	**16QM**	**17QM**	**18QM**	**19QM**	**20QM**	**21QM**	**21QM**	**22QM**	**23rd QM**	**25QM**	**26QM**
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**
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**
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**
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**	**NF**	**<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 concentrations of monitored locations

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

Table B.29: TOC concentrations of monitored locations

Monitoring sites	July, 2018		January, 2019		July, 2019		February, 2020		July, 2020	
	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)	Total Carbon (mg/L)	Total Organic Carbon (mg/L)
Project jetty site	26.4	19.5	20.7	14.3	17.2	13.6	37.5	26.4	9.17	152
Majhar point	21.9	25.1	24.8	18.8	21.7	18.1	21.7	18.1	9.48	200
Hiron point	NM	NM	6.8	5.7	NM	NM	8.1	6.7	NM	NM

(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
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
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

Note: NM-Not measured.

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

Note: NM-Not measured.

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			
		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
1	Chalna, Dacope	55.92	60.88	61.23	59.34	58.98	61.03	55.78	58.60	56.24	54.09	53.45	54.59	52.00	51.11	50.56	51.28
2	NW Corner of the Project area	56.44	53.21	55.88	55.18	48.92	53.45	50.97	51.11	40.96	43.33	51.98	45.42	43.9	42.95	43.26	43.37
3	Chunkuri-2, Bajua	56.15	63.34	58.60	59.36	58.39	52.92	54.51	55.27	59.78	51.59	54.96	55.44	49.42	48.52	48.32	48.75
4	SW corner of the Project area	66.94	58.41	65.65	63.66	47.67	49.98	42.05	46.57	56.35	54.05	56.40	55.60	49.91	49.78	50.85	50.18
5	Project site near Shapmari area	53.14	55.40	55.05	54.53	53.97	55.80	54.77	54.86	51.02	47.91	47.93	48.95	54.55	53.21	52.88	53.72
6	Barni, Gaurambha	51.36	57.98	NM	54.67	53.69	49.37	48.53	50.53	57.37	60.48	68.05	61.97	56.53	40.65	49.21	48.80
7	Khan Jahan Ali Bridge, Khulna	63.38	60.55	66.44	63.46	65.19	67.65	65.32	66.05	60.75	62.81	63.05	62.20	65.55	66.86	66.52	66.31
8	Mongla Port area	60.49	62.10	63.43	62.01	60.24	55.66	55.85	57.25	59.74	62.38	61.07	61.06	64.92	67.90	63.71	66.41
9	Harbaria, Sundarbans	47.62	42.18	NM	44.90	43.48	44.71	NM	44.10	45.59	42.29	41.35	43.94	47.80	52.15	41.2	49.97
10	Akram Point, Sundarbans	44.05	45.62	NM	44.84	47.12	42.60	NM	44.86	NM	36.59	40.46	36.59	51.04	45.11	43.1	51.04
11	Hiron Point, Sundarbans	NM	NM	NM	NM	39.2	41.34	NM	40.28	41.3	39.41	NM	40.34	NM	NM	NM	NM

Source: CEGIS field Survey

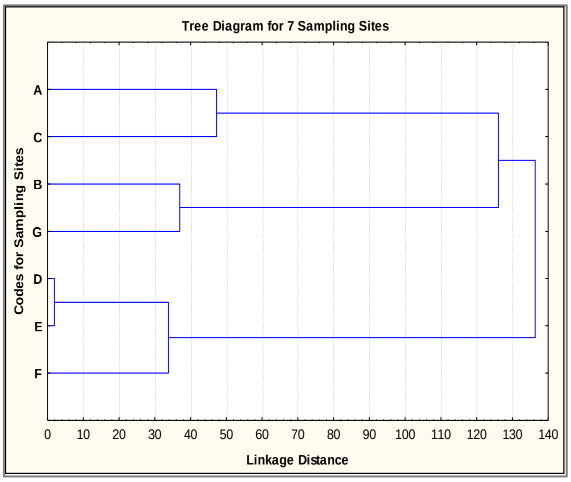
Note: NM-Not measured.

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

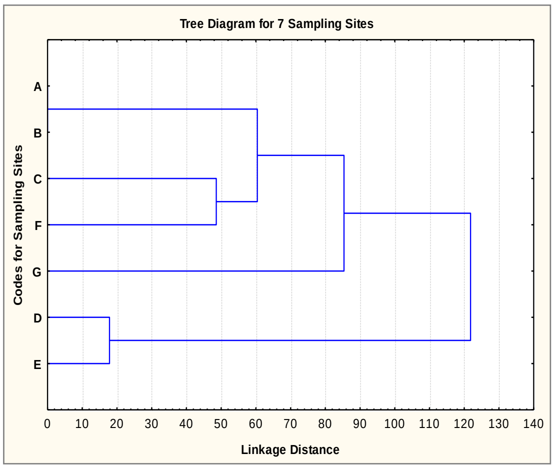
Sl No	Location	QM 26 (Noise Level in dB (A)) Oct, 2020				QM 27 (Noise Level in dB (A)) Jan, 2021			
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG
1	Chalna, Dacope	65.91	51.62	56.93	58.15	58.33	NM	62.68	60.50
2	NW Corner of the Project area	47.82	50.15	47.45	48.48	45.00	52.75	56.51	51.42
3	Chunkuri-2, Bajua	43.58	47.68	46.45	45.91	48.75	45.45	46.96	47.05
4	SW corner of the Project area	49.50	48.83	49.22	49.18	NM	50.88	53.84	52.36
5	Project site near Shapmari area	50.23	41.71	41.43	44.45	49.19	47.07	51.00	49.09
6	Barni, Gaurambha	67.71	51.76	55.51	58.33	51.69	51.99	55.60	53.09
7	Khan Jahan Ali Bridge, Khulna	81.72	81.45	82.25	81.81	61.95	NM	61.93	61.94
8	Mongla Port area	74.72	75.67	80.37	76.92	55.16	56.85	57.53	56.52
9	Harbaria, Sundarbans	59.01	NM	50.06	54.54	46.98	41.82	NM	44.40
10	Akram Point, Sundarbans	NM	42.23	NM	42.23	40.34	35.35	NM	37.85
11	Hiron Point, Sundarbans	52.40	49.01	NM	50.70	42.50	35.23	NM	38.85

(D) Fisheries resources monitoring data

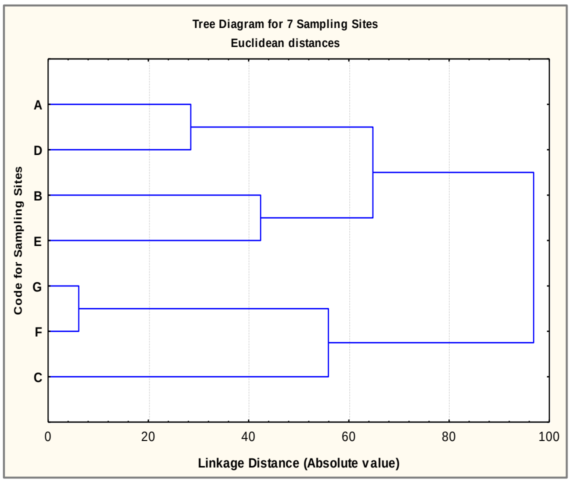
D1: Classification of functional habitat



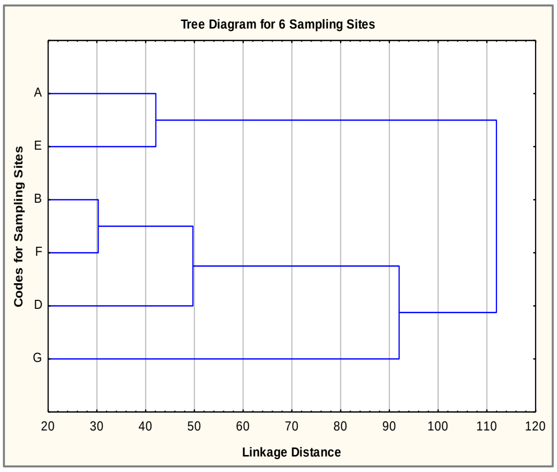
1st Monitoring, April, 2014



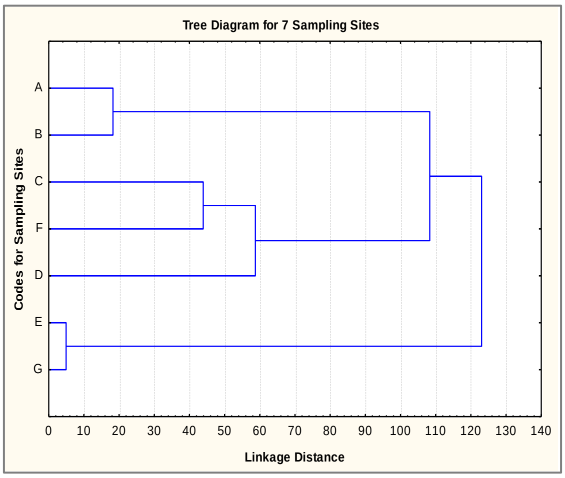
2nd Monitoring, July 2014



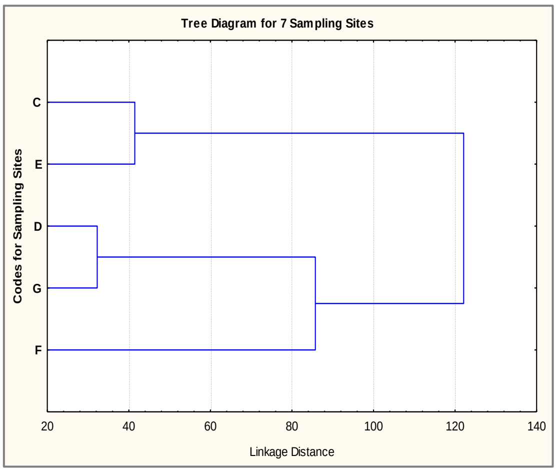
3rd Monitoring, October, 2014



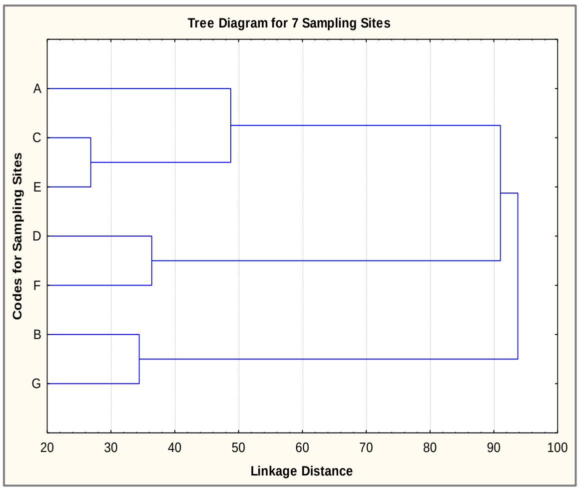
4th Monitoring, January 2015

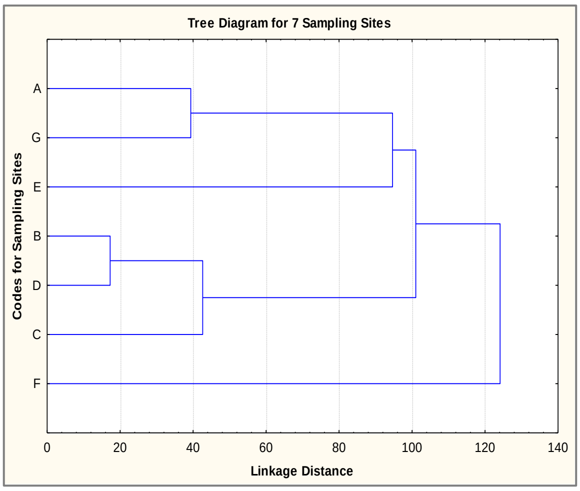


5th Monitoring, April, 2015



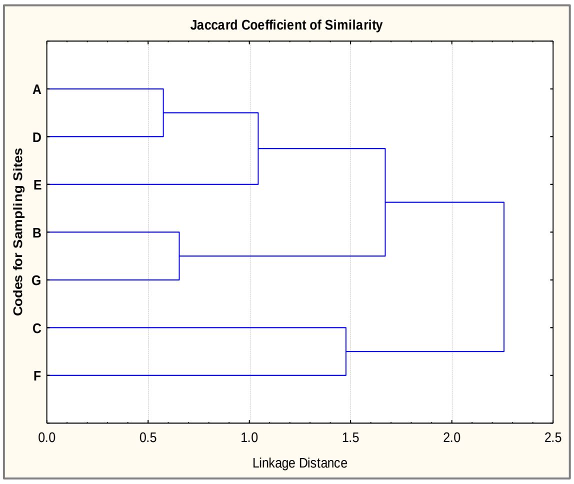
6th Monitoring, August, 2015

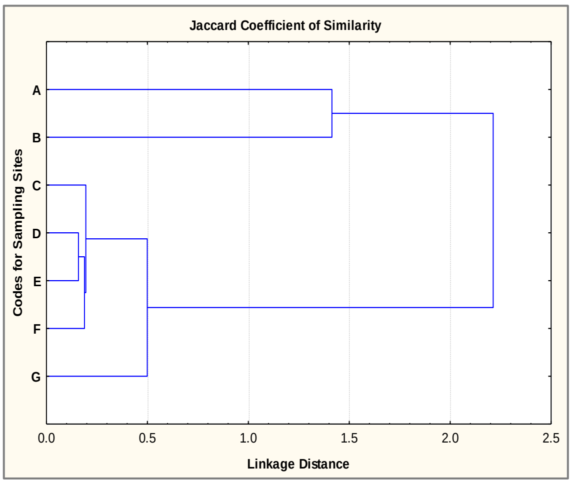


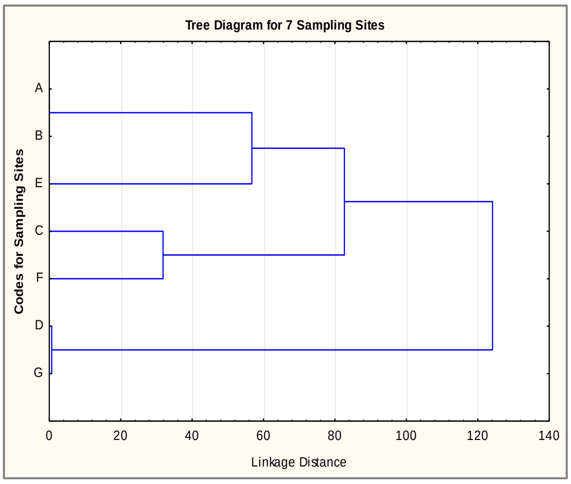


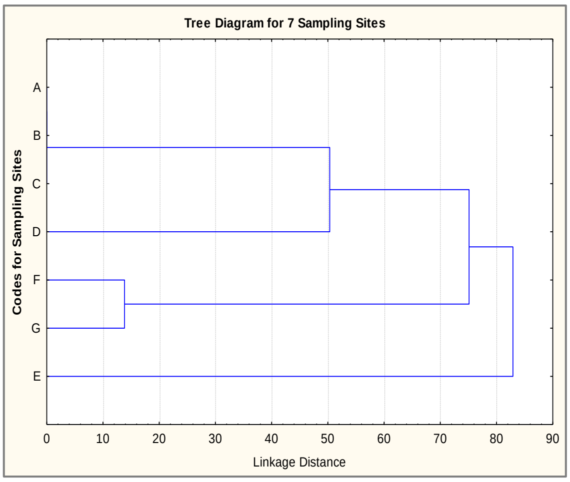
7th Monitoring, October, 2015

8th Monitoring, January, 2016



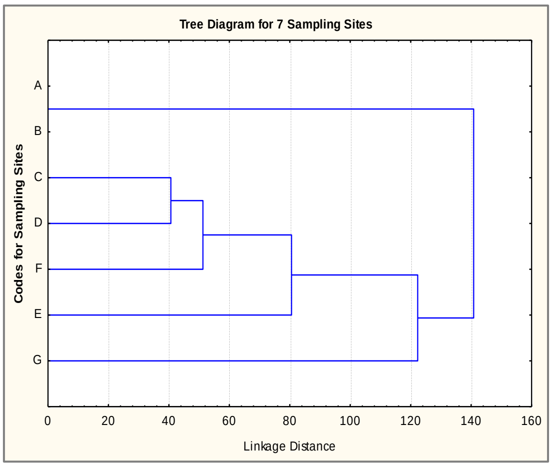




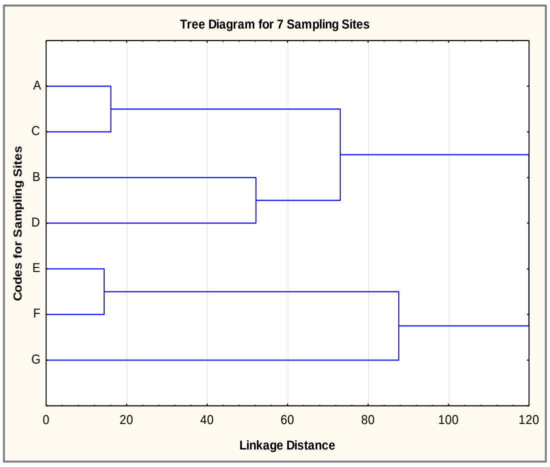


9th Monitoring, April, 2016

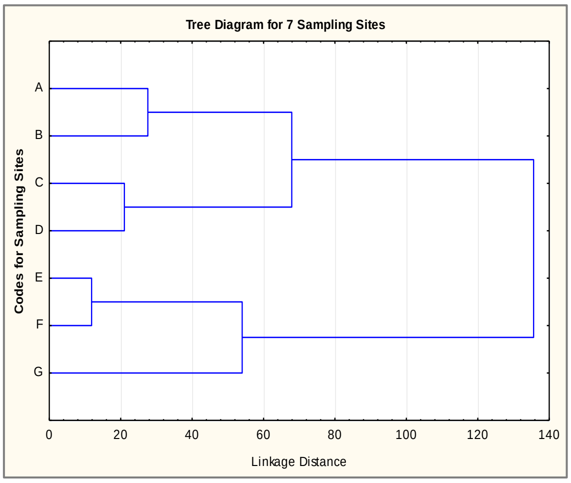
10th Monitoring, July, 2016



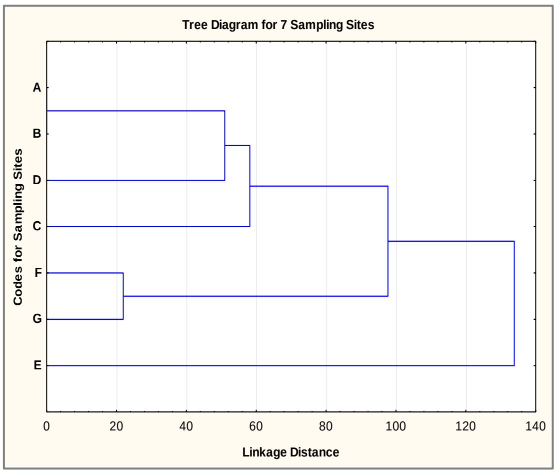
11th Monitoring, October, 2016



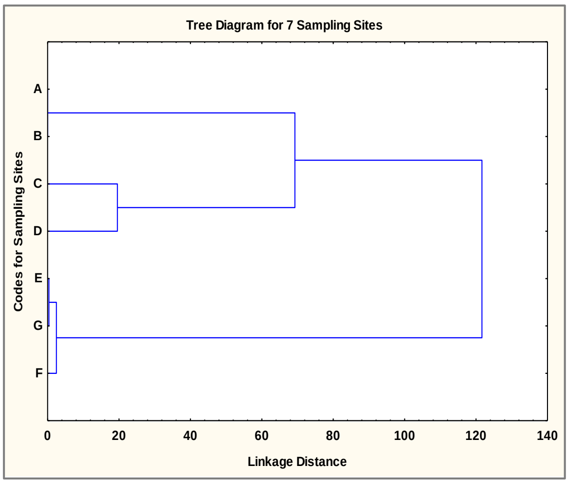
12th Monitoring, January, 2017



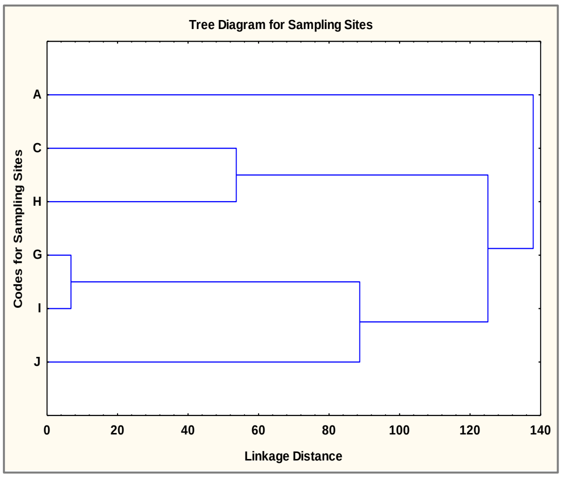
13th Monitoring, April, 2017



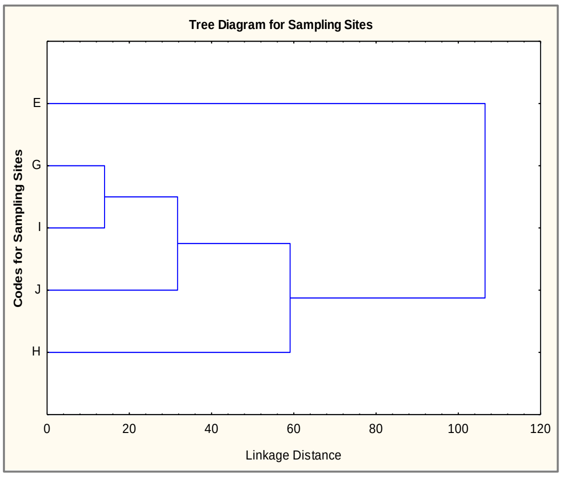
14th Monitoring, October, 2017



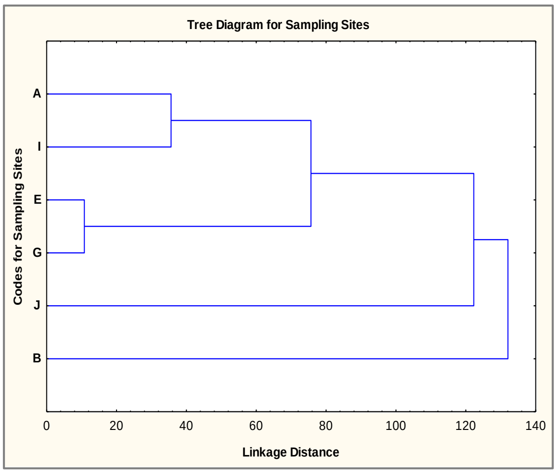
15th Monitoring, January, 2018



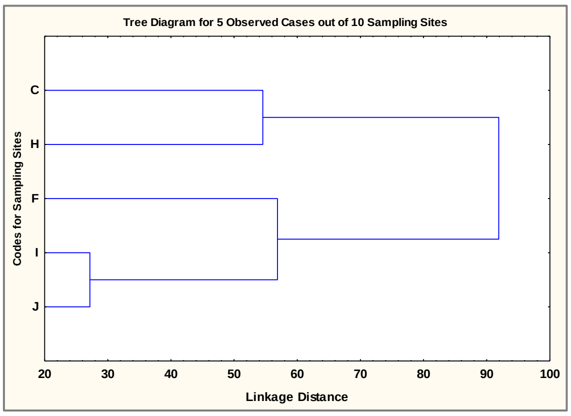
16th Monitoring, April, 2018



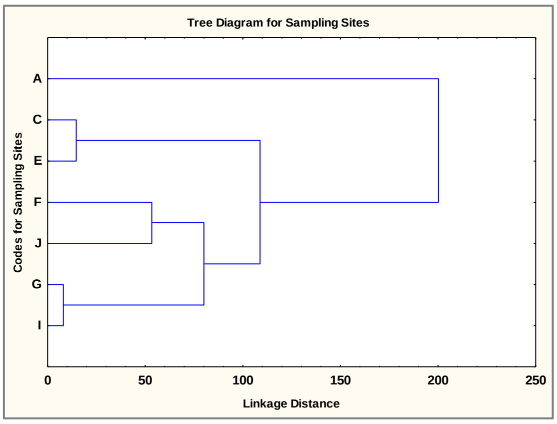
17th Monitoring, July, 2018



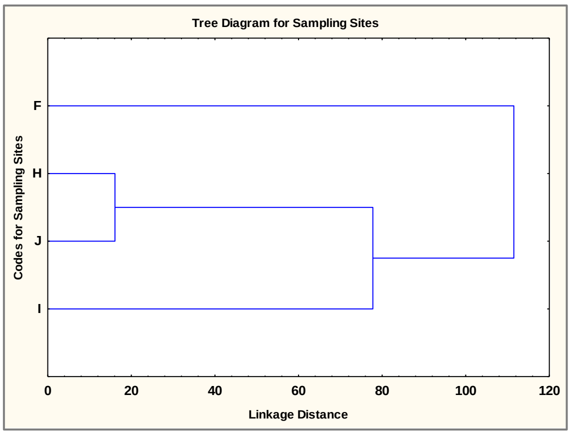
18th Monitoring, November, 2018



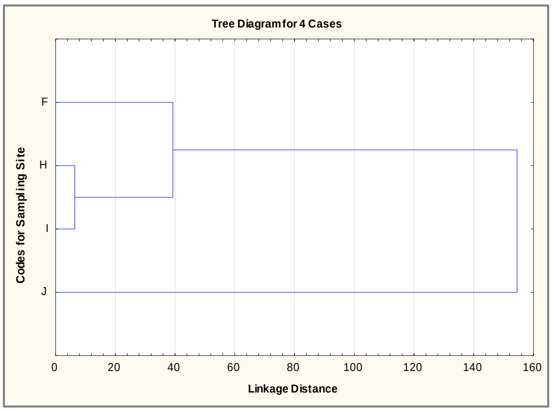
19th Monitoring, February, 2019



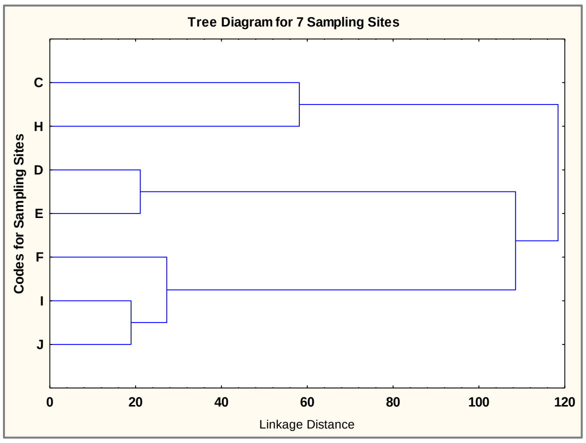
20th Monitoring, April, 2019



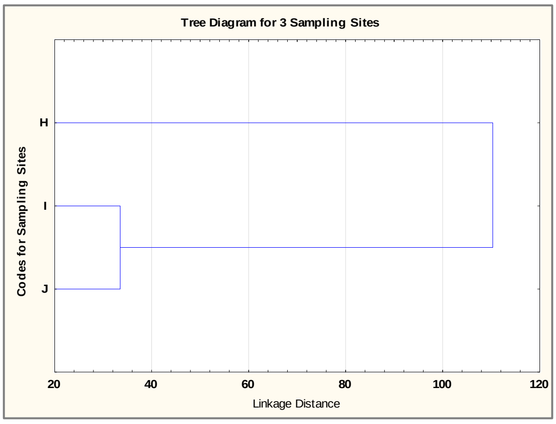
21st Monitoring, July 2019



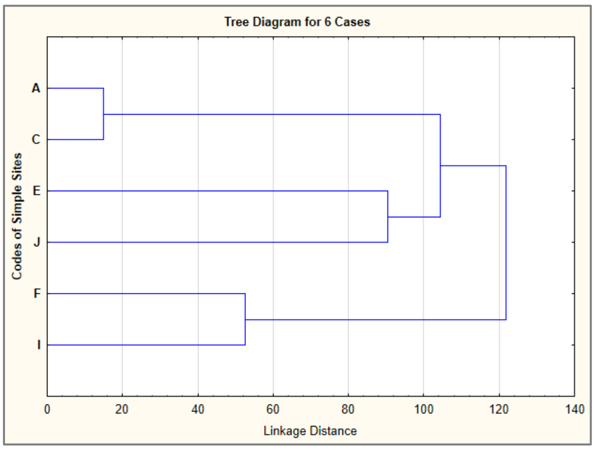
22nd Monitoring, November, 2019



23rd Monitoring, February 2020

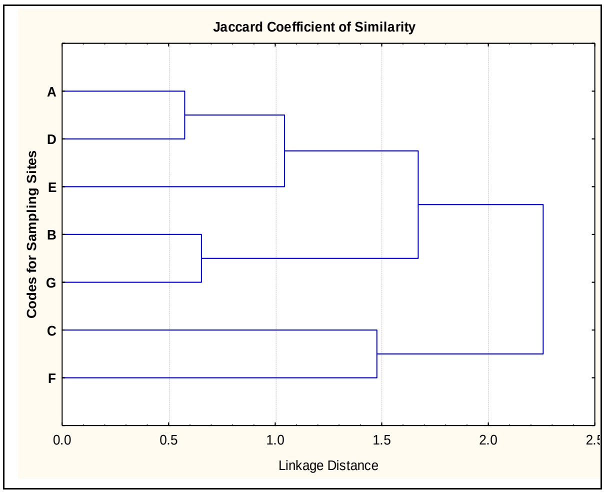


25th Monitoring, July 2020

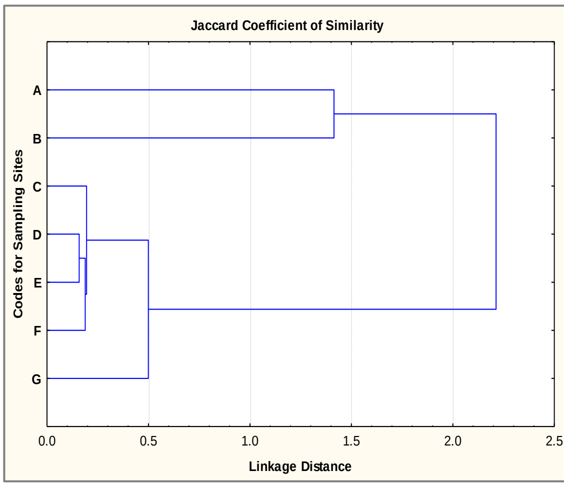


26th Monitoring, November 2020

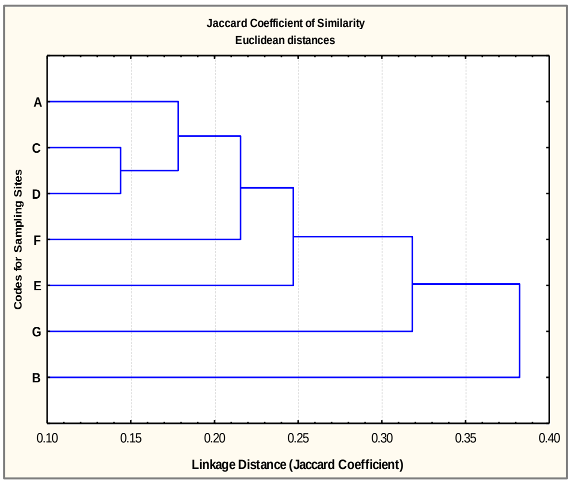
D2: Jaccard Co-efficient of Similarity of Habitats respecting fish species occurrence



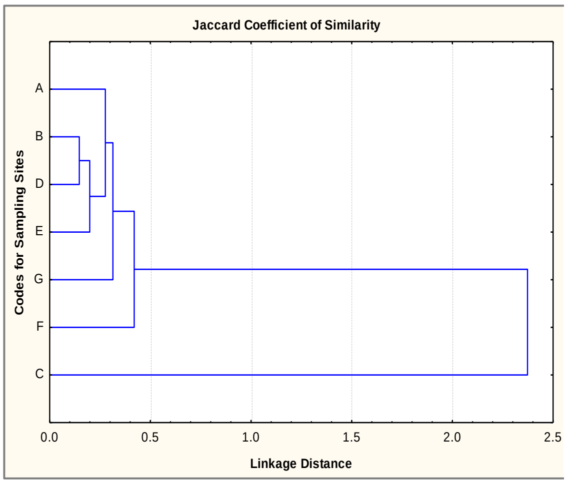
1st Monitoring, April, 2014



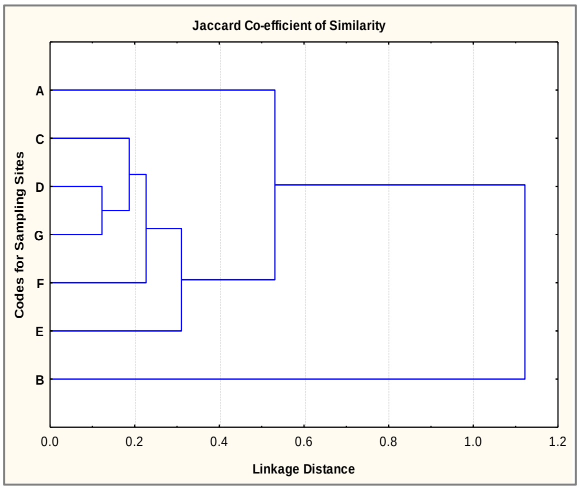
2nd Monitoring, July 2014



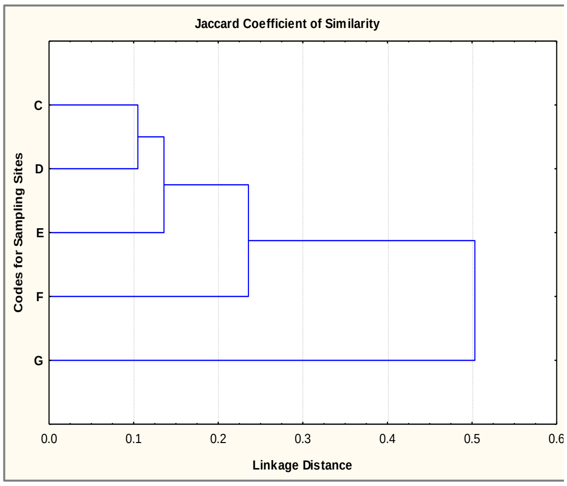
3rd Monitoring, October, 2014



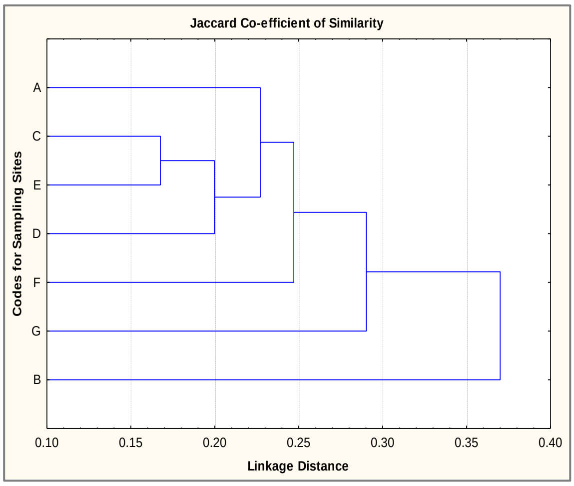
4th Monitoring, January 2015



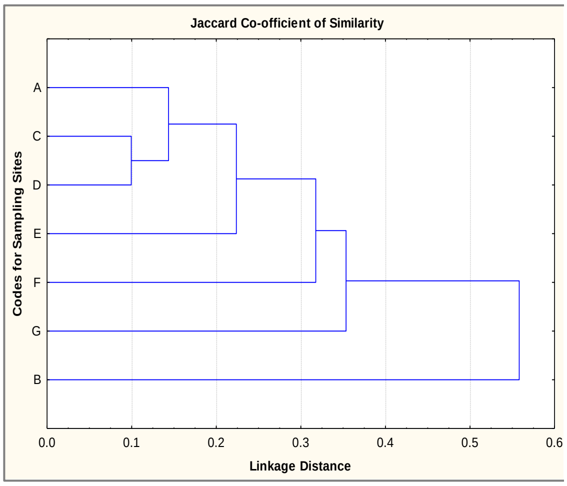
5th Monitoring, April, 2015



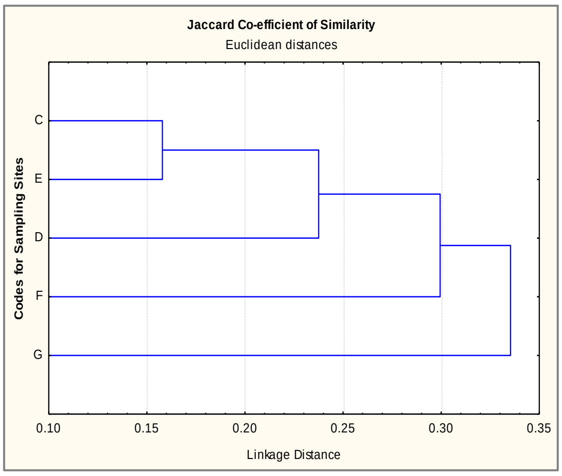
6th Monitoring, August, 2015



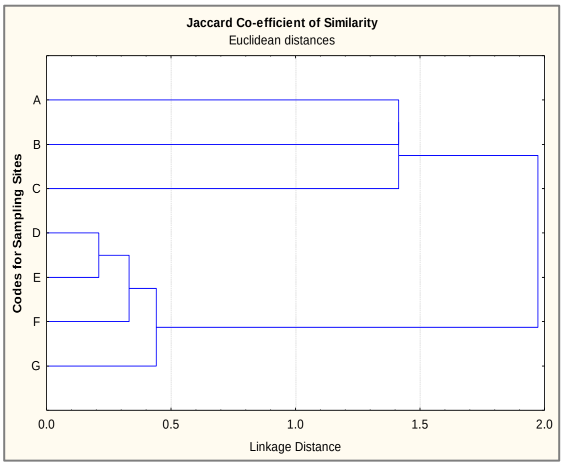
7th Monitoring, October, 2015



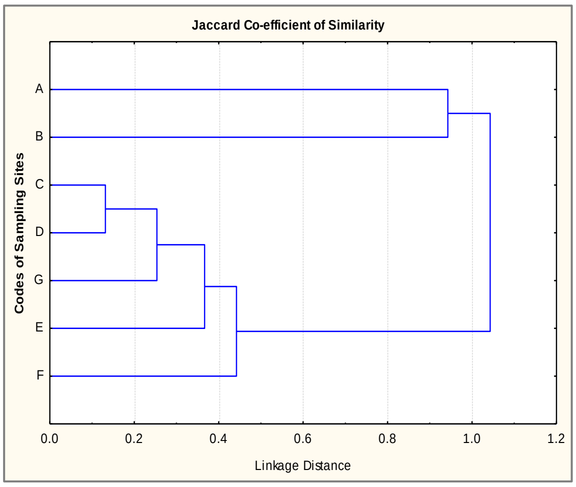
8th Monitoring, January, 2016



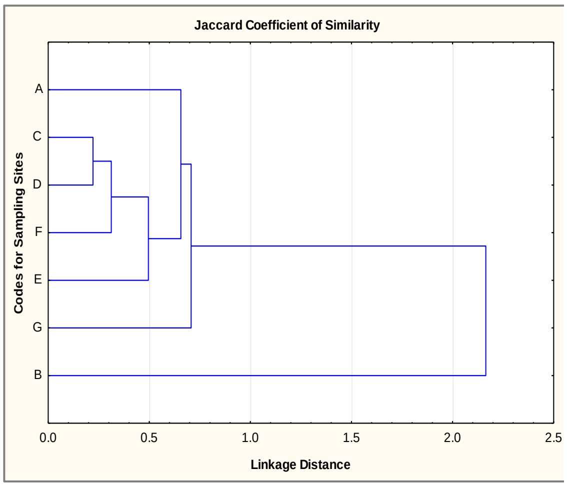
9th Monitoring, April, 2016



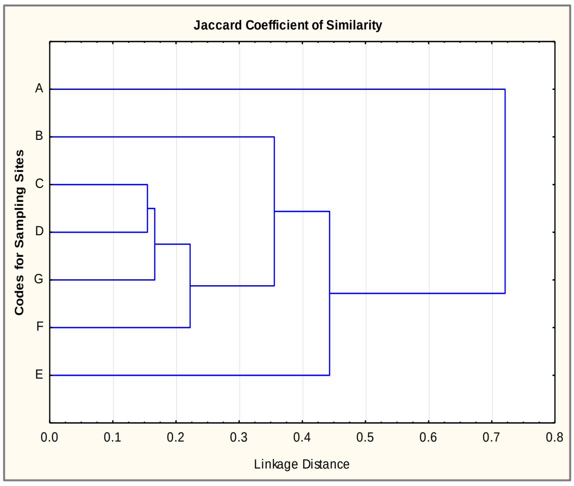
10th Monitoring, July, 2016



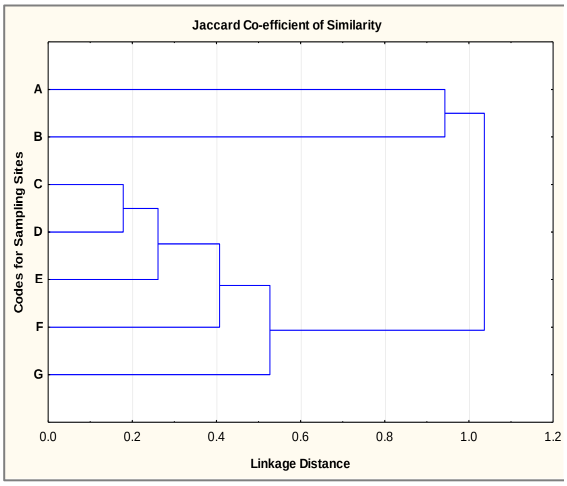
11th Monitoring, October, 2016



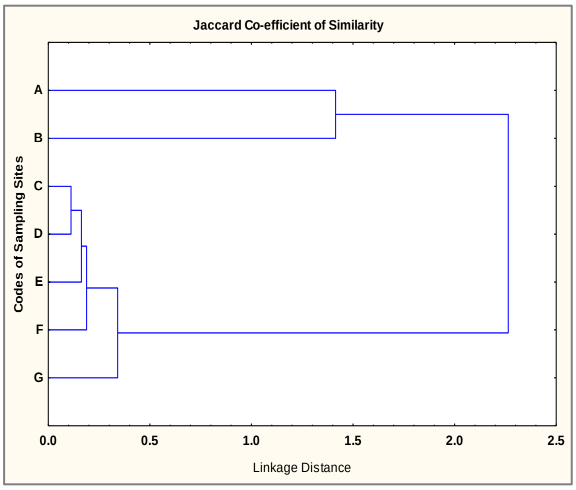
12th Monitoring, January, 2017



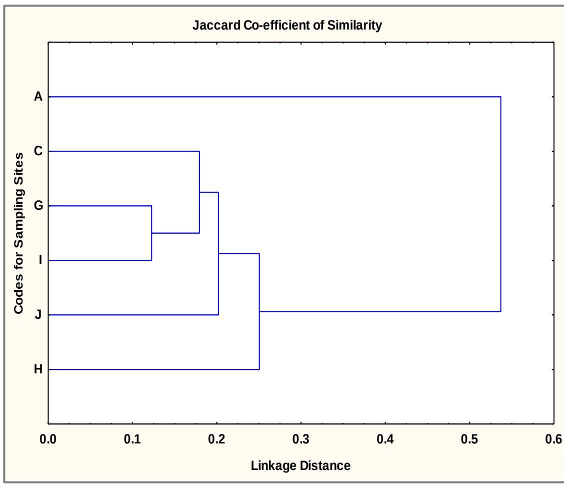
13th Monitoring, April, 2017



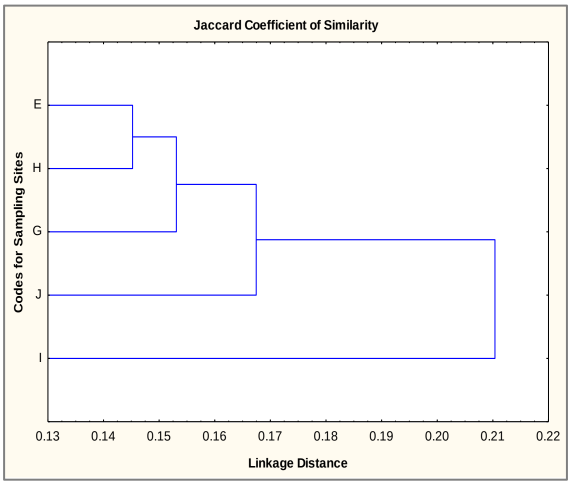
14th Monitoring, October, 2017



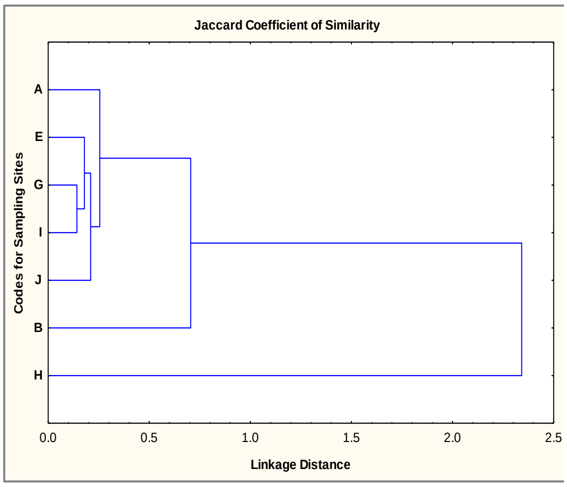
15th Monitoring, January, 2018



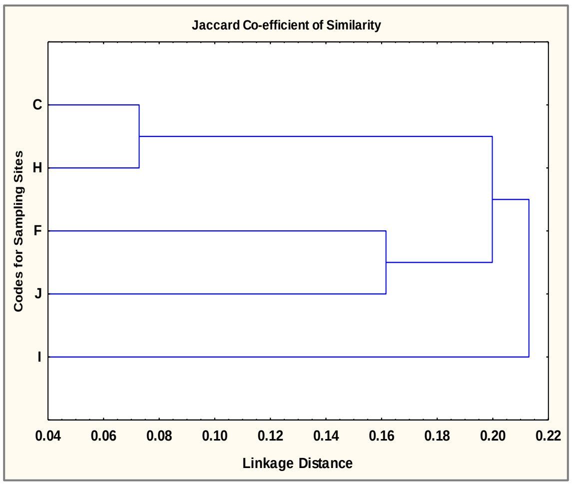
16th Monitoring, April, 2018



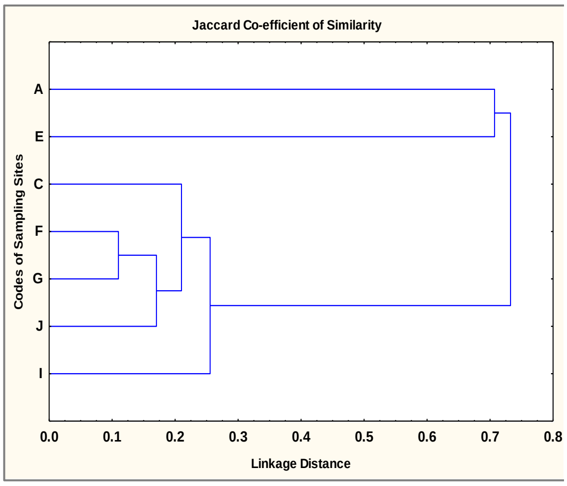
17th Monitoring, July, 2018



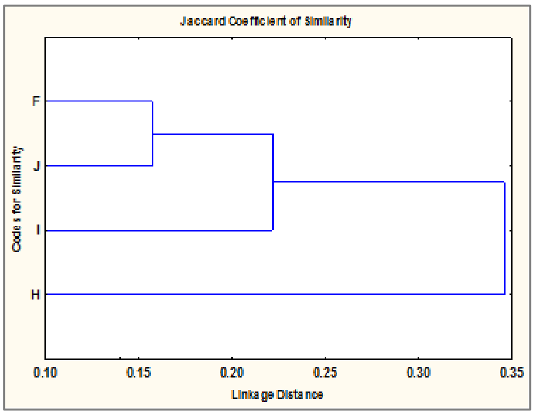
18th Monitoring, November, 2018



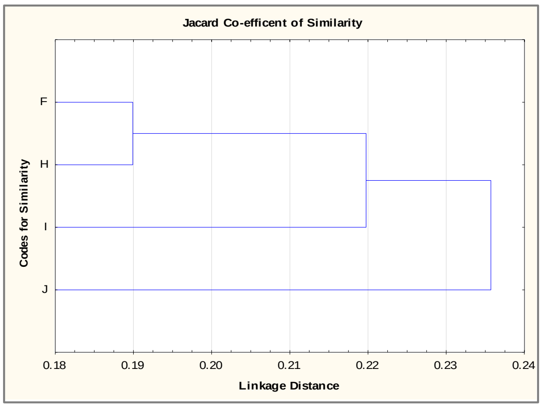
19th Monitoring, February, 2019



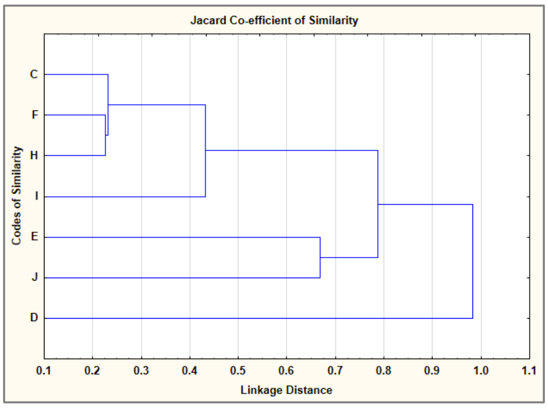
20th Monitoring, April, 2019



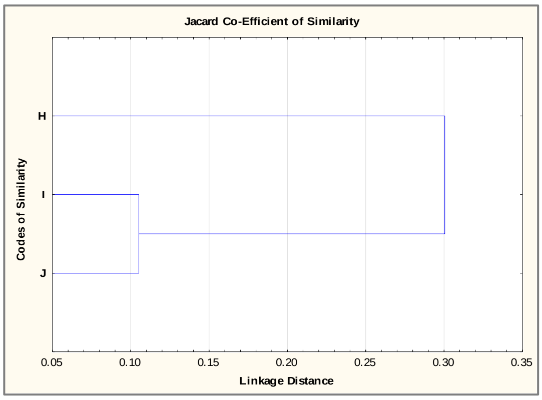
21st Monitoring, July 2019



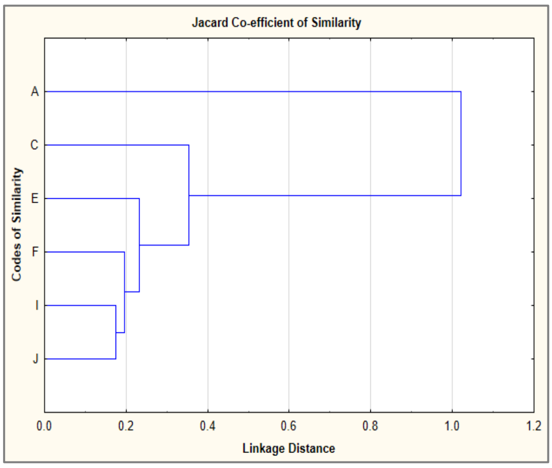
22nd Monitoring, November 2019



23rd Monitoring, February 2020

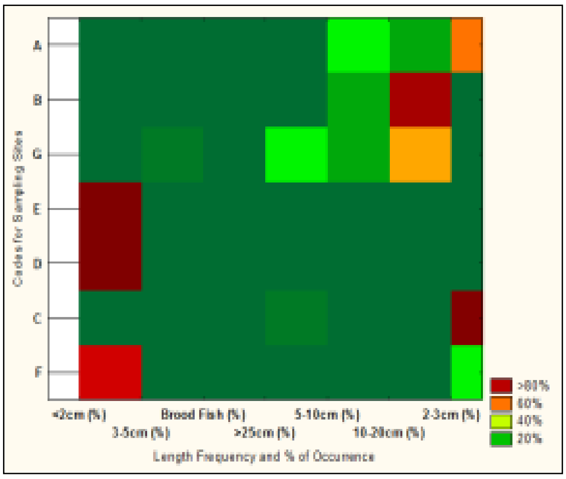


25th Monitoring, July 2020

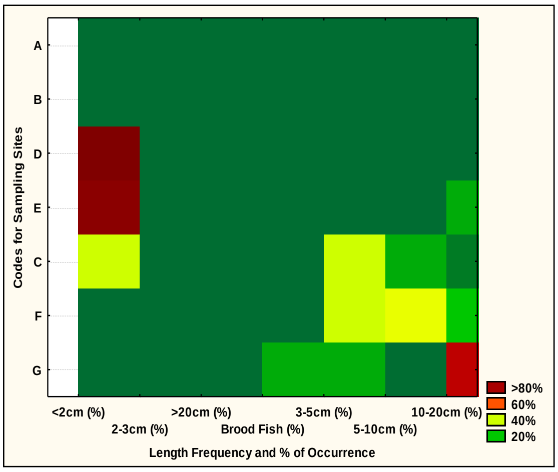


26th Monitoring, November, 2020

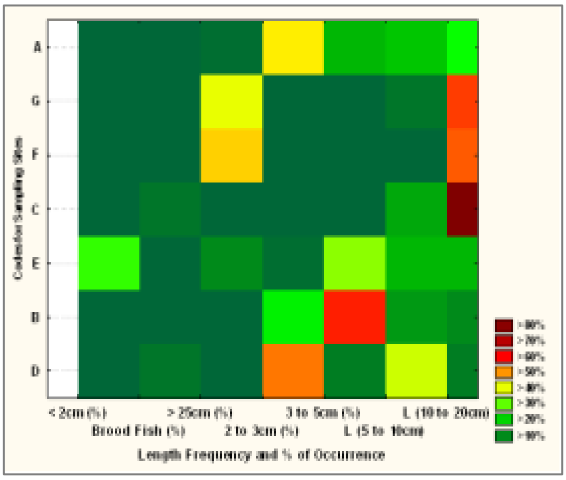
D3: Fish Community Structure



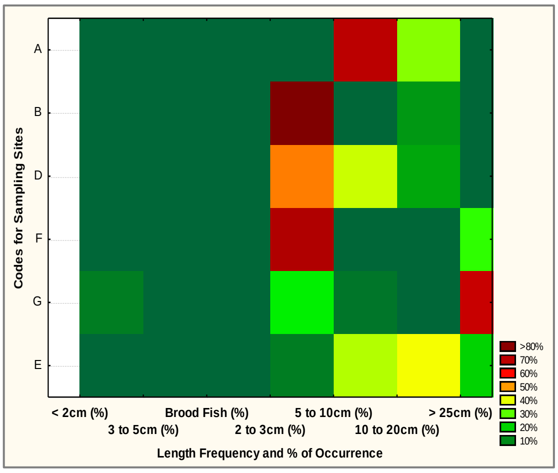
1st Monitoring, April, 2014



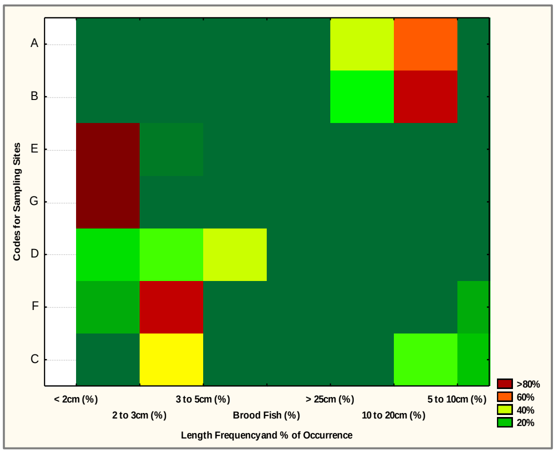
2nd Monitoring, July 2014



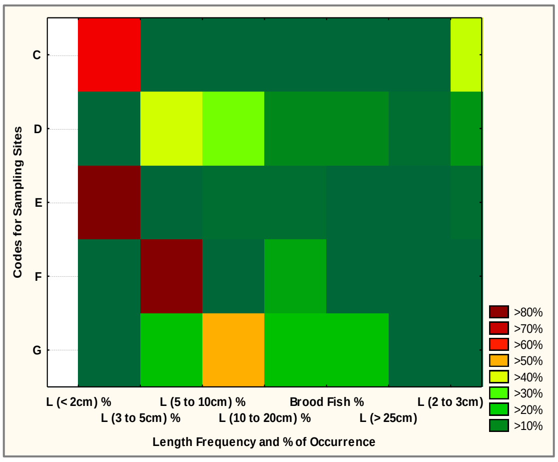
3rd Monitoring, October, 2014



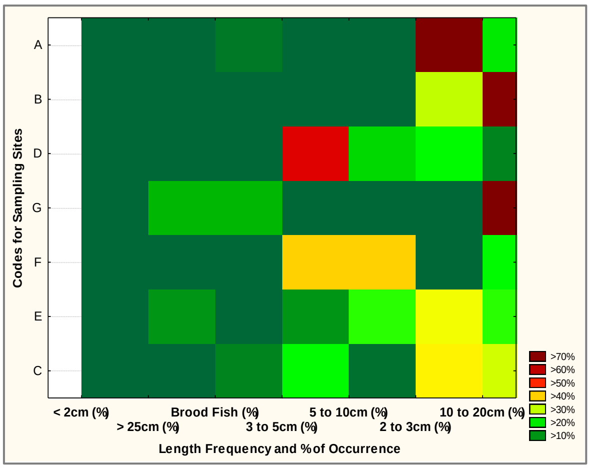
4th Monitoring, January 2015



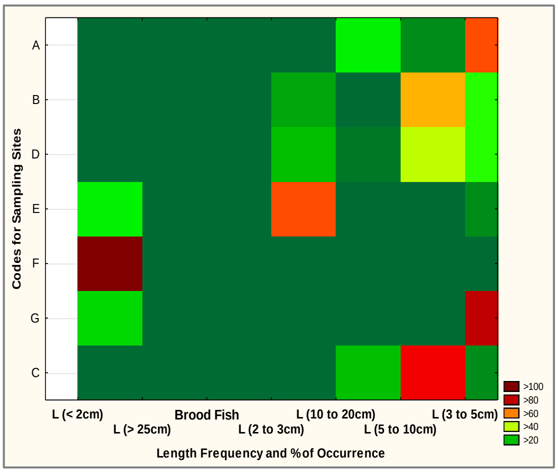
5th Monitoring, April, 2015



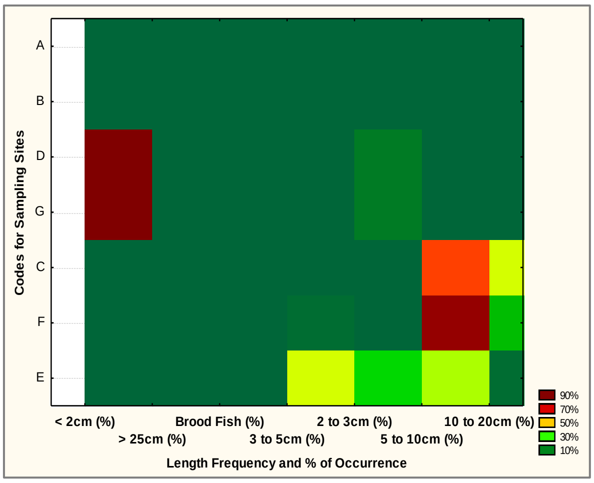
6th Monitoring, August, 2015



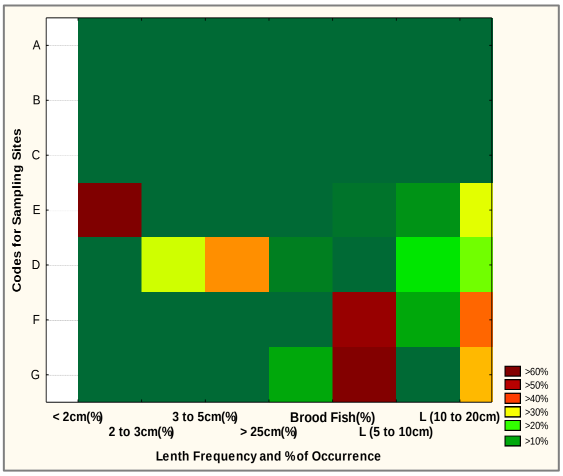
7th Monitoring, October, 2015



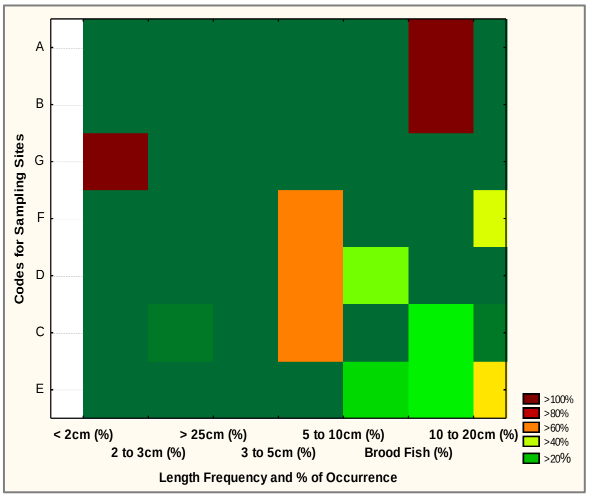
8th Monitoring, January, 2016



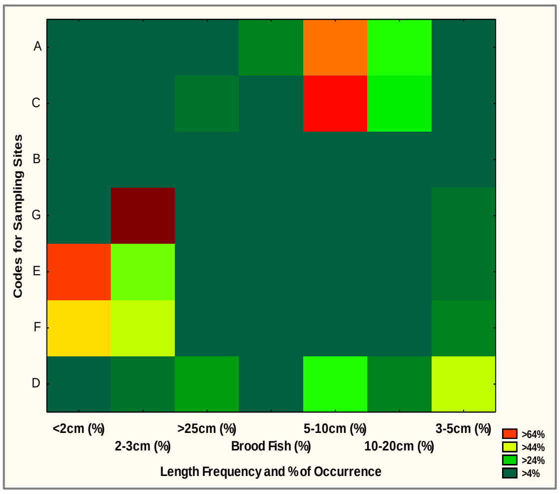
9th Monitoring, April, 2016



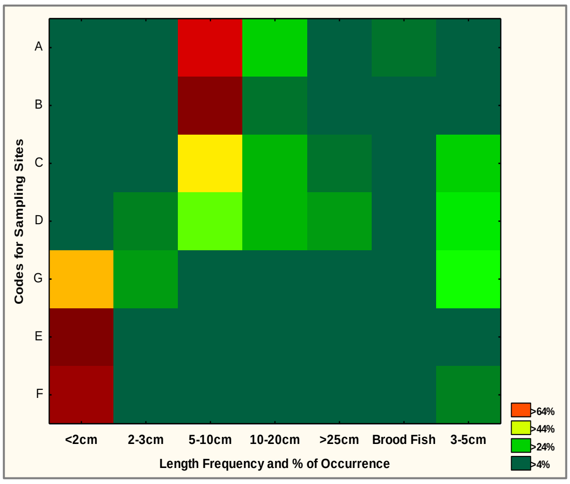
10th Monitoring, July, 2016



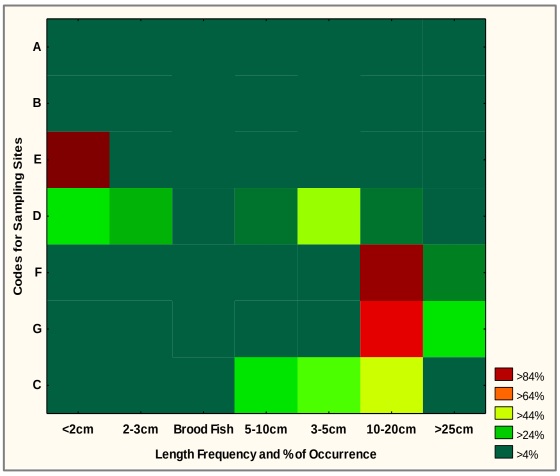
11th Monitoring, October, 2016



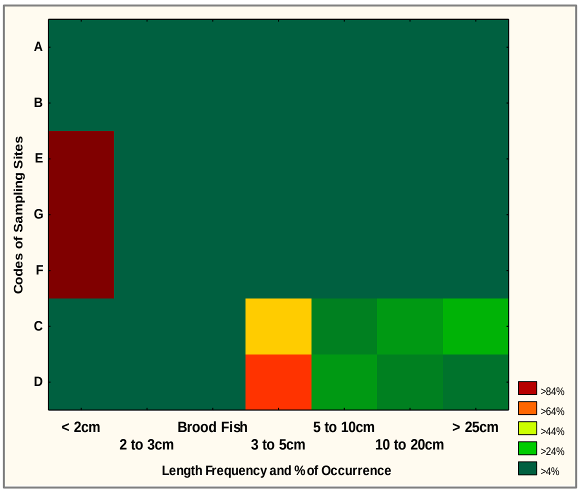
12th Monitoring, January, 2017



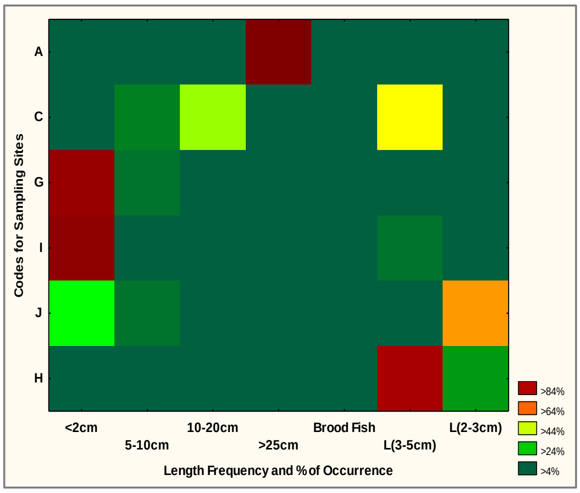
13th Monitoring, April, 2017



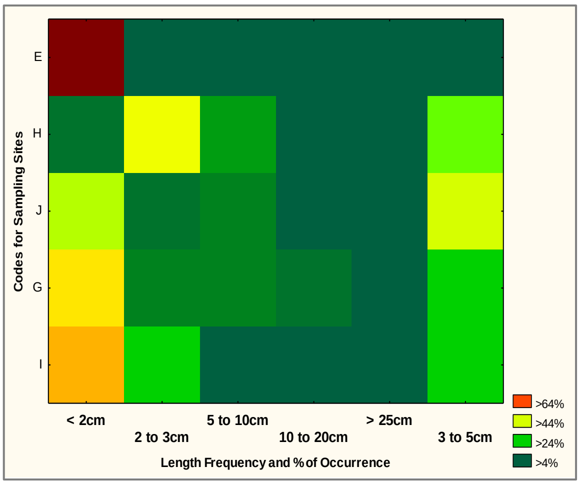
14th Monitoring, October, 2017



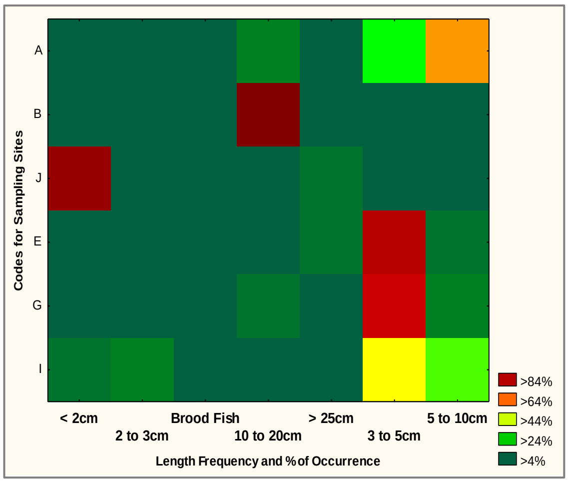
15th Monitoring, January, 2018



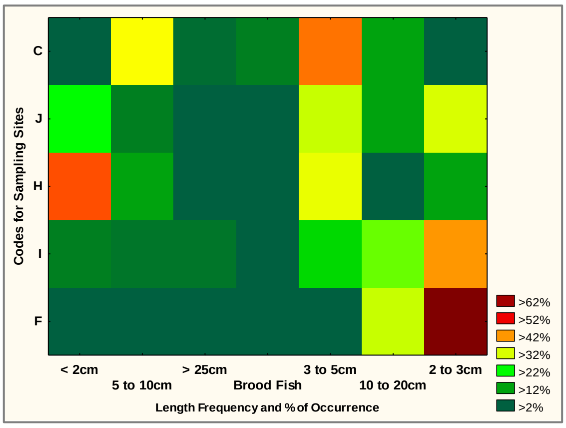
16th Monitoring, April, 2018



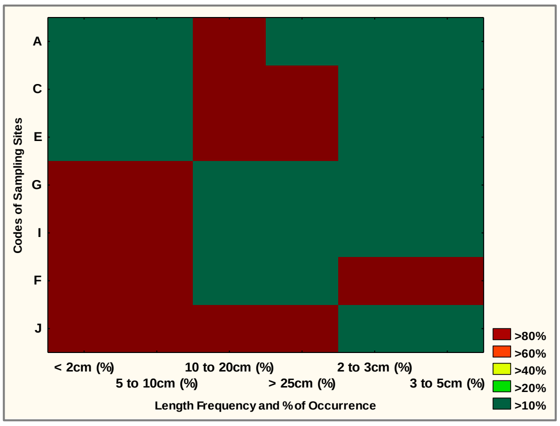
17th Monitoring, July, 2018



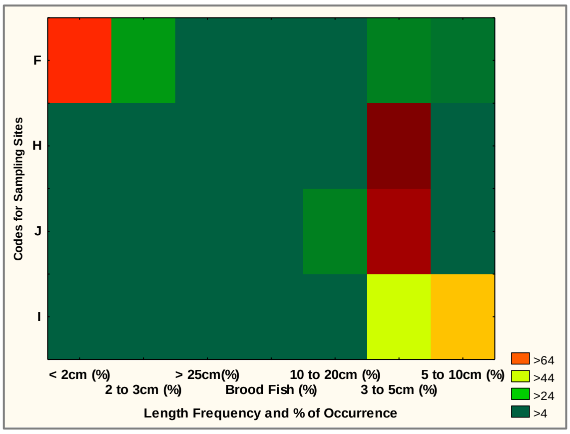
18th Monitoring, November, 2018



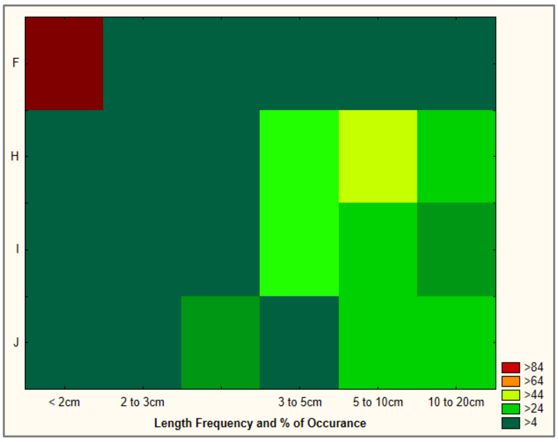
19th Monitoring, February, 2019



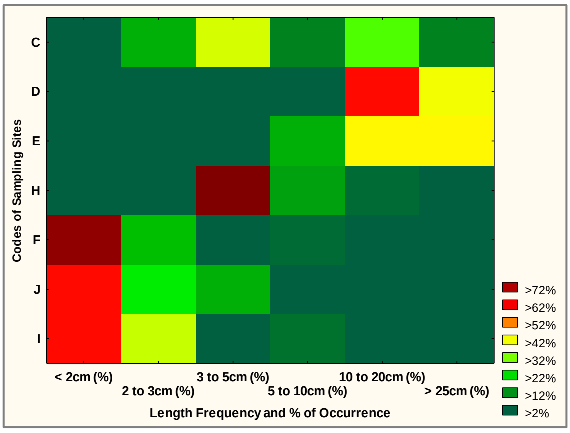
20th Monitoring, April, 2019



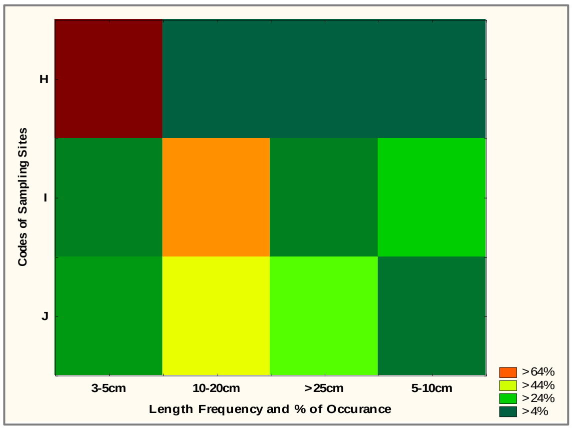
21st Monitoring, July 2019



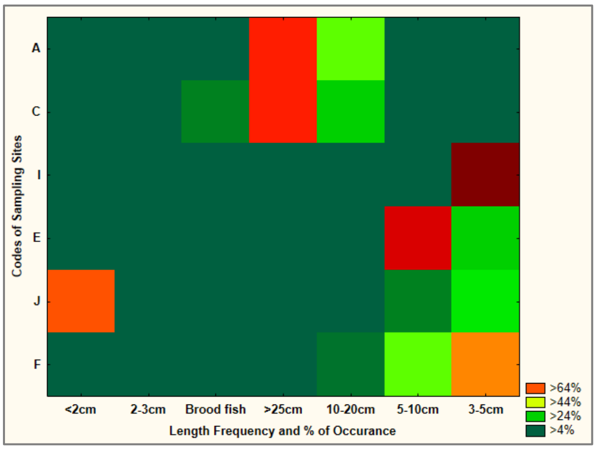
22nd Monitoring, November 2019



23rd Monitoring, February 2020



25th Monitoring, July 2020



26th Monitoring, November 2021

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	*Tenualosa ilisha*	NO	-	-	+	-	-	+	+	-	-	-	+	-
Sagor Baim	*Anguilla bengalensis*	NT	+	-	-	-	-	+	-	-	-	-	-	-
Bacha	*Eutropiichthys vacha*	CR	+	-	-	-	-	-	-	-	-	+	-	-
Bagda Chingri	*Penaeus monodon*	DD	+	+	+	+	+	+	+	+	+	+	-	+
Banspata	*Brachypleura novae-zeelandiae*	NO	+	+	+	+	-	+	+	+	+	-	+	+
Kukurjib	*Cynoglossus lingua*	NO	+	-	-	-	-	-	-	+	+	+	-	+
Bele	*Glossogobius giuris*	NO	+	+	+	+	+	+	+	+	+	-	+	+
Aswine Bele	*Butis butis*	NO	-	-	-	-	-	-	+	+	+	+	+	+
Bairagi	*Coilia dussumieri*	NO	+	+	+	+	+	+	-	+	-	-	-	+
Boishakhi Chingri	*Macrobrachium* sp.	NO	-	+	-	-	+	+	+	+	+	-	-	-
Chammu Chingri	*Metapenaeus brevicornis*	DD	+	+	+	-	+	+	+	+	+	+	+	-
Chaka Chingri	*Penaeus indicus*	DD	+	+	-	+	+	+	+	+	+	-	+	-
Ghora Chela	*Securicula gora*	-	+	-	-	-	-	-	-	-	-	-	-	-
Chanda Chela	*Securicula* sp.		-	+	+	-	-	-	-	-	+	+	-	-
Sada Chewa	*Trepauchen vagina*	NO	+	-	+	-	-	+	-	-	-	+	-	-
Lal Chewa	*Taenioides cirratus*	NO	+	+	+	+	+	+	+	+	+	-	-	-
Chhuri	*Trichiurus muticus*	NO	+	-	+	-	-	-	-	-	-	-	-	-
Sagor Chela	*Megalops cyprinoids*	NO	+	-	-	-	-	-	-	-	-	-	-	-
Purabi Chela	*Thryssa purava*	NO	+	-	-	-	-	-	-	-	-	-	-	-
Kabashi Tengra	*Mystus cavasius*	DD	+	-	-	-	-	-	-	-	-	-	-	-
Gagra Tengra	*Nemapteryx nenga*	DD	-	+	+	-	+	-	+	-	+	+	+	+
Gulsha Tengra	*Mystus bleekery*	DD	+	+	-	+	-	+	+	+	+	+	+	+
Harina Chingri	*Metapenaeus ensis*	DD	+	+	+	+	+	+	+	+	+	-	+	-
Ekthuto	*Hyporhampus limbatus*	NO	+	-	+	+	-	-	-	+	+	-	+	-
Kakila	*Xenentodon cancila*	NO	+	-	-	-	-	-	-	-	-	-	+	-
Chapila	*Gudusia chapra*	NO	+	+	-	-	-	-	-	-	-	+	-	-
Kuchia	*Monopterus cuchia*	DD	+	+	-	+	+	+	+	+	+	+	+	+

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											
Loitta	*Harpodon nehereus*	NO	+	+	+	-	+	-	-	-	+	+	-	-
Motka Chingri	*Macrobrachium villosimanusless*	DD	+	+	+	+	+	+	+	+	+	+	+	-
Mud Crab	*Scylla serrata*	NO	+	-	+	+	+	+	+	+	+	-	+	+
Tular Dandi	*Sillaginopsis panijus*	NO	+	-	+	-	+	-	+	-	-	-	+	-
Paira Chanda	*Scatophagus argus*	DD	+	-	-	-	-	-	-	-	-	+	-	-
Paissa	*Liza parsia*	NO	+	+	+	+	+	+	+	+	+	+	+	+
Pangas	*Pangasius pangasius*	CR	+	-	+	-	-	-	-	+	-	-	-	+
Tak Chanda	*Leiognathus equulus*	NO	+	-	-	-	-	-	+	-	-	+	-	-
Phessa	*Setipinna phasa*	NO	+	+	+	+	+	+	+	+	+	-	+	-
Teli Phessa	*Setipinna phasa*	DD	-	-	+	-	-	-	-	-	-	+	-	-
Poma	*Poma poma*	NO	+	+	+	+	+	+	+	+	+	+	+	+
Potka	*Chelonodon patoca*	NO	+	+	-	+	+	+	-	+	+	-	+	+
Shilong	*Silonia silondia*	EN	+	-	+	-	-	-	-	-	-	-	+	-
Tailla	*Eleutheronema tetradactylum*	DD	+	-	-	-	-	-	-	-	-	+	-	-
Tapse	*Polynemus paradiseus*	DD	+	+	+	-	-	+	+	+	-	-	+	+
Daitna	*Acanthopagrus latus*	DD	-	-	-	+	-	-	-	+	+	-	+	+
Shole	*Channa striatus*	DD	-	-	-	+	-	-	-	+	-	-	-	-
Magur	*Clarias batrachus*	DD	-	-	-	+	-	-	-	+	-	-	-	+
Koi	*Anabas testudineus*	DD	-	-	-	+	-	-	-	+	-	+	-	-
Vetki	*Lates calcarifer*	DD	-	-	-	+	+	+	+	+	+	-	+	+

Local Name	Scientific Name	Local Status*	13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM
		‘-‘ = No; ‘+’ = Occurrence														
Hilsa	*Tenualosa ilisha*	NO	-	-	-	-	-	+	-	-	-	+	-	-	-	-
Sagor Baim	*Anguilla bengalensis*	NT	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bacha	*Eutropiichthys vacha*	CR	+	-	-	-	-	-	-	-	-	+	-	-	-	-
Bagda Chingri	*Penaeus monodon*	DD	+	-	+	+	+	+	+	+	+	+	+	-	-	+
Banspata	*Brachypleura novae-zeelandiae*	NO	+	+	+	+	+	+	+	+	+	-	-	+	+	+
Kukurjib	*Cynoglossus lingua*	NO	-	-	+	-	-	-	+	-	+	+	-	+	-	+
Bele	*Glossogobius giuris*	NO	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Aswine Bele	*Butis butis*	NO	+	+	+	+	+	-	+	+	-	-	-	-	-	-
Bairagi	*Coilia dussumieri*	NO	+	+	+	+	+	+	+	+	+	-	+	+	-	+
Boishakhi Chingri	*Macrobrachium* sp.	NO	-	-	-	-	+	-	-	-	-	-	+	-	-	-
Chammu Chingri	*Metapenaeus brevicornis*	DD	-	+	+	+	+	+	+	+	+	+	+	-	+	+
Chaka Chingri	*Penaeus indicus*	DD	+	-	+	+	+	+	+	+	+	+	+	-	+	+
Ghora Chela	*Securicula gora*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chanda Chela	*Securicula* sp.		-	-	+	+	+	+	-	-	-	+	+	-	-	-
Sada Chewa	*Trepauchen vagina*	NO	-	-	-	+	-	-	-	+	-	+	-	-	-	-
Lal Chewa	*Taenioides cirratus*	NO	+	+	-	+	+	-	+	+	-	-	+	-	-	-
Chhuri	*Trichiurus muticus*	NO	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Sagor Chela	*Megalops cyprinoids*	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Purabi Chela	*Thryssa purava*	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kabashi Tengra	*Mystus cavasius*	DD	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Gagra Tengra	*Nemapteryx nenga*	DD	+	+	+	+	+	+	+	+	+	-	+	+	+	+
Gulsha Tengra	*Mystus bleekery*	DD	+	+	+	+	+	-	+	+	+	-	+	-	-	+
Harina Chingri	*Metapenaeus ensis*	DD	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ekthuto	*Hyporhampus limbatus*	NO	+	+	-	-	+	+	+	+	+	+	-	-	-	+
Kakila	*Xenentodon cancila*	NO	-	+	-	-	+	-	-	-	-	+	-	-	+	-
Chapila	*Gudusia chapra*	NO	-	-	-	-	+	+	+	-	+	+	-	+	+	+
Kuchia	*Monopterus cuchia*	DD	+	+	+	+	+	+	-	+	+	-	+	+	-	+
Loitta	*Harpodon nehereus*	NO	+	-	+	-	-	-	-	+	-	-	-	-	-	-
Motka Chingri	*Macrobrachium villosimanusless*	DD	+	+	+	+	+	+	+	+	+	+	+	-	-	+

Local Name	Scientific Name	Local Status*	13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM
		'-' = No; '+' = Occurrence														
Mud Crab	*Scylla serrata*	NO	+	+	+	+	-	+	+	+	-	+	+	-	-	-
Tular Dandi	*Sillaginopsis panijus*	NO	-	+	-	-	-	+	+	+	+	-	-	-	+	-
Paira Chanda	*Scatophagus argus*	DD	-	-	-	-	-	-	+	-	-	-	-	-	-	+
Paissa	*Liza parsia*	NO	+	+	+	+	-	+	+	+	+	+	+	+	+	+
Pangas	*Pangasius pangasius*	CR	-	-	-	-	-	+	+	+	+	+	-	-	-	-
Tak Chanda	*Leiognathus equulus*	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pheksa	*Setipinna phasa*	NO	+	+	-	+	-	-	+	+	+	+	+	-	+	-
Teli Pheksa	*Setipinna phasa*	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Poma	*Poma poma*	NO	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Potka	*Chelonodon patoca*	NO	+	+	+	+	+	+	+	+	-	-	-	-	-	+
Shilong	*Silonia silondia*	EN	+	+	-	-	-	-	-	-	-	+	-	+	-	-
Tailla	*Eleutheronema tetradactylum*	DD	-	-	-	-	-	+	-	+	+	-	-	-	+	+
Tapse	*Polynemus paradiseus*	DD	-	+	+	+	+	+	+	+	+	-	+	+	+	-
Daitna	*Acanthopagrus latus*	DD	-	+	+	+	-	+	+	+	-	-	+	-	+	+
Shole	*Channa striatus*	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	+
Magur	*Clarias batrachus*	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	-
Koi	*Anabas testudineus*	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vetki	*Lates calcarifer*	DD	+	+	+	+	-	+	+	-	+	-	-	-	+	-

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

Fish Species	Site	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Bagda Icha	F	100.00	0.00	0.00	0.00	0.00	0.00	0.00
	J	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Baila	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	45.45	54.55	0.00	0.00
	F	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	J	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Banshpata	C	0.00	0.00	0.00	0.00	60.00	40.00	0.00
Bhola	A	0.00	0.00	0.00	66.67	33.33	0.00	0.00
	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Boiragi	H	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Chaka Chingri	A	0.00	0.00	0.00	66.67	33.33	0.00	0.00
	C	0.00	0.00	0.00	11.11	88.89	0.00	0.00
Chali Chingri	A	0.00	0.00	80.00	20.00	0.00	0.00	0.00
Chamua Chingri	A	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	C	0.00	18.18	81.82	0.00	0.00	0.00	0.00
	F	0.00	76.30	23.70	0.00	0.00	0.00	0.00
Chela	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	38.46	61.54	0.00	0.00	0.00
	F	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Chitra	C	0.00	0.00	66.67	33.33	0.00	0.00	0.00
Chota Baila	C	0.00	0.00	0.00	0.00	76.47	23.53	0.00
Datina	C	0.00	0.00	0.00	50.00	50.00	0.00	0.00
	J	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Dogra	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Gagra	A	0.00	0.00	0.00	40.00	60.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Goda Icha	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	F	0.00	0.00	100.00	0.00	0.00	0.00	0.00

Fish Species	Site	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
	J	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Golda Icha	A	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	82.61	17.39	0.00
Gulsha Tengra	C	0.00	0.00	0.00	7.14	92.86	0.00	0.00
Harina Chingri	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	8.52	90.91	0.00	0.00	0.57
Kain Magur	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Kalo Baila	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Kata Chingri	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Kathali Chingri	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Khoira	C	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Kuchia	J	0.00	0.00	0.00	66.67	33.33	0.00	0.00
Motka Icha	A	0.00	0.00	100.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	72.73	27.27	0.00	0.00	0.00
	J	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Mutkura Baila	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	4.17	95.83	0.00	0.00	0.00
	F	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Nandi Baila	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
Paira	C	0.00	0.00	60.00	40.00	0.00	0.00	0.00
Paissa	A	0.00	0.00	13.33	63.33	23.33	0.00	0.00
	C	0.00	0.00	0.00	99.31	0.69	0.00	0.00
	F	0.00	33.33	66.67	0.00	0.00	0.00	0.00
	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Poma	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Potka	C	0.00	0.00	64.52	32.26	3.23	0.00	0.00
Punti	J	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Ramchos	C	0.00	0.00	0.00	0.00	100.00	0.00	0.00
	H	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Shol	C	0.00	0.00	0.00	0.00	0.00	100.00	0.00

Fish Species	Site	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Tairel	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Telkumra	C	0.00	0.00	0.00	0.00	0.00	100.00	0.00
Teo Phailsha	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Thurina	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	40.54	59.46	0.00	0.00
Tiger Chingri	A	0.00	0.00	0.00	100.00	0.00	0.00	0.00
Vadi Chingri	H	0.00	100.00	0.00	0.00	0.00	0.00	0.00
	J	100.00	0.00	0.00	0.00	0.00	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	-	-	-	-	-	-		-	-
	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	-	-	-		-	-

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**
		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 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	-	-	-	-	-	-		-	-

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
	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	-	-	-	-	-	-			-		-	-
	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

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
		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 and Adult	Feeding 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	-	-	-	-	-		-	-

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
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 Growing	-	-		-	Feeding
		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		-			-
		Age-1 adult	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing	-			-	-
	Chalna Point	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
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 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	-	-	-	-	-	-	-		-	-

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
	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		-	-
	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
	Akram Point	Adult	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
Tular Dandi (Nona bele)	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	-	-	-	-	-	-		-	-
	Haldikhali	Adult	-	-	-	Feeding	-	-	-	-	-		-	-
	Harbaria	Juvenile	-	-	-	-	-	-	-	-			-	-
	Chalna Point	Juvenile and Adult	Feeding	Feeding and Growing	-	-	-	-	Feeding and Growing	-	Feeding and Growing		-	-
		Adult	-	-	Feeding	Feeding	Feeding	-	Feeding	-	-		-	-
	Mongla Point	Adult	-	-	Feeding	Feeding	-	-		-	-		Feeding	-
	Chandpai	Juvenile and Adult	Feeding	Feeding and Growing	-	-	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	-		-	Feeding
		Brood	-	-	-	-	-	-	-	-	-		-	Spawning
		Juvenile	-	-	-	-	-	-	Feeding and Growing			-	-	-
	Haldikhali	Juvenile and Adult	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
		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
	Harbaria	Juvenile	-	-	-	-	-	-	Feeding and Growing	-	-			-
	Mongla Point	Fry	Breeding and Spawning	-	-	-	-	Nursery	-	-	Nursery		-	-
		Age-1 Juvenile	-	-	-	-	-	-	-Nursing, Feeding and Growing	-			-	-
		Age-1 Adult	-	-	-	-	Feeding and Growing	Feeding	-	-	Feeding and Growing		-	-
	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	-

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
	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	-	-	-	-	-	-	-	-	-		Breeding and Spawning	-
	Haldikhali	Brood Fish	-	-	-	-	-	-	-	-	-			-
		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													
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th 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	-	-	-	-	-	-	-	-		-	-	-	-
		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	-	-	-	-	-	-	-	-	-		-	-	-	-

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

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

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose													
			13th QM	**14th QM**	**15th QM**	**16th QM**	**17th QM**	**18th QM**	**19th QM**	**20th QM**	**21st QM**	**22nd QM**	**23rd QM**	**25th QM**	**26th QM**	**27th QM**
		Juvenile	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-	-		-	-	-	-
		Adult		Feeding	Feeding	Feeding	-	-	-	-	-		-	-	-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-
	Haldikhali	Fry and Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-
	Harbaria	Adult and Brood Fish	-	-	-	-	-	-	-	-	-			-	-	-
		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		-	-	-	-
		Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-
	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	-	-	-	-	-	-	-	-		-	-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose													
			13th QM	**14th QM**	**15th QM**	**16th QM**	**17th QM**	**18th QM**	**19th QM**	**20th QM**	**21st QM**	**22nd QM**	**23rd QM**	**25th QM**	**26th QM**	**27th QM**
Chhuri	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-
	Akram Point		-	-	-	-	-	-	-	-	-		-	-	-	-
Chela	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-
	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-		-	-	-	Maturation and Feeding
	Harbaria	Fry and Juvenile	-	-	-	-	-	-	-	-	-		-	-	Nursing and Maturation	-
	Chalna Point		-	-	-	Nursing and Feeding	-	-	-	-	-	Nursing and Maturation	-	Nursing and Maturation	-	-
	Chandpai		-	-	Feeding and Growing		-	-	-	Nursing	Nursing		-	-	Nursing and Maturation-	-
	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	-
		Brood Fish	-	-	Breeding	-	-	-	-	-	-		-	-	-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-
	Chalna Point	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-

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

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

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose													
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM
		Juvenile	-	Feeding and Growing	-	-	-	-	-	-	Feeding and Growing		-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing	-		-	-	-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	Nursing	-	-	-
	Chandpai	Juvenile-1	-	-	-	-	Feeding and Growing	-	-	-	-		-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	-	-	Nursing	Maturation	Maturation	-	-	-
		Fry	-	-	-	-	Nursing	-	-	-	-		-	-	-	-
	Maidara	Juvenile	-	-	-	-	-	-	-	-	-	Maturation	-	-	-	-
		Fry	-	-	Nursing	-	-	-	-	-		-	-		-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	-	-	-	Feeding	-	Feeding	-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-	-		Maturation	-	-	-
Bele	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-
		Juvenile	-	-	-	-	-	-	-				-	-	-	Feeding
	Chandpai	Fry	-	-	-	Nursing	Nursing	-	-	Nursing	-	Nursing	-	-	-	-
		Juvenile and Adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	Feeding and Growing-		-	-	-	Maturation and Feeding	-
	Jongra	Fry	-	-	-	-	-	-	Nursing	-		-	-	-	-	-
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Fry	-	Nursing	-	-	Nursing	-	-	-	-	-	-	-	-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-	-	-	-
	Chalna Point	Fry	-	-	Nursing	Nursing	-	-	-	-			-		-	-
		Fingerling	-	-	-	-	Nursing	-	-	-	-		Nursing	Nursing	-	-
		Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	Maturation and Feeding	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose													
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM
	Maidara	Juvenile and Age-1 adult	-	-	Feeding and Growing	-	Feeding and Growing	Feeding and Growing	-	-	Maturation and Feeding	Maturation and Feeding	Maturation and Feeding	-	-	-
		Fry	Nursing	-	Nursing	-	-	-	-	-		-	-		-	-
	Charaputia	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	-	-	-	-	-	-	-
	Chalna Point	Adult	-	-	-	-	-	-	Maturation	Maturation	Maturation and Feeding	-	-	-	Maturation and Feeding	-
Tairel	Akram Point	Adult	-	-	-	Feeding	-	-	-	-	-	-	-	-	-	
		Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Maturation
	Charaputia	Juvenile	-	-	-	-	-	-	-	Maturation	-		-	-	-	-
	Harbaria	Age-1 Adult	-	Feeding and Growing	-	-	-	-	-	-	-		-	-	-	-
	Chandpai	Juvenile	-	-	-	-	-	Growing	-	-	Feeding and Growing		-	-	-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	Growing		-	-	-	-
	Maidara	Juvenile	-	-	-	-	-	Growing	-	-	-		-	-	-	-
Pheksa	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-
	Charaputia	Juvenile and Adult	-	-	-	-	-	-	-	Feeding and Maturation	-			-	-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose													
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM
	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	--	-	-	-	-	-	-
	Maidara	Adult	-	Feeding	-	-	-	-	-	-	-	-	-	-	-	-
Paissa	Akram Point	Juvenile and Adult	Feeding	-	-	-	-	Growing and Maturation	-	-	-	-	-	-	-	Growing and Maturation
		Brood	Spawning	-	-	-	-	-	-	-	-	-	-	-	-	-
	Charaputia	Brood Fish	-	-	-	Spawning	-	-	-	-	-	-	-	-	-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	Feeding
		Fry	-	-	-	-	-	-	-	-	-	-	Nursing	-	-	-
	Harbaria	Juvenile-1 and Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-	Feeding and Growing	-
		Adult	-	Feeding	-	-	-	-	-	-	-		-	-	-	-
	Chalna	Fry	-	-	-	-	-	-	Feeding and Growing	-	Feeding and Growing		Nursing	Nursing	-	Feeding
	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	-	-			-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	Nursing			-	-	-	-
	Harbaria	Juvenile	-	-	Feeding and Growing	-	-	Maturation	-	-			-	-	Feeding and Growing	-
		Fry	-	-	Nursing	-	-	-	-	-			-	-	-	-

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

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose													
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM
	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	-	-

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
	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

Sampling Site	Total Catch (ton): 2015-2016							
	5th QM		6th QM		7th QM		8th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
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
Sub-total =	**-**	**0**	**-**	**-**	**-**	**6**	**-**	**0**
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
Sub-total =		**1.14**	**-**	**-**	**-**	**9**	**-**	**0**
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
Sub-total =	**-**	**2**	**-**		**-**	**4**	**-**	**2.01**
Grand-total =	**-**	**3.14**	**-**		**-**	**19**	**-**	**2.01**

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		

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**
							Sarpunti	**0.53**	Rui	0.00	Vetki	2		
							Horina	**1.91**	Tengra	0.13				
							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**						
Sub-total =		**0**		**14.2**	**-**	**-**	=	**34.38**	=	**2.75**	**=**	**25**		
	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	-
3	-	-	Tilapia	5	-	-	Paissa	**0.00**	Tengra	0.00			Nilotica	-
	-	-	Rui	3	-	-	Horina Chingri	**0.60**	Tilapia	0.20			Khorsul	-
	-	-	Vetki	2	-	-								
	-	-	Catla	10	-	-								
Sub-total =	**-**	**0**	**-**	**32**	**-**	**-**								
Grand-total =	**-**	**1**	**-**	**49.8**	**-**	**-**	**=**	**2.72**	**=**	**0.30**	**=**	**0**		

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

Sampling Site/ Location	Total Catch (ton): 2019-20 and 2020-21													
	20th QM		21st QM		22nd QM		23rd QM		25th QM		26th QM		27th QM	
	Fish Species	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**	**Fish Species**	**Total Production (ton)**
Bhekatkhali Khal, Rajnagar	Bagda	32	Bagda	2.72	Bagda	0.8	Harina	0.02	Bagda	1.2	Patari	0.2	-	-
	Horina	48	Harina	3.44	Harina	1.0	-	-	Harina	2.0	Tilapia	0.5	-	-
	-	-	Tilapia	0.7	Chali	0.2	-	-	Tilapia	1.0	Paissa	0.05	-	-
	-	-	Parse	0.17	Patari	0.3	-	-	-	-	Harina	0.2	-	-
	-	-	-	-	Tairel	0.03	-	-	-	-	Carpu	1.0	-	-
	-	-	-	-	Tilapia	0.5	-	-	-	-	Rui	0.05	-	-
	-	-	-	-	Datina	0.02	-	-	-	-	Grass Carp	0.05	-	-
											Golda	0.02	-	-
											Bagda	0.3	-	-
Sub-total =		**80**		**7.0**		**2.8**		**0.02**		**4.2**		**2.37**	**-**	**-**
Kapashdanga-Muralia	Bagda	1.41	Bagda	6.74	Bagda	3.42	Harina	0.01	Bagda	4.84	Bagda	1.45	-	-
	Paissa	0.60	Golda	0.01	Harina	3.96	-	-	Hatina	0.92	Hatina	1.08	-	-
	Crab	0.00	Harina	0.65	Chali	0.38	-	-	Chali	0.20	Chali	0.30	-	-
	Tilapia	0.30	Chali	0.04	Bele	2.11	-	-	Bele	0.27	Bele	0.19	-	-
	Golda	0.10	Bele	0.09	Paissa	2.62	-	-	Paissa	0.04	Paissa	1.80	-	-
	Horina Chingri	2.92	Tilapia	0.22	Tilapia	9.85	-	-	Tilapia	3.87	Tilapia	6.93	-	-
	Chali Chingri	1.52	Tengra	0.57	Golda	0.04	-	-	Golda	0.03	Golda	0.03	-	-
	Bele	1.35	Bhangan	0.08	Tengra	0.17	-	-	Tengra	0.01	Tengra	0.17	-	-
	Tengra	0.27	-	-	Patari	2.25	-	-	Patari	0.11	Patari	0.25	-	-
	Major Carp	0.55	-	-	Chemo	0.02	-	-	Datna	0.01	Catol	0.04	-	-
	-	-	-	-	Datina	1.01	-	-	Rui	0.47	Chemo	0.32	-	-
	-	-	-	-	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**	**-**	**-**
Chunkuri-2	Bagda	0.04	Patari	0.01	Tilapia	0.02	-	-	Paissa	0.05	Sada Chingri	0.03	-	-
	Paissa	0.00	Tair/Tailla	0.01	Paissa	0.066	-	-	Golda	0.03	Paissa	0.03	-	-
	Khorsula	0.00	Bhangan	0.01	Khorsul	0.009	-	-	Kharulla	0.01	Patari	0.02	-	-
	Horina Chingri	0.10	Datina	0.03	Bagda	0.015	-	-	Bagda	0.10	Tengra	0.01	-	-
	Motka	0.04	Bagda	0.02	Golda	0.006	-	-	Bele	0.03	Datina	0.02	-	-
	Chali Chingri	0.03	Golda	0.03	Patari	0.015	-	-	Harina	0.15	Ilish	0.005	-	-
	Chaka Chingri	0.01	Faissa	0.01	Harina	0.008	-	-	Tengra	0.02	Golda	0.01	-	-
	Bele	0.01	Chaka Chingri	0.01	Chali	0.009	-	-	Tairu	0.03	Nilotica	0.06	-	-
	Crab	0.03	Harina	0.02	China Punti	0.047	-	-	Chaka	0.01	Baila	0.004	-	-

	Total Catch (ton): 2019-20 and 2020-21													
Sampling Site/ Location	20th QM		21st QM		22nd QM		23rd QM		25th QM		26th QM		27th QM	
	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)	Fish Species	Total Production (ton)
	-	-	-	-	Tengra	0.008	-	-	Datina	0.02	Goda Chingri	0.001	-	-
	-	-	-	-	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**	**-**	**-**

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: January 24, 2021 (Sunday)

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	9	15	0	17	26	0	3	36	0
Auto Rickshaw	0.8	9	2	8	10	19	23	0	0	0
Van	0.6	37	51	53	72	96	101	0	82	49
Cycle	0.2	15	6	4	12	13	5	2	29	6
Human Howler	0.6	6	9	9	8	23	18	6	4	6
CNG	0.5	0	2	1	2	3	2	0	5	3
Private Car	1	13	33	46	34	47	80	5	23	28
Motor Cycle	0.3	74	139	64	196	159	107	9	139	44
Jeep	1	1	8	9	3	3	6	6	6	11
Pick-up	2	10	17	52	26	24	99	6	19	49
Micro	1	6	13	19	16	30	46	7	22	29

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**
Bus	2.5	24	28	130	43	38	203	5	35	99
Light Truck	2	8	4	23	19	16	68	0	20	40
Medium Truck	2	14	26	79	25	73	195	2	41	86
Heavy Truck	2	18	6	46	10	11	40	9	21	59
			Total	**542**			**991**			**508**

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

Date: January 22, 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	6	9	0	6	23	0	26	23	0
Auto Rickshaw	0.8	4	4	6	4	0	3	2	0	2
Van	0.6	13	9	13	17	2	11	15	2	10
Cycle	0.2	4	3	1	3	5	2	3	2	1
Human Howler	0.6	16	3	11	18	13	18	28	29	34
CNG	0.5	3	0	2	0	2	1	1	0	1
Private Car	1	7	3	10	6	6	11	9	7	16
Motor Cycle	0.3	19	14	10	26	29	17	44	36	24
Jeep	1	2	4	6	1	2	2	2	2	3
Pick-up	2	2	4	13	3	5	14	5	0	9
Micro	1	2	6	8	4	5	9	12	6	17
Bus	2.5	7	8	38	9	12	51	14	6	49
Light Truck	2	5	4	19	2	3	9	2	5	13
Medium Truck	2	8	8	31	6	16	42	19	11	59
Heavy Truck	2	7	6	26	10	21	61	18	15	65
			Total	**194**			**250**			**301**

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

Date: January 23, 2021 (Saturday)

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	2	7	0	4	10	0	11	19	0
Auto Rickshaw	0.8	2	3	4	0	0	0	0	0	0
Van	0.6	6	8	8	0	14	8	0	11	6
Cycle	0.2	3	0	1	3	2	1	2	1	1
Human Howler	0.6	5	5	6	6	10	9	6	7	8
CNG	0.5	0	1	1	0	0	0	0	0	0
Private Car	1	4	2	5	2	3	5	5	2	6
Motor Cycle	0.3	10	9	6	17	19	11	9	7	5
Jeep	1	2	1	2	4	1	5	6	0	6
Pick-up	2	2	2	8	5	6	20	6	11	34
Micro	1	1	3	4	3	5	8	7	2	9
Bus	2.5	0	0	0	1	1	4	5	3	19
Light Truck	2	3	2	9	1	0	1	0	0	0
Medium Truck	2	2	2	7	1	0	1	2	1	6
Heavy Truck	2	4	2	12	1	4	8	9	1	20
			Total	**73**			**80**			**119**

(F) Monitoring Results

Air quality parameter analysis result

Quarterly Ambient Air Quality Monitoring Report of 2×660 MW Maitree Super Thermal Project at Rampal, Bagherhat

Data Table 1- Air Quality Analysis Result

Sample Location ID	Concentration present of different parameter in ambient air							
	$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO	O_3	Remarks
AQ1	166.72	234.41	347.39	18.61	33.48	3	212	Not comply
AQ2	94.23	188.64	269.30	20.23	26.30	0.8	68	Not comply
AQ3	55.35	106.13	163.48	14.74	37.16	0	9	Complies
AQ4	52.74	112.04	170.33	18.32	29.90	0	6	Complies
AQ5	68.26	131.84	180.43	16.19	34.10	0	12	Not comply
AQ6	59.18	117.42	188.27	16.45	26.14	0.1	23	Complies
AQ7	61.29	93.36	159.80	16.47	21.18	0	6	Not comply
AQ8	88.71	159.22	240.18	18.80	34.20	2	80	Not comply
AQ9	74.19	118.67	201.16	12.26	19.25	2	66	Not comply
AQ10	53.28	100.11	146.20	14.66	21.44	0	6	Complies
AQ11	55.71	99.64	155.39	16.20	23.53	0	11	Complies
AQ12	48.20	90.12	144.95	15.05	20.60	0.2	8	Complies
AQ13	66.31	102.73	156.56	16.16	28.54	1	20	Not comply
Units	μg/m³	μg/m³	μg/m³	μg/m³	μg/m³	mg/ m³	μg/m³	
Test Duration (Hours)	24	24	8	8	8	8	8	
Method of Analysis	Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob & Hochheiser	CO Meter	O_3 Meter	
Bangladesh (DoE) Standard for ambient Air	65	150	200	365	100	10	157	
IFC/WB Standard	75	150	NF	125	200	NF	160	

7.0 Terminology:

1. Fine Particulate Matter ($PM_{2.5}$), 2. Respirable Dust Content (PM_{10}), 3. Suspended Particulate Matter (SPM), 4 Oxides of Nitrogen (NO_x). 5. Sulphur Di-Oxide (SO_2), 6. Carbone Mono-Oxide (CO), 7. Ozone (O_3) & 8. DoE- Department of Environment, NF – Not found.

8.0 Comment

The above result for ambient air quality monitoring shows the $PM_{2.5}$, PM_{10}, SPM, SO_2, NO_x, O_3 & CO concentrations of the ambient air. It is discernible that, location AQ1 (Township Area) exceeds at $PM_{2.5}$, PM_{10}, SPM and O_3 concentrations in the ambient air. Location AQ2 (Taltola Bazar/BIFPCL Project) and AQ8 (Khan Jahan Ali Bridge toll plaza) has elevated level of particulate matter concentrations. Location AQ5 (Koigoddas Kathir Char) & AQ7 (Gaurambha Union) cross limit when it comes to $PM_{2.5}$ concentration. Location AQ9 (Mongla Port) has higher then permitted level of $PM_{2.5}$ and SPM. Location AQ13 (Chalna Bazar) has higher then permitted level of $PM_{2.5}$ concentration.

Water quality parameters analysis result

[illegible]

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110201	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-01)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	24	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	16	mg/L	CRM	-
5	Chloride	150-600	44	mg/L	Titrimetic	-
6	Silica (Sio2)	0.0	6.3	mg/L	UVS	-
7	Bi-Carbonate (HCO3-)	0.0	143	mg/L	Titrimetic	-
8	Cr (Total)	0.05	0.0003	mg/L	AAS	0.0003
9	Hardness	200-500	272	mg/L	Titrimetic	-
10	Iron (Fe)	0.3-1	1.68	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	12	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	3.2	mg/L	UVS	0.10
14	Phosphate	6.0	0.46	mg/L	UVS	0.10
15	Potassium (K)	12.0	6	mg/L	AAS	-
16	Sodium (Na)	200	32	mg/L	AAS	0.34
17	Sulphate	400	3	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	122	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-
20	Turbidity	10	34	NTU	Turbidity Meter	-
21	Carbonate (CO3)	-	0.27	mg/L	Titrimetic	-

Comments: Sample was collected & supplied by client.

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

Page 1 of 2

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110202	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-02)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	12	mg/L	CRM	-
4	Cr (Total)	0.05	0.0003	mg/L	AAS	0.0003
5	Hardness	200-500	195	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.005	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.3	mg/L	UVS	0.10
8	Phosphate	6.0	0.48	mg/L	UVS	0.10
9	Sulphate	400	6	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	96	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	11	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2020	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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Date: 06-01-2021

Lab Memo: 592/ CC, DPHE, CL, Dhaka

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110203	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-03)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	0.00017	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
4	Cr (Total)	0.05	0.0004	mg/L	AAS	0.0003
5	Hardness	200-500	225	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	4.7	mg/L	UVS	0.10
8	Phosphate	6.0	0.50	mg/L	UVS	0.10
9	Sulphate	400	11	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	94	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	8	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Date: 06-01-2021

Lab Memo: 592/ CC, DPHE, CL, Dhaka

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110204	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-04)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	25	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	28	mg/L	CRM	-
5	Chloride	150-600	40	mg/L	Titrimetic	-
6	Silica (Sio2)	0.0	9.1	mg/L	UVS	-
7	Bi-Carbonate (HCO3-)	0.0	137	mg/L	Titrimetic	-
8	Cr (Total)	0.05	0.0003	mg/L	AAS	0.0003
9	Hardness	200-500	210	mg/L	Titrimetic	-
10	Iron (Fe)	0.3-1	1.90	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	11	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	2.5	mg/L	UVS	0.10
14	Phosphate	6.0	0.72	mg/L	UVS	0.10
15	Potassium (K)	12.0	5	mg/L	AAS	-
16	Sodium (Na)	200	34	mg/L	AAS	0.34
17	Sulphate	400	5	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	102	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-
20	Turbidity	10	87	NTU	Turbidity Meter	-
21	Carbonate (CO3)	-	0.41	mg/L	Titrimetic	-

Comments: Sample was collected & supplied by client.

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

Page 1 of 2

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Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110205	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-05)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

LABORATORY TEST RESULTS:

SI.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	16	mg/L	CRM	-
4	Cr (Total)	0.05	0.0005	mg/L	AAS	0.0003
5	Hardness	200-500	235	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.6	mg/L	UVS	0.10
8	Phosphate	6.0	0.54	mg/L	UVS	0.10
9	Sulphate	400	3	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	179	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	6	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 06/01/2021

Md. Biplab Hossain
Chief Chemist
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Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110207	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-07)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Calcium (Ca)	75	35	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
5	Chloride	150-600	110	mg/L	Titrimetic	-
6	Silica (Sio2)	0.0	159	mg/L	UVS	-
7	Bi-Carbonate (HCO3-)	0.0	132	mg/L	Titrimetic	-
8	Cr (Total)	0.05	0.0003	mg/L	AAS	0.0003
9	Hardness	200-500	240	mg/L	Titrimetic	-
10	Iron (Fe)	0.3-1	2.89	mg/L	AAS	0.05
11	Lead (Pb)	0.05	0.018	mg/L	AAS	0.001
12	Magnesium (Mg)	30-35	19	mg/L	AAS	0.05
13	Nitrogen (Nitrate)	10.0	0.5	mg/L	UVS	0.10
14	Phosphate	6.0	0.65	mg/L	UVS	0.10
15	Potassium (K)	12.0	9	mg/L	AAS	-
16	Sodium (Na)	200	42	mg/L	AAS	0.34
17	Sulphate	400	6	mg/L	UVS	1.0
18	Total Dissolved Solid (TDS)	1000	181	mg/L	Multimeter	-
19	Total Suspended Solid (TSS)	10	15	mg/L	Gravimetric Method	-
20	Turbidity	10	183	NTU	Turbidity Meter	-
21	Carbonate (CO3)	-	0.33	mg/L	Titrimetic	-

Comments: Sample was collected & supplied by client.

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

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110208	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-08)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	0.00018	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	12	mg/L	CRM	-
4	Cr (Total)	0.05	0.0003	mg/L	AAS	0.0003
5	Hardness	200-500	235	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.1	mg/L	UVS	0.10
8	Phosphate	6.0	0.43	mg/L	UVS	0.10
9	Sulphate	400	4	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	98	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	8	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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 06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist 06/01/2020 06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer 06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110209	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-09)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	20	mg/L	CRM	-
4	Cr (Total)	0.05	0.0004	mg/L	AAS	0.0003
5	Hardness	200-500	243	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	3.0	mg/L	UVS	0.10
8	Phosphate	6.0	1.3	mg/L	UVS	0.10
9	Sulphate	400	12	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	92	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	6	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021 06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110210	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-10)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	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	0.0003	mg/L	AAS	0.0003
5	Hardness	200-500	198	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.003	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.5	mg/L	UVS	0.10
8	Phosphate	6.0	1.2	mg/L	UVS	0.10
9	Sulphate	400	31	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	206	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	8	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2020
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110211	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-11)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00017	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	28	mg/L	CRM	-
4	Cr (Total)	0.05	0.0003	mg/L	AAS	0.0003
5	Hardness	200-500	217	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.3	mg/L	UVS	0.10
8	Phosphate	6.0	0.68	mg/L	UVS	0.10
9	Sulphate	400	26	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	164	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	7	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110212	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-12)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	56	mg/L	CRM	-
4	Cr (Total)	0.05	0.0003	mg/L	AAS	0.0003
5	Hardness	200-500	265	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.0	mg/L	UVS	0.10
8	Phosphate	6.0	0.75	mg/L	UVS	0.10
9	Sulphate	400	21	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	148	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	8	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110213	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-13)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	0.00017	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	76	mg/L	CRM	-
4	Cr (Total)	0.05	0.0004	mg/L	AAS	0.0003
5	Hardness	200-500	225	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	1.5	mg/L	UVS	0.10
8	Phosphate	6.0	0.29	mg/L	UVS	0.10
9	Sulphate	400	540	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	2260	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	5	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2020 B.Hossain 06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110214	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-14)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	60	mg/L	CRM	-
4	Cr (Total)	0.05	0.0003	mg/L	AAS	0.0003
5	Hardness	200-500	210	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.020	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.5	mg/L	UVS	0.10
8	Phosphate	6.0	0.37	mg/L	UVS	0.10
9	Sulphate	400	430	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	1472	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	8	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110215	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Suface Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-15)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.009	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	40	mg/L	CRM	-
4	Cr (Total)	0.05	0.0003	mg/L	AAS	0.0003
5	Hardness	200-500	230	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.013	mg/L	AAS	0.001
7	Nitrogen (Nitrate)	10.0	2.6	mg/L	UVS	0.10
8	Phosphate	6.0	0.40	mg/L	UVS	0.10
9	Sulphate	400	30	mg/L	UVS	1.0
10	Total Dissolved Solid (TDS)	1000	490	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	6	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110216	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Ground Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW-01)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

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	232	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	0.5	mg/L	UVS	0.10
6	Phosphate	6.0	0.67	mg/L	UVS	0.10
7	Sulphate	400	9	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	139	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	3	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110217	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Ground Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW-02)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.053	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	185	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	3.8	mg/L	UVS	0.10
6	Phosphate	6.0	6.3	mg/L	UVS	0.10
7	Sulphate	400	3	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	335	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	5	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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Lab Memo: 592/ CC, DPHE, CL, Dhaka

Date: 06-01-2021

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2020110218	Sample Receiving date: 18-11-2020
Ref. Memo No: 42.06.2626.119.37.001.20-1963 & Dated: 18-11-2020	Sample Source: Ground Water
Sent by:Director ,PRMRD , CEGIS, Gulshan-1, Dhaka-1212.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW-03)	Union:, Vill.:
Sample Collection date:	Date of Testing: 18/11/2020-31/12/2020

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.006	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	207	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
5	Nitrogen (Nitrate)	10.0	3.1	mg/L	UVS	0.10
6	Phosphate	6.0	2.28	mg/L	UVS	0.10
7	Sulphate	400	3	mg/L	UVS	1.0
8	Total Dissolved Solid (TDS)	1000	202	mg/L	Multimeter	-
9	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, 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	06.01.2021	1.) Name: Mita Sarker Designation: Senior Chemist	06/01/2021
2.) Name: Taslima Akhter Designation: Sample Analyzer	06-01-2021	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	B Hossain 06/01/2021 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

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: Dec2020029009

Lab ID: INS-567-571

Sample ID: A-567-571

Unit (Lab/Inst.) Ref No: A-567-571

Sample Receiving Date: 15/12/2020

Submission Date: 15 Dec 2020

Report Delivery Date: 03/01/2021

Sample Description: Project jetty site, Mongla confluence, 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	Parameter	Concentration	Test Method (APHA)
A-567	Water (Project jetty site)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-568	Water (Mongla Confluence)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-569	Water (Harbaria)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-570	Water (Akram Point)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-571	Water (Hiron Point)	Oil and Grease	Less than 2.0 mg/L	5520.B

03.01.2021
Analyst

03-01-2021
Section/Division In-Charge

...nia Akter
...Scientific Officer
...National Analytical
...Service (INARS)

03.01.2021
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.

Analytical Service Cell
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Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

Pages 1 of 1

3rd of January 2021 12:24 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: Dec2020029008

Lab ID: INS-549-566

Sample ID: A-549-566

Unit (Lab/Inst.) Ref No: A-549-566

Sample Receiving Date: 15/12/2020

Submission Date: 15 Dec 2020

Report Delivery Date: 04/01/2021

Sample Description: Mercury (Sample no-1,2,3,4,5,6,7,8,9,10, Shapmari, Mongla Confluence, Harbaria, Akram point , Hiron point, project site, Rajnagar, Kapashdanga)

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	Parameters	Concentration	Test Method (APHA)
A-549	Water (Sample-01)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-550	Water (Sample-02)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-551	Water (Sample-03)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-552	Water (Sample-04)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-553	Water (Sample-05)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-554	Water (Sample-06)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-555	Water (Sample-07)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-556	Water (Sample-08)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-557	Water (Sample-09)	Mercury (Hg)	Less than 0.001 mg/L	3112.B

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Pages 1 of 2

4th of January 2021 04:01 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)

A-558	Water (Sample-10)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-559	Water, Shapmari (Sample-11)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-560	Water, Mongla Confluence (Sample-12)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-561	Water, Harbaria (Sample-13)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-562	Water, Akram Point (Sample-14)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-563	Water, Hiron Point (Sample-15)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-564	Water, Project site (Sample-16)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-565	Water, Rajnagar (Sample-17)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-566	Water, Kapashdanga (Sample-18)	Mercury (Hg)	Less than 0.001 mg/L	3112.B

06.01.2021
Analyst

Md. Abu Bakar Siddique
Senior Scientific Officer
Institute of National Analytical Research and Service (INARS)
BCSIR, Dhaka-1205

06-01-2021
Section/Division In-Charge

Shakila Akter
Principal Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

06.01.2021
In-Charge/Director

Shamim Ahmed
Director (In-Charge)
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

Note:

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Analytical Service Cell

Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205,Bangladesh

Soil wqulaity parameters results

The Government of People's Republic of Bangladesh
Soil Resources Development Institute
Divisional Laboratory, Dhaka
Krishi Khamer Sarak, Dhaka 1215.

To
Director
Power, Energy and Mineral Resources Division
CEGIS, Dhaka-1212.

Analytical Results of Supplied Soil Samples

Sl. No.	Lab. No.	Name of the Element																
		pH	EC (dS/m)	OM	N	P		S	K	Ca	Mg	B	Cu	Zn	Fe	Mn	Pb	Cd
						Bray	Olsen											
				(%)		(ppm)			(Cmol⁺/kg)			(ppm)						
1.	3370	7.1	1.08	2.70	0.15	---	7.14	70.07	0.89	15.90	7.56	1.05	7.72	1.59	149.46	31.19	11.73	0.00
2.	3371	6.9	1.33	2.70	0.15	---	8.02	236.88	0.82	16.72	7.42	1.08	12.50	2.24	258.06	51.31	8.70	0.00
3.	3372	7.1	1.74	2.27	0.13	---	6.91	107.29	0.80	13.74	7.16	1.00	8.30	1.17	122.76	18.92	6.43	0.00
4.	3373	5.7	1.05	3.36	0.19	---	3.63	306.81	0.95	11.64	7.10	1.11	2.93	6.16	514.56	16.41	7.94	0.00
5.	3374	5.3	1.30	3.53	0.20	2.95	---	352.18	1.14	10.54	6.78	1.13	8.49	4.53	648.98	11.85	6.05	0.00
6.	3375	5.2	2.14	3.53	0.20	4.10	---	282.87	1.10	9.57	6.42	0.72	7.46	6.53	620.67	13.60	6.81	0.00
7.	3376	6.1	3.60	1.85	0.10	3.64	---	257.82	1.30	9.22	7.03	0.80	8.79	0.73	98.18	14.09	9.08	0.00
8.	3377	6.3	5.30	2.10	0.12	2.13	---	460.03	1.15	19.38	7.90	1.16	8.37	0.75	117.99	21.40	6.04	0.13
9.	3378	6.7	4.60	1.85	0.10	---	1.92	428.56	1.10	17.94	6.14	1.16	8.88	0.87	159.93	34.02	4.16	0.00
10.	3379	7.2	3.40	1.09	0.06	---	8.45	256.22	0.89	19.47	4.20	0.94	7.29	0.92	50.91	24.93	6.04	0.26
11.	3380	7.4	3.71	0.92	0.05	---	6.66	237.72	0.86	25.73	5.59	0.63	5.48	0.93	40.19	15.14	6.81	0.16
12.	3381	7.5	4.37	1.26	0.07	---	6.55	243.48	0.76	22.95	5.52	0.72	6.76	1.37	44.92	23.64	23.88	0.15
13.	3382	7.9	2.60	0.84	0.04	---	6.26	137.42	0.70	23.22	5.30	0.73	2.09	0.64	29.71	19.41	16.24	0.15
14.	3383	7.5	4.60	2.02	0.11	---	3.23	411.87	1.30	22.15	6.42	1.24	6.91	1.88	113.25	28.02	9.08	0.28
15.	3384	7.6	5.10	1.76	0.10	---	4.85	406.83	1.30	25.85	7.32	1.26	7.85	1.66	133.31	44.61	11.35	0.49
16.	3385	7.6	4.90	1.34	0.07	---	6.51	370.27	0.86	22.67	5.52	0.80	3.72	0.86	65.60	13.85	7.18	0.23
17.	3386	7.7	4.30	1.60	0.09	---	4.58	344.45	1.07	22.73	6.02	1.23	7.67	1.40	151.79	56.07	7.18	0.29
18.	3387	7.9	4.20	2.10	0.12	---	3.75	190.16	0.92	22.62	5.83	1.07	6.59	0.82	81.29	32.28	7.18	0.32

Rauf

Rauf
14.03.2021

ড. মোঃ আব্দুর রউফ
প্রধান বৈজ্ঞানিক কর্মকর্তা
মৃত্তিকা সম্পদ উন্নয়ন ইনস্টিটিউট
বিভাগীয় গবেষণাগার, ঢাকা
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার