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

37th Quarter Monitoring Report

Monitoring Period: May – July 2023

January 2024

Center for Environmental and Geographic Information Services

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Acknowledgements

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Last but not the least, the study team appreciates and acknowledges the concerns and perceptions of local people regarding the project and their active participations during field visits.

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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	mg	Milligram
hr	Hour	MW	Mega Watt
Kg	Kilogram	Nm	Normal Meter
Km	Kilometre	ppm	parts per million
KV	Kilo Volt	ppt	parts per trillion
KW	Killo Watt	ton/year	Ton Per Year
m	Meter	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 37th quarterly monitoring report covers the status of EMP (Environmental Management Plan) implementation for the concurrent period (during construction stage) and prepared as per the recommecdation of the EIA (Environmental Impact Assessment) report of power plant vide Memo No: DoE/Clearance/5062/2011 dt. 05/08/2013 as well as EIA report of Coal Transportation vide Memo No: DoE/Clearance/5532/2016 dtd.31/01/2018. During the month of August, 2023 covering the Monsoon season, CEGIS team carried out the monitoring activities for every monitoring aspects as assigned in the ToR (Terms of Reference) and approval conditions of DoE along with valuable suggestions and recommendations from different national and international organizations. In other words, the aspects can briefly be addressed as monitoring of the Environmental Compliances and monitoring of the selected environmental parameters such as ambient air quality, noise level, water quality, land resource, traffic management status, water resources management status, agricultural resources monitoring, fisheries resources, Socio-economic monitoring, aquatic & terrestrial ecosystem monitoring and the Sundarbans Reserve Forest (SRF) health monitoring.

However, the present environmental compliance monitoring includes the status of EMP implementation based on physical observation, investigation and interviews/discussion to the proponents, project officials, relevant authorities and overall staffs of the entire plant. A comprehensive and detailed checklist was prepared to cover environmental compliance of different components e.g., Environmental and Social Management System and Action Plan; Labour and Working Condition; Community Health, Safety and Security; Biodiversity and Sustainable Management of Living Natural Resources, waste management and other relevant issues.

During 37th visit we went across again on those issues and found the same situation. CEGIS raised this issue in the meeting to consider this issue as urgent and project management has assured us to take immediate step to resolve the issue. Along with the previous issues we would like to bring the following issues to the respective authorities for an earlier solution:

1. The sensitive and critical issue has come in front is the Asbestos management issue. Plenty of Asbestos fibre were observed in the plant premises specially at the boiler and ESP plant site. Lack of proper management, Asbestos can be a serious health hazard causing the lung function decrease, lung cancer and even death if someone inhale plenty of Asbestos fibres. We strongly suggested to take necessary actions to manage the Asbestos as soon as possible.
2. Taking consideration of asbestos issue, BIFPCL has already issued a letter to BHEL to take necessary step on this issue but the respective authority is reluctant to resolve the issue.
3. Waste management issues need to be solved as soon as possible. The lavatory waste sewerage facility at labour shed is inadequate that is causing substantial environmental hazard in and around the camp area. Also dumping the construction waste by the side of Maidara river and Coal-water slurry at the jetty area has become a significant threat for the aquatic ecosystem at Maidara and Pashur river respectively mixing by rain water and other ways.
4. Current Dredged material disposal practice seems unsustainable and harmful for the environment and the adjacent biodiversity. Proper dredged material disposal plan is highly recommended. We have discussed this issue in the meeting where a concurrence has made to develop the Dredged Material Disposal Plan (DMDP) as soon as possible.

5. Coal Conveyor belt from jetty area to 1st Transportation Point (About 20 to 25 m) found still uncovered and lack of integrated dust control system allowing the coal ash to be dispersed in the air and nearby water body. Also, the grabber of the excavator was not enclosed that is also causing the air and river water pollution.
6. Heap of Sand and other loose material were found uncovered at the labour shed and inside the plant premises.

The concentration of Criteria pollutants ($PM_{2.5}$, PM_{10}, SPM, SO_2, NOx, CO and O_3) at the project area and the project influence area changes over the seasonal shift and location. Winter is the worst season in terms of air pollution of that area followed pre-monsoon. All of the air pollution remains lower during the monsoon or post-monsoon time due to wet wash of maximum rainy days. SO_2 and NO_x are considerably lower particularly at Sundarbans areas. It increases towards project area and Khan Jahan Ali Bridge areas. Land development works of the project in 2014 increased dust pollution and finalized site development with grassy top soil by the end of 2016 might be responsible for reduced dust level in ambient air. Hiron point, Akram Point and Harbaria 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.

In course of noise level monitoring, the observed level of noise at *Chalna*, a commercial area located at a distance of 4 km to the north-west direction of the chimney location was recorded as 57.13 dB whereas its standard level is 70 dB**.** Levels of noise at *Kaigar Daskati (*49.06 dB) situated at the Gucchha Gram (a residential area located at north-west corner of the project area) and Chunkuri-2 (49.54 dB) located at 4km south-west direction from the chimney location did not exceed their corresponding standard limit. On the other hand, levels of noise at *Maidara Khal* (the south-west corner of the project area and a residential area) and *Shapmar*i (township area) were recorded as 53.32 dB and 46.67 dB respectively that denotes, the levels of noise didn't cross their corresponding standard value (55 dB) in these two locations . The level of noise at *Barni (Gaurambha)* was recorded as 53.26 dB which was 6.74 dB lower than that of its standard limit (60 dB) of noise level for this location . *Harbaria* and *Akram Point* are two ecologically silent zones in the study area. Both of these locations, Harbaria (48.89 dB) and Akram Point (48.09 bB) were not found to exceed their standard limit of noise level (std. 50 dB). The level of noise level at Hiron point was recorded as 54.15 dB whereas its standard reference is 50 dB. This is the only location in this monitoring season where the level of noise shows higher values by 4.15 dB. The level of observed noise at Khan Jahan Ali Bridge and the Mongla port area were recorded as 56.88 dB and 55.31 dB respectively. Whereas, the standard noise limits for Khan Jahan Ali Bridge (a commercial zone) and Mongla port (an industrial zone) during the day are 70 dB and 75 dB, respectively.

The physicochemical properties of Passur River change with the tidal intrusion in different seasons. During the 37th quarterly monitoring, pH was found slightly basic. Salinity, Temperature, and Dissolved Oxygen level was found in fair and favourable for the aquatic life forms. TDS and TH have been found relatively the same for the same seasons of the last consecutive years. On the other hand, Nitrate (NO_3^-) and Phosphate (PO_4^{3-}) levels were found to exceed the standard set by the ECR'2023. The Sulphate concentrations were found relatively higher in the post-monsoon and winter periods than in the monsoon seasons. In the case of metal pollution, no significant variation was recorded for As and Pb but this time the value was found to be 0.003 mg/L and exceeded the previously obtained values from all locations i.e. 0.001 mg/L which slightly exceeded the ECR' 2023 standard as set in the ER'2023. Oil & grease concentration was found less than 2.0 mg/L at all sites like the previous monitoring periods which is less than the recommended concentration.

On the other hand, the physical characteristics of groundwater quality are still in good condition with slight variations in pH and salinity. The reason is saline water intrusion and infiltration due to the

excessive withdrawal of groundwater by the surrounding communities during the dry season but during the monsoon season, the water becomes less saline as the aquifer recharges during the monsoon season. During the monitoring tier in May 2023, TDS values were found higher than the ECR'2023 which might be because Before monsoon, the water chemistry is governed by the weathering of carbonate and silicate minerals, reverse ion exchange and evaporation processes, which resulted in high EC, TDS, TH and major ions in the groundwater.[1] On the other hand, during winter and pre-monsoon concentration was found to breach the national water quality standard two times at Kapashdanga. The reason behind this exceedance is very hard to interpret (Islam et al., 2010) but the most widely discovered two theories for the background of arsenic contamination of groundwater in Bangladesh may be the pyrite oxidation and iron oxyhydroxide reduction (Saha and Rahman, 2020).

Again, the 37th monitoring soil analysis report represents the samples collected in 36th monitoring which is considered as dry season. Decreasing trend of salinity in the major findings of this monitoring except Kapalirmet monitoring spot of the monitoring plots are decreasing. This might be caused due to intrusion of saline water in this monitoring spot as Na concentration has been increased. Organic matter concentration is found to increase in four locations and decreased in two (Baranpara and Chunkuri-2). Lead concentration has been deceased in all locations except Kapalirmet after last year jump while cadmium concentration has been increased significantly during this monitoring. But both of the element's concentration remains within the maximum permissible limit in soil. Agricultural and livestock data was not collected during this monitoring field visit as per TOR obligation. Next survey will be conducted in October, 2023 and report will be incorporated accordingly.Livestock resource is found to be similar during this monitoring field visit. However, number of freely reared livestock continues to decrease due to lack of grazing land.

Similar to the earlier quarterly monitoring report, Khulna Mongla Road at Khudir Bottola had the highest traffic volume compared to the other two locations namely Khulna Mongla Road at Gonai Bridge and Power Plant access road at Taltola Bridge. On the other hand, Access road of the Power plant receives the lowest traffic load than the other monitoring locations. Moreover, during the noon time traffic loads were observed to be lower than the other time of the day. Vehicular movements at access road area were observed during the surveys were mostly for the regular construction activities of the Power Plant but decreasing than the previous time as one unit of 2x660 MW has already been completed. Furthermore, due to the completion of the Padma Bridge the Khulna mongla roads are receiving more traffic recently. Sediment samples were collected from selected sampling locations during this monitoring field visit. These samples have been sent to BCSIR for analysis. The analysis data will be incorporated with next monitoring report.

Monitoring of 37-quarter for fisheries resources have been conducted at 13 sampling sites which were set at the inception stage. Out of these sites, effective samplings were done at 10 sites as fishing in other sites in the river were not observed. Amongst the effective sites, eight (07) were in the river and three (03) were in the country side (shrimp farms). The followings are the key findings of the 37th quarter monitoring in the fiscal year of 2023-24. Changes in habitat uses were observed in every past fiscal year along with the current one (as compared to the fiscal year of 2014-2015, 2015-2016, 2017-2018, 2018-2019, 2019-20, 2020-21, 2021-22 and 2022-23), 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) omni ground including nursery,

[1] E. Manikandan, N. Rajmohan, S. Anbazhagan, Monsoon impact on groundwater chemistry and geochemical processes in the shallow hard rock aquifer, CATENA, Volume 195, December 2020, 104766.

maturation and feeding ground. Shannon-Weiner diversity index has also been observed to vary between 37-quarter with that of all previous quarters. Highest Shannon-Weiner index was found at Mongla Point (0.76) indicating high evenly distributed fish species. On the contrary, lowest evenness was found at Maidara (0.16). However, maximum FSR was obtained at Charaputia (n=32), while very low FSR was recorded at Mongla (n=03). Among the habitats in down-stream of the Passur River system, Akram point was home to rich assemblage of Baila, Paissa and Kathali Chingri, Charaputia was rich of Baila, Chaka Chingri and Chela, Harbaria was rich of Chaka, Golda and Motka Chingri. Fish species like Chela, Baila, Paissa, Gagra Tengra and Gang Koi attain the maximum abundance among the migratory fish species. Moreover, among the migratory species Bailla, Paissa and Ramchos were observed to migrate long distance. In this monitoring, the highest productivity was found at Charaputia followed by Harbaria. The present study revealed that the highest catch susceptibility was also found in case of Charpata Jal (6.0 kg/haul). In terms of Eclogical monitoring, vegetation composition, plant diversity, vegetation canopy status, plant health, bird habitat status and dolphin occurrence in aquatic ecosystems have been monitored for this monitoring season. A total of 36 tree species were recorded from all the monitoring sites with Shanon-Winner diversity index of 2.39 which denotes the diversity decreased than previous monitoring tier. Plant heath and canopy status at most of the sites revealed significant change comparing the same seasonal monitoring in last year due to leaf growth during monsoon. But, none of the changes revealed any effects from project activities. Only one bird nests were recorded at Borni during this monitoring tier. Except for the Passur-Maidara River, dolphin occurrences at all sites showed a trend of improvement compared to previous observations, but no cause for this improvement was defined.

On the contrary, over a span of ten years, the team has observed dynamic variations in different parameter, among them seedling density, a key aspect influenced by factors such as canopy cover and soil characteristics. Intriguingly, the study brings to light the challenges faced by seedlings, including early-stage mortality. Notably, adverse conditions, such as sand deposition resulting from dredging activities, have been identified as factors negatively impacting seedling density, particularly at Hiron Point. The exploration of mangrove ecosystems extends to a decade-long examination of pneumatophore density across five locations. Environmental conditions and potential anthropogenic impacts contribute to variations, as highlighted by ANOVA results that emphasize the location-dependent nature of pneumatophore density. The fluctuations observed are influenced by factors such as elevation, seasonal variation, weather conditions, and tide variations. However, Crab holes, acting as indicators of crab activity, have been observed to exhibit varying densities across locations. Akram Point stands out with the highest density due to its favourable habitat, while Hiron Point, characterized by sandy soil coverage, records the lowest crab hole density. Seasonal variations and the impact of the monsoon emerge as factors influencing crab hole density, with ANOVA results emphasizing location-dependent differences. The stability of crab hole density within the plot over time suggests resilience despite environmental variations. Canopy cover stability is a notable observation across monitoring plots. However, significant spatial variability indicates influences of climatic and edaphic factors, natural stresses, and pest and disease attacks. Despite fluctuations, all sites maintain greater than 60% canopy coverage, suggesting overall forest health. The varying Leaf Area Index (LAI) values among plots underscore the influence of species composition and forest structure on canopy characteristics, with implications for forest health, productivity, and resilience to climate change. Floral diversity and species richness, essential for ecosystem functionality, exhibit declining trends across plots, except for Karamjol, attributed to natural processes and human activities. Ecological instability is evident at Karamjol, while local insights highlight the impact of anthropogenic activities on vegetation decline. The positive trend in carbon storage across diverse locations indicates increased carbon sequestration, with sediment deposition contributing to organic matter enrichment in soil—a vital factor for ecosystem health. Overall, the monitoring data collectively provides valuable insights into the dynamics of seedlings, pneumatophores, crab holes, canopy cover, leaf area index, floral diversity, and carbon storage in different mangrove locations.

Moreover, the Socio-economic monitoring was conducted to explore project impacts on livelihoods, working environment, community health and safety, and activities under the Corporate Social Responsibility (CSR). For the study, physical observation, consultation and informal interviews collected information from the PMU and local communities. On the basis of the monitoring some recommendations have been proposed-

a. Recruitment of local labors should be in open circular basis, where the number of requirements and exam date will be explicit in the poster at UP Chairman offices/notice board;

b. Re-consideration about the issue of restriction on new local labor recruitment under Rampal Upazila in terms of allegation of thief to the existing local labors of that upazila;

c. Local work forces should be trained on masonry, carpentering, electrician & electronics, welding, driving, rod binding and machineries operation to prepare them as the semi-skilled working force for this project;

d. Representatives from BIFPCL should present/offer their requirement to the local community at the coordination meeting of that union Parishad, so that it can be easily disseminate to the community. Because most of the local people are unaware about their support services and offers.

e. It is required to installed a grievance box for the local community in the MSTTP main gate, and establish a grievance redress committee (GRC) to monitor and resolve the locally raised problem in associate with MSTTP;

f. Dredged material management plan should be prepared for successfully and properly handling the regular maintenance dredging;

g. Previously sewing and computer training were introduced for the skill development of local people. Outcomes of those trainings should be monitored as a lesson learnt, before initiating further such types of training;

h. Asbestos in the construction yard is not properly managed which is a serious health hazardous issue for the construction workers and it should be properly and carefully handled.

i. Plantation program should be re-initiated to ensure good and sustainable environment for the workers and employees of the MSTPP;

j. CSR activities should be performed prioritizing the PAPs. This should be audited by a third-party monitoring team;

k. Local people are well aware about the new entrepreneurship development in this area. In this regard, the authority can arrange training on potential scope of entrepreneurship development in the project surrounding unions under the CSR activities;

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

m. Unauthorized internal connection of the ROs pipeline should be cut down immediately to ensure uninterrupted service for the expected households.

1. Introduction

1.1 Background

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

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**). As per the contract, the findings of the previously formulated quarterly monitoring reports have been submitted to BIFPCL.

Monitoring of Environmental parameters and associated data collection is being continued considering the spatial as well seasonal variations. However, CEGIS team has carried out the 37th quarterly monitoring activities in August, 2023 covering all the preselected monitoring parameters.

1.2 Objectives

The prime objectives of the study are:

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

1.3 Criteria for Selection of Monitoring Sites/Locations

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

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

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

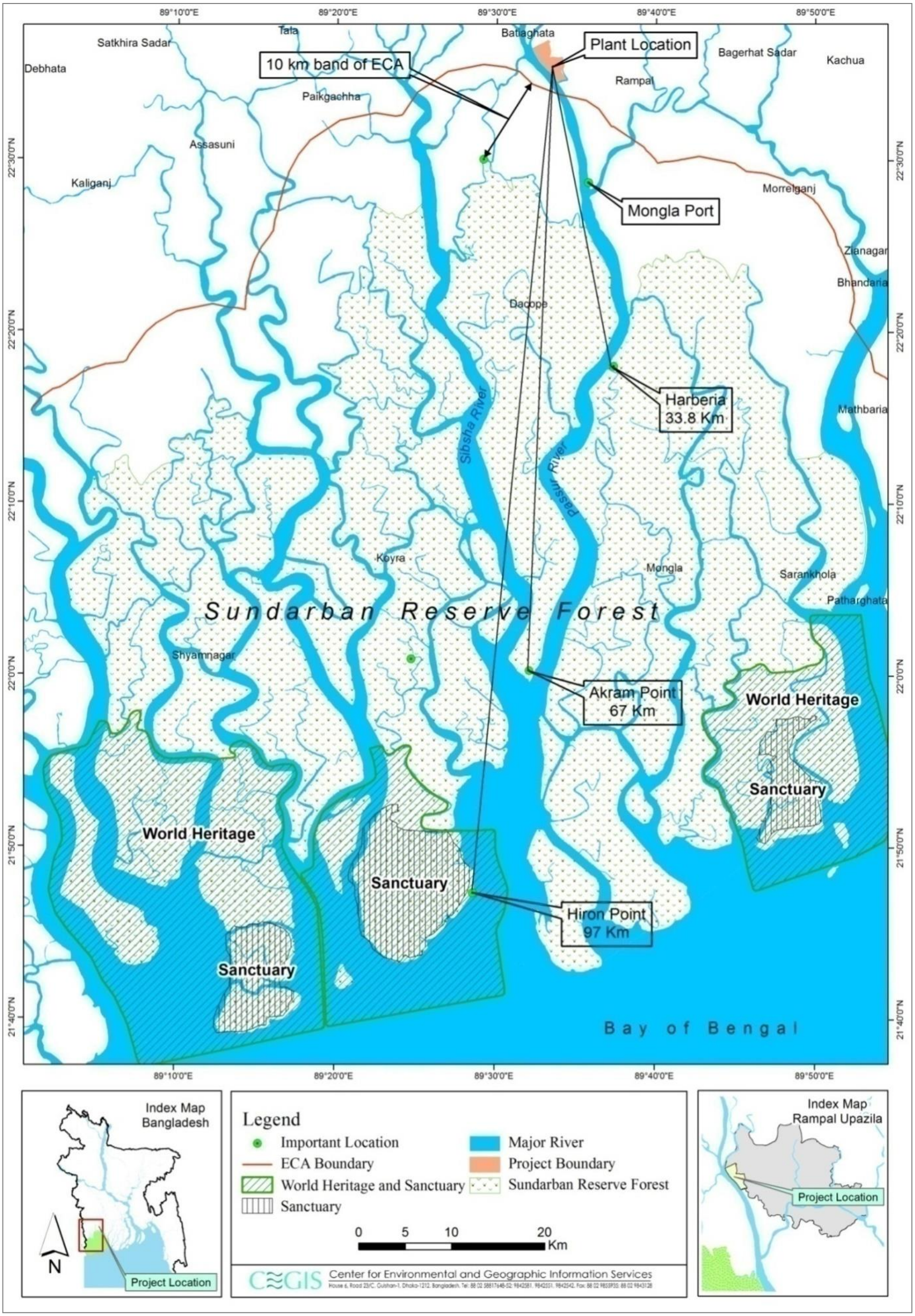


Figure 1.1: Location Map of the Study Area

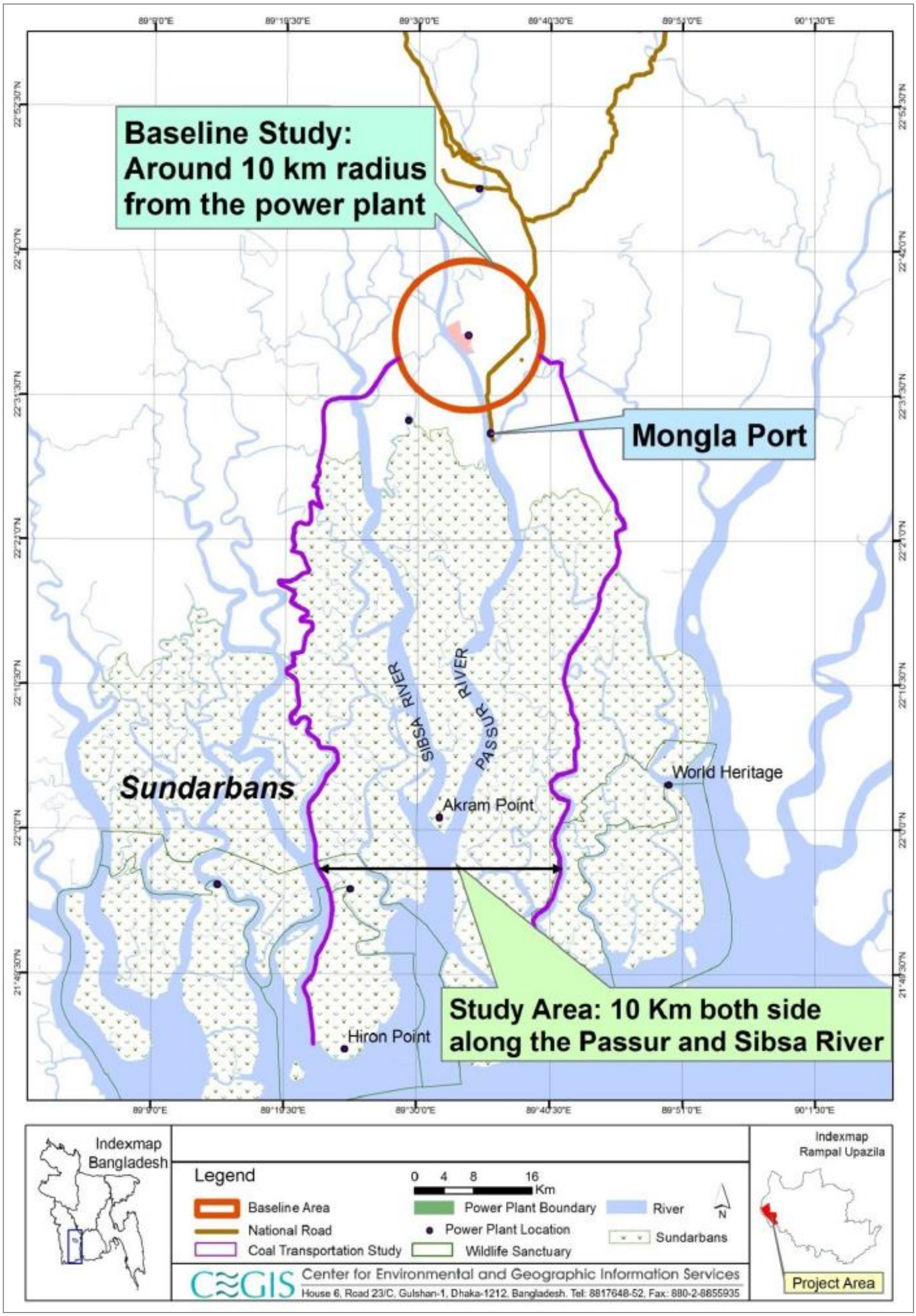


Figure 1.2: AOI of Environmental and Socio-economic Monitoring

1.4 Main Stakeholders

1.4.1 Forest Department

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

- Inclusion of a Soil Scientist and a Botanist in the monitoring team,
- Monitoring of regeneration, in growths (seedlings), diseases and pests (if necessary, to carry out laboratory analysis),
- Monitoring of soil nutrients (macro, micro) and heavy metals,
- Monitoring of floral diversity, species richness and 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 37th quarterly monitoring will also be forwarded to the same officials of the corresponding Departments.

1.4.2 Department of Environment (DoE)

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

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

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

1.4.4 Local Community

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

1.4.5 Major Component of Monitoring Study

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

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

2. Physical Environment

2.1 Air Quality

Air quality parameters and monitoring locations were selected considering the major effects to be exerted by the power project activities during the pre-construction, construction, and operation stages as depicted in the EIA study. During the recent visit, all the preselected parameters and locations were monitored to observe major changes in air quality due to concurrent construction and erection activities of the project. The monitoring team visited in the site from August, 23 to September 08, 2023. Air samples were collected in 13 pre-selected site.

2.1.1 Methodology

During the EIA study the criteria pollutants i.e., Particulate Matters (i.e., $PM_{2.5}$, PM_{10}, and SPM), SOx, NOx, CO and O_3 were expected to be generated from different phases i.e. pre-construction, construction, and operation activities of the Power Plant. However, the monitoring locations as well as the indicators for this study were also selected during the EIA study based on a number of measures e.g., the sensitivity of the receptors, project activities like movement of coal-carrying vessels, coal trans-shipment activities; wind speed, wind direction, atmospheric deposition (Wet and Dry) and atmospheric stability classes etc. However, the Continuous Ambient Air Quality Micro-Monitoring Station (caaqMMS) AirSENCE was used to collect the in-situair quality data. The AirSENCE provides Concentrations for gaseous pollutants including NO, NO_2, CO, O_3, SO_2, VOC, H_2S, and CO_2 and in addition to all particulate matter fractions such as PM_{10}, $PM_{2.5}$, and PM_1.

2.1.2 Pollution Sources in the Sundarbans

The key sources of air pollution around the Mongla Port area and project site can be considered as cement factories, LPG bottling plant, non-regulated mechanized boats, cargo vessels and ships plying to Mongla Port area 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 collection, Golpata and timber collection; tourism etc. could be big contributing sources of air pollutants i.e., Particulate matters ($PM_{2.5}$, PM_{10} and SPM), Oxides of Sulphur (SOx), Oxides of Nitrogen (NOx) and Green House Gases (GHGs) in the study area as well as across the Passur channel. However, an inventory of the existing emission types and sources for the study area has been provided in **Table A2** of **Appendix IV**.

2.1.3 Monitoring Locations

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

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	AirSENCE Continuous Ambient Air Quality Micro monitoring station, model ELITE. It provides concentrations for criteria gaseous pollutants including NO, NO_2, CO, O_3, SO_2, VOC, and CO_2 and for all particulate matter pollutant, fraction sizes including PM_{10}, $PM_{2.5}$, and PM_1.
2		Proposed township area near Chimney location, Mauza: Sapmari Katakhali.	89°32'3.8"E; 22°36'32.5"N		
3		North West corner of the Project boundary (Kaigar Daskati)	89°33'51.8"E; 22°36'1.06"N		
4		Barni, Gaurambha Union (4km North East from the chimney location)	89°34'37.7"E; 22°38'51.8"N		
5		Chunkuri-2, Bajua Union (4km South West from the chimney location)	89°34'01.1"E; 22°32'3.3"N		
6		Pankhali, Dacope, (4km North West from the Chimney location)	89°31'24.2"E; 22°36'6.7"N		
7		Mongla Port Area	89°35'50.4"E; 22°28'24.8"N		
8		Harbaria, Sundarbans	89°35'34.2"E 22°17'43.1"N		
9		Akram point, Sundarbans	89°30'54.1"E 22° '23.50"N		
10		Hiron Point, Sundarbans	89°27'53.2"E; 21°46'27.60"N		
11		Khulna city near Khan Jahan Ali Bridge	89°35'35.5"E; 22°46'36.8"N		
12		Project site-1 (Proposed Township area)	89º 33´ 13.7"E 22º35´43"N		
13		Access road bridge area	89°35'16.49" 22°34'37.11"N		

Figure 2.1: Acquisition of Ambient Air Quality Monitoring

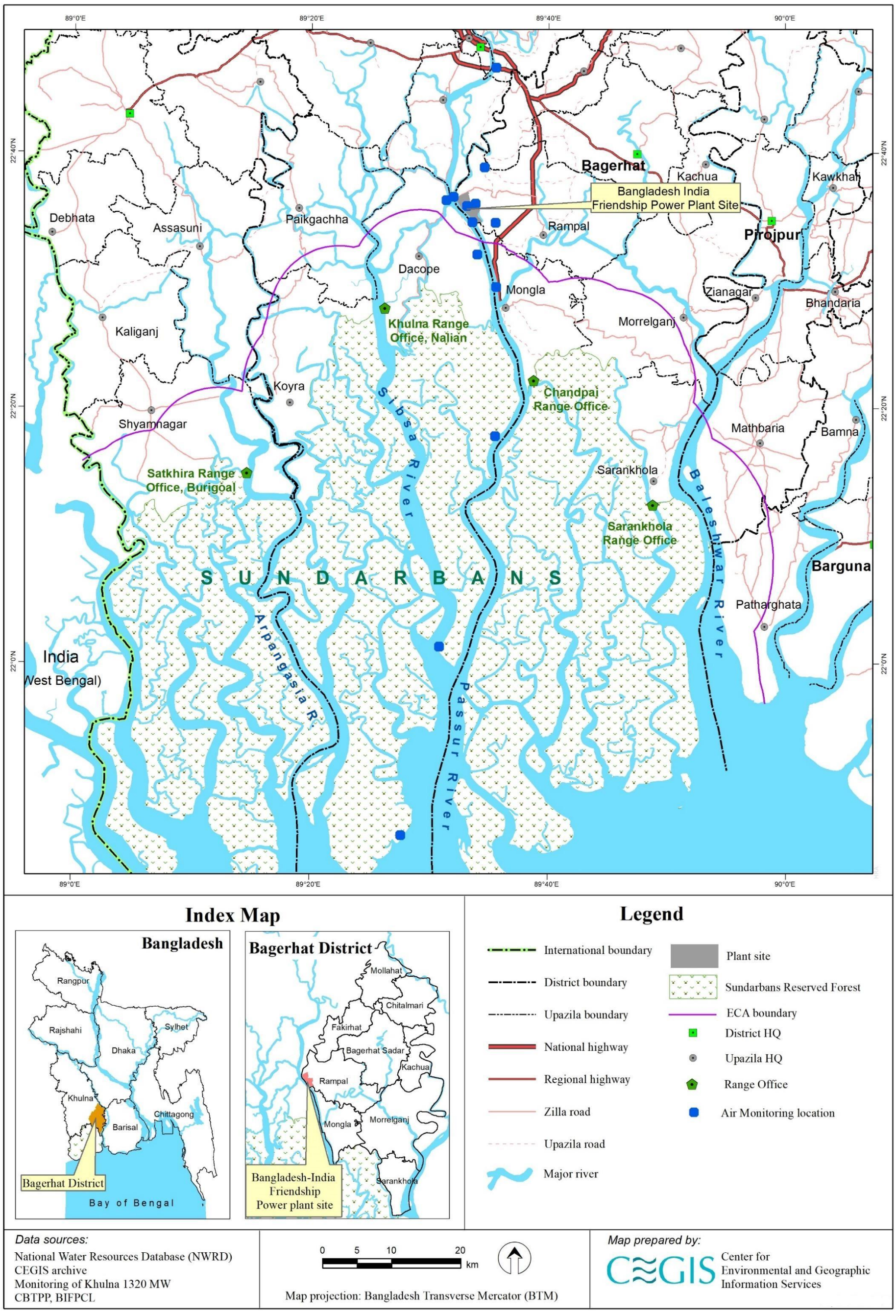


Figure 2.2: Air Quality Monitoring Locations

2.1.4 Status of Air Quality

During this monitoring tier, the maximum value (86.08 μg/m^3) of $PM_{2.5}$ was found at Khan Jahan Ali Bridge area whereas the minimum value (2.28 μg/m^3) was recorded at Hiron point of Sundarbans. Similarly, the concentration of PM_{10} and SPM were also found highest (99.54 μg/m3 and 81.37 μg/m3 respectively) at Khan Jahan Ali Bridge area and the lowest (2.61μg/m3 and 2.26 μg/m3 respectively) at the Hiron Point of Sundarbans area.

However, the concentrations of Sulphur dioxide (SO2) in ambient air were found much lower than the Bangladesh standard limit of (80μg/m3) at all the sampling locations. Among those, the maximum concentration (22.14μg/m3) was found at Khan Jahan Ali Bridge Toll plaza area whereas the minimum concentration (1.08 μg/m3) was recorded at Akram point of Sundarbans area. On the other hand, the values of NOx were also observed well below than the Bangladesh standard value of 80 μg/m3. The maximum concentration (41.6 μg/m3) of NO2 was found at Koigardashkatir Char area whereas the lowest concentration (17.53 μg/m3) was recorded at Hiron Point area. The contributor of such NOx emission may be from local human hauler, car, bus etc. Moreover, the maximum values of CO (0.614 mg/m3) and O3 (22.91 μg/m3) were found at Harbaria area and Khan Jahan Ali Bridge area respectively though the results were found much lower than the standard value (5 mg/m3 and 100 μg/m3 respectively) set in Air pollution control Rules, 2022. From the measured values, it can be concluded that effect of seasonal variations on the surrounding environment may be the prominent reason for increasing or decreasing of the concentrations of the criteria pollutants for the corresponding air sheds.

During the monitoring tier all the criteria pollutants from all locations were observed to be within the standard limit set in Air Pollution Control Rules, 2022. Though the concentration were found to be within the standard limit but specially to minimize the particulate matter as well as the other criteria pollutant's concentration inside the power plant, the authority may take the necessary initiatives as suggested in the EMP of the EIA study e.g. continuous or periodic water spraying on the connected road networks inside the power plant area, install water sprinkler system at the prominent infrastructures like office areas, township area etc. and the major construction area, strictly maintain the vehicular speed at the sensitive areas and properly maintain the EMPs as stated in the EIA study of the power plant. The monitoring results of 37th monitoring program has been shown in **Table 2.2** and all the monitoring results across the monitoring periods are attached in **Table A1** of **Appendix IV.** The baseline emissions scenarios are appended in **Table A2** of **Appendix IV**.

Seasonal varriation

The values of all the criteria pollutants as averaged for the corresponding locations for the corresponding seasons were found to be higher in Khan Jahan Ali Bridge area than the project influence area followed by the Sundarbans reserve Forest (SRF) area. On the other hand, the concentration of the measured parameters was found to be higher in winter seasons of the monitoring periods except for CO, SO_2, & NO_2 which found to be higher in Post-monsoon periods. It is also to be noted that, the concentration of all criteria pollutants was observed to be decreased at Sundarbans area than the previously monitored data of monsoon season except for CO. On the other hand, PM2.5 and PM10 has been found to be increased at Khan Jahan Ali bridge (Toll plaza area) than the previous monsoon period whereas the other parameters were found to be decreased comparing to the same season of the previous year. And, the concentration of PM2.5, SPM and O3 increased comparing to the same season of the previous year though the remaining parameters were observed to be decreased. 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 (Air Pollution Control Rules, 2022) (**Figure 2.3**).

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 Maidara (L1), Shapmari (L2), Koigardashkatir char (3), Gaurambha (L4) and Bajua (L5) represent lower or moderate commercial activities **(Figure 2.4).**

Table 2.2: Air Quality Monitoring Results (37th Quarterly Program)

Sl. No.	Location	Parameters						
		$PM_{2.5}$ (μg/m³)	PM_{10} (μg/m³)	SPM (μg/m³)	SO_2 (μg/m³)	NO_x (μg/m³)	CO (mg/m³)	O_3 (μg/m³)
1	South-West corner of the project Boundary, Moidara	53.38	67.47	52.28	3.04	30.46	0.438	21.77
2	Propose Township area near Chimney location, Mouza-Sapmari Katakhali	44.65	54.76	43.17	7.21	33	0.282	21.83
3	North west corner of the project boundary (Koigardas Kathir Char)	46.66	58.91	45.76	6.6	41.6	0.234	20.39
4	Barni, Gaurambha Union 4 KM North-West from the Chimney location	52.33	65.17	50.75	8.82	34.68	0.22	22.45
5	Bauja Union 4km south west from the chimney location	59.21	73.88	57.88	19.42	38.37	0.442	22.38
6	Chalna Bazar Area, Dacope	45.44	54.87	43.77	12.22	28.75	0.37	18.41
7	Mongla Port area	49.15	74.7	47.16	14.9	20.8	0.4	21.85
8	Harbaria, Sundarban	13.93	15.28	13.43	7.7	35.17	0.614	17.73
9	Akram Point (Sibsa River)	2.63	3.07	2.59	1.08	17.88	0.204	8.32
10	Hiron Point, Sundarban	2.28	2.61	2.26	1.08	17.53	0.138	8.32
11	Khulna Khan Jahan Ali Bridge near toll plaza area	86.08	99.54	81.37	22.14	34.49	0.57	22.91
12	Padma Abashan area	25.7	28.3	24.23	7.57	30.51	0.162	18.58
13	Taltola Bazar/BIFPCL (Project)	28.36	33.23	27.24	4.64	26.49	0.213	18.65
Std* (Air pollution Control Rules, 2022)		65	150	200 (ECR'97)	80	80	5	100

Source: CEGIS field survey, August, 2023; STD-Standard.*

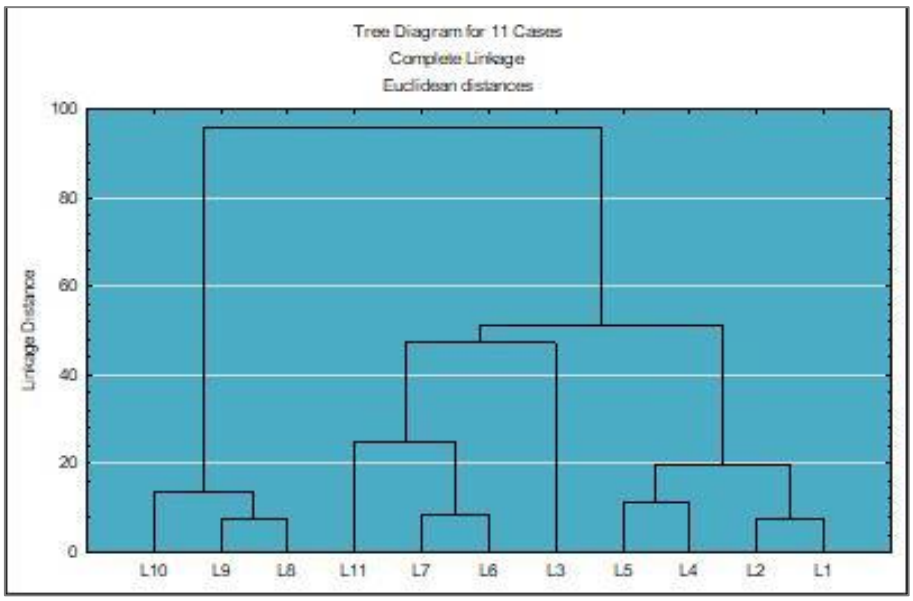


Figure 2.4: Dendogram of the Monitoring Stations using Euclidean Distance

2.1.5 Findings

According to the observed data it can be concluded that, winter is the worst season in terms of air pollution of that area followed pre-monsoon. All of the air pollution remains lower during the monsoon or post-monsoon time due to wet wash of maximum rainy days. SO_2 and NO_x are considerably lower particularly at Sundarbans areas. It increases towards project area and Khan Jahan Ali Bridge areas. Land development works of the project in 2014 increased dust pollution and finalized site development with grassy top soil by the end of 2016 might be responsible for reduced dust level in ambient air. Hiron point, Akram Point and Harbaria 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.

2.2 Noise Quality

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 (dBA).

2.2.1 Methodology

Noise levels were measured thrice in a day (morning, afternoon and evening) at eight locations and twice (morning & afternoon) at three locations around the project and study area. Each time, noise levels were recorded using noise 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 2.6).** The monitoring activities are shown in **Figure 2.5.**

Figure 2.5: Ambient Noise Acquisition during the Monitoring Period

2.2.2 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 **Table 2.3**.

Table 2.3: Noise Monitoring Plan

SL. No.	Monitoring locations	GPS points
1	South West corner of the Project boundary	89°33'34.5"E; 22°34'33.8"N
2	Proposed township area near Chimney location, Mauza: Sapmari Katakhali	89°32'3.8"E; 22°36'32.5"N
3	North West corner of the Project boundary (Kaigar Daskati)	89°33'51.8"E; 22°36'1.06"N
4	Barni, Gaurambha union (4km North East from the chimney location)	89°34'37.7"E; 22°38'51.8"N
5	Chunkuri-2, Bajua Union (4km South West from the chimney location)	89°34'01.1"E; 22°32'3.3"N
6	Pankhali, Dacope, (4km North West from the Chimney location)	89°31'24.2"E; 22°36'6.7"N
7	Mongla Port Area	89°35'50.4"E; 22°28'24.8"N
8	Harbaria, Sundarbans	89°35'34.2"E; 22°17'43.1"N
9	Akram point, Sundarbans	89°30'54.1"E; 22°'23.50"N
10	Hiron Point, Sundarbans	89°27'53.2"E21°46'27.60"N
11	Khulna city near Khan Jahan Ali Bridge	89°35'35.5"E; 22°46'36.8"N

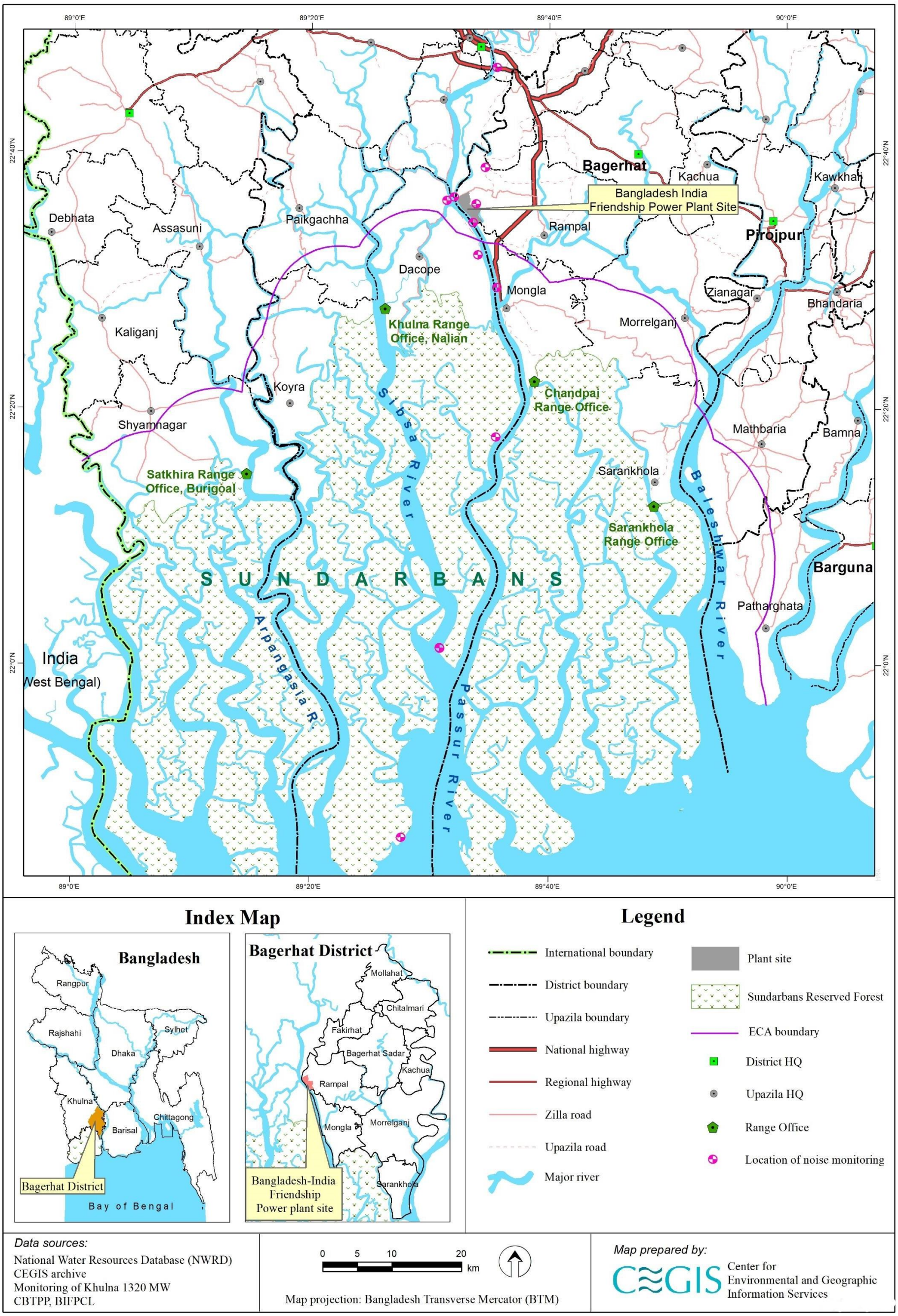


Figure 2.6: Noise Level Monitoring Locations

2.2.3 Noise in the Study Area

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

2.2.4 Status of Noise

In order to provide an overview of the observed noise data set, the average values for the respective locations have been appended in **Table C9 of Appendix IV** for ready reference; but the detailed noise level data have been attached in **Table C1, C2**, **C3, C4, C5, C6, C7, C8,** and **C9** respectively in the **Appendix IV**.

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

Observed level of noise at *Chalna*, a commercial area located at a distance of 4 km to the north-west direction of the chimney location was recorded as 57.13 dB whereas its standard level is 70 dB **(Table C9 of Appendix IV).** Levels of noise at *Kaigar Daskati (*49.06 dB) situated at the Gucchha Gram (a residential area located at north-west corner of the project area) and Chunkuri-2 (49.54 dB) located at 4km south-west direction from the chimney location did not exceed their corresponding standard limit. On the other hand, levels of noise at *Maidara Khal* (the south-west corner of the project area and a residential area) and *Shapmar*i (township area) were recorded as 53.32 dB and 46.67 dB respectively that denotes, the levels of noise didn't cross their corresponding standard value (55 dB) in these two locations **(Table C9 of Appendix IV)**. The level of noise at *Barni (Gaurambha)* was recorded as 53.26 dB which was 6.74 dB lower than that of its standard limit (60 dB) of noise level for this location **(Table C9 of Appendix IV)**. *Harbaria* and *Akram Point* are two ecologically silent zones in the study area. Both of these locations, Harbaria (48.89 dB) and Akram Point (48.09 bB) were not found to exceed their standard limit of noise level (std. 50 dB). The level of noise level at Hiron point was recorded as 54.15 dB whereas its standard reference is 50 dB. This is the only location in this monitoring season where the level of noise shows higher values by 4.15 dB. The level of observed noise at Khan Jahan Ali Bridge and the Mongla port area were recorded as 56.88 dB and 55.31 dB respectively. Whereas, the standard noise limits for Khan Jahan Ali Bridge (a commercial zone) and Mongla port (an industrial zone) during the day are 70 dB and 75 dB, respectively **Figure 2.7** and **Figure 2.8**

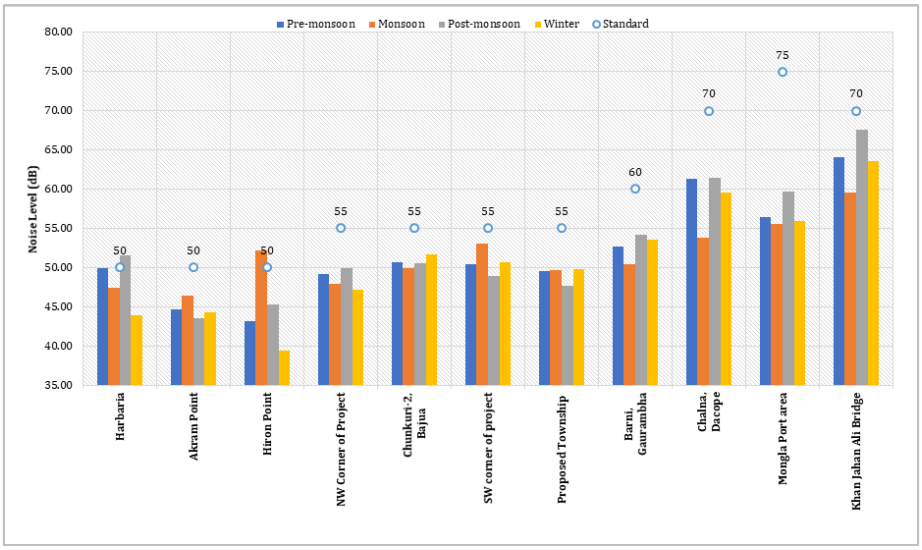


Figure 2.7: Status of Average Seasonal Variations of Noise Level at Different Monitoring Locations

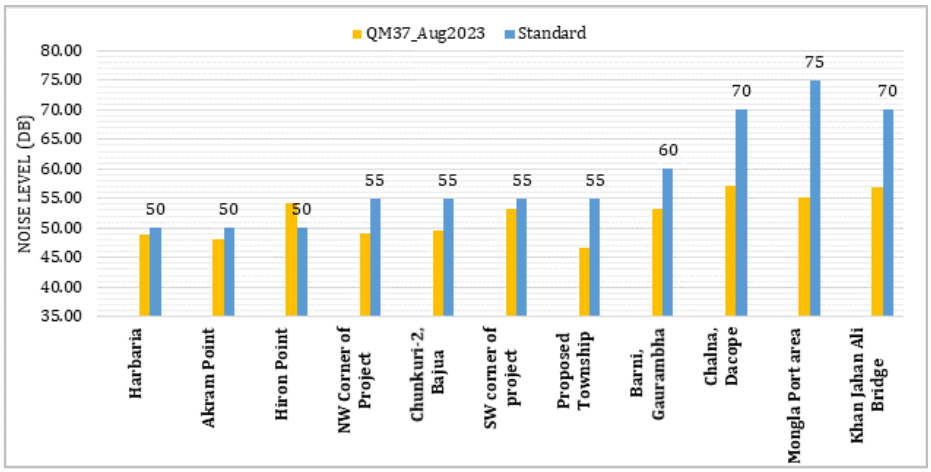


Figure 2.8: Status of Noise Level of 37th Monitoring Season at Different Locatons

2.3 Water Quality

An updated water quality status of the Passur-Sibsa River system and adjacent water bodies has been depicted in this section. Both the national and international guidelines were followed and adopted for sample collection as well as for analysis. This report includes physical water quality parameters collected during the 37th quarterly monitoring tier (August 2023) and the test results obtained from the laboratory up to May 2023 (36th quarterly monitoring program). Several identical parameters as well for the selected locations to understand the effect of power plant activities on the surface and groundwater quality which may affect the aquatic life of the adjacent river, the Sundarbans Forest ecosystem, and community health in and around the power plant area.

2.3.1 Methodology

The procedure for water quality monitoring covers selection of water quality parameters, identification of sampling locations, determination of sampling frequency and evaluation criteria of the monitoring parameters etc. Standard approaches and methodologies were followed for the above-mentioned events. Both the surface and groundwater quality status of the water bodies in and around the Power Plant and the Sundarbans area were examined. The samples were collected from eighteen

(18) pre-selected locations (15 locations for surface water along the Passur River from Chalna to Sibsa River near Akram Point, Maidhara River near the project area and 3 locations for groundwater i.e. project area, Kapashdanga and Rajnagar). However, the standard sampling procedure was followed for both surface and groundwater sampling to reduce the possibility of any error and ach sample was labelled at the time of sampling. The selected monitoring locations for the monitoring program are shown in **Figure 2.10**. 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 2.4** and **Table 2.5** respectively.

2.3.2 Selection of Parameters

The selected parameters for Groundwater quality monitoring 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) etc.

Water Quality Parameters

The selected parameters for surface water and groundwater quality include Temperature, pH, Dissolved Oxygen (DO), Total Dissolve Solids (TDS), Total Suspended Solids (TSS), Total Hardness (TH), Turbidity, Chemical Oxygen Demand (COD), Salinity, Nitrate (NO_3^-), Phosphate (PO_4^{3-}), Sulphate (SO_4^{2-}), Heavy Metals (As, Pb, Hg), and Oil and Grease (for surface water). The parameters were categorized into 4 groups:

- Physical and aggregate properties i.e. pH, Temperature, Salinity, Hardness, TDS, TSS, Turbidity, Oil & Grease (for surface water);
- Inorganic non-metallic constituents i.e., DO, NO_3^-, PO_4^{3-} and SO_4^{2-};
- Aggregate organic constituents i.e. 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 connection with the surface water quality monitoring study (3 locations as per recommendation of the DoE approved coal transportation study monitoring framework as well as approval condition no. 26 and accordingly the analyzed data of the additional parameters are recorded and submitted to the DoE and other authorities periodically.

2.3.3 Sampling Procedure

The study area is highly influenced by tidal variation. Hence, temporal and spatial variations of tides were considered in the sampling procedure. Surface water samples were collected at a distance of 50-100m away from the river bank and 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. Acidified sampling bottles were used for heavy metal (As, Pb, Hg) sample collection. On the contrary, the Analysis of BOD_5 has been discarded because of constraints to maintain the proper procedure to collect, preserve, and lab test the water samples at ideal conditions. All samples were preserved as per standard procedure. The in-situ testing of the selected water quality parameters is shown in **Figure 2.9**. On the other hand, 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 storage. Acidified sampling bottles were used for heavy metals (As, Pb, Hg) sample collection and were preserved following standard procedure.

Figure 2.9: Water Sample Collection and Insitu Testing of Water Parameters

Table 2.4: Groundwater Quality Monitoring Parameters, Locations and Plan

Sl. No.	Sampling Locations ID	Locations	GPS (Decimal Degree)		Frequency	Methods/Monitoring indicators/ Techniques
			Easting	Northing		
1	SL-1	Near Proposed Township Area	89.566139˚E	22.594167˚N	Quarterly	In-situ testing of physical water quality parameters was done by Horiba U-50 multi-meter. Preservation of samples and Laboratory analysis were carried out at DPHE Central Laboratory and BCSIR
2	SL-2	Rajnagar	89.576056˚E	22.612528˚N		
3	SL-3	Kapashdanga	89.563000˚E	22.622528˚N		

Table 2.5: Surface Water Quality Monitoring Parameters, Locations and Plan

Sl No	Monitoring Indicators	Sampling Locations ID	Locations	GPS (Decimal Degree)		Frequency	Methods/Tool /Techniques
				Easting	Northing		
1	pH, Temperature, Salinity, DO, BOD_5, TDS, TH, TSS, COD, Nitrate, Sulphate, Phosphate, Arsenic, Lead, Mercury, Oil & Grease, PAH, TOC, TC	SL-1	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 testing of physical water quality parameters was done by Horiba U-50 multi-meter. Preservation of samples and Laboratory analysis were carried out at DPHE Central Laboratory and BCSIR
2		SL-2	Middle of Passur River at 100m u/s of North West corner of the Project boundary	22.607222°N	89.528889°E		
3		SL-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		SL-4	Left Bank of Passur River at Project Site-Jetty	22.584833°N	89.543583°E		

Sl No	Monitoring Indicators	Sampling Locations ID	Locations	GPS (Decimal Degree)		Frequency	Methods/Tool /Techniques
				Easting	Northing		
5		SL-5	Middle of Passur River at Project Site-Jetty	22.587667°N	89.546472°E		
6		SL-6	Right Bank of Passur River at Project Site-Jetty	22.589333°N	89.548222°E		
7		SL-7	Left Bank of Passur River at South West corner of the Project boundary	22.572889°N	89.552583°E		
8		SL-8	Middle of Passur River at South West corner of the Project boundary	22.574611°N	89.557500°E		
9		SL-9	Right Bank of Passur River at South West corner of the Project boundary	22.575667°N	89.559861°E		
10		SL-10	Maidara river at the South East corner of the project boundary at Ichamoti-Maidara confluence	22.600639°N	89.565611°E		
11		SL-11	Maidara river near proposed Township area	22.577472°N	89.569250°E		
12		SL-12	Passur river at Passur – Ghasiakhali confluence	22.473861°N	89.602361°E		
13		SL-13	Passur river at Harbaria of the Sundarbans Reserve Forest area	22.295250°N	89.593139°E		
14		SL-14	Passur river at Akram Point of the Sundarbans Reserve Forest Area	22.024120° N	89.514220°E		
15		SL-15	Passur river at Hiron point of the Sundarbans Reserve Forest Area	21.774183°N	89.464778°E		

2.3.4 Water Quality Parameter Analysis Techniques/Methods

Water quality parameters were analysed as per the procedure of American Public Health Association (APHA) standard. The analysis procedures of different parameters along with the standards are given in **Table 2.6**.

2.3.5 Water Quality Reporting Arrangement

The 37^{h} quarterly report covers yearly variations of Winter up to January, 2023 for chemical water quality status and yearly variations for pre-monsoon in physical water quality status up to May, 2023 and are presented and compared with the ECR' 2023 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 2.7.**

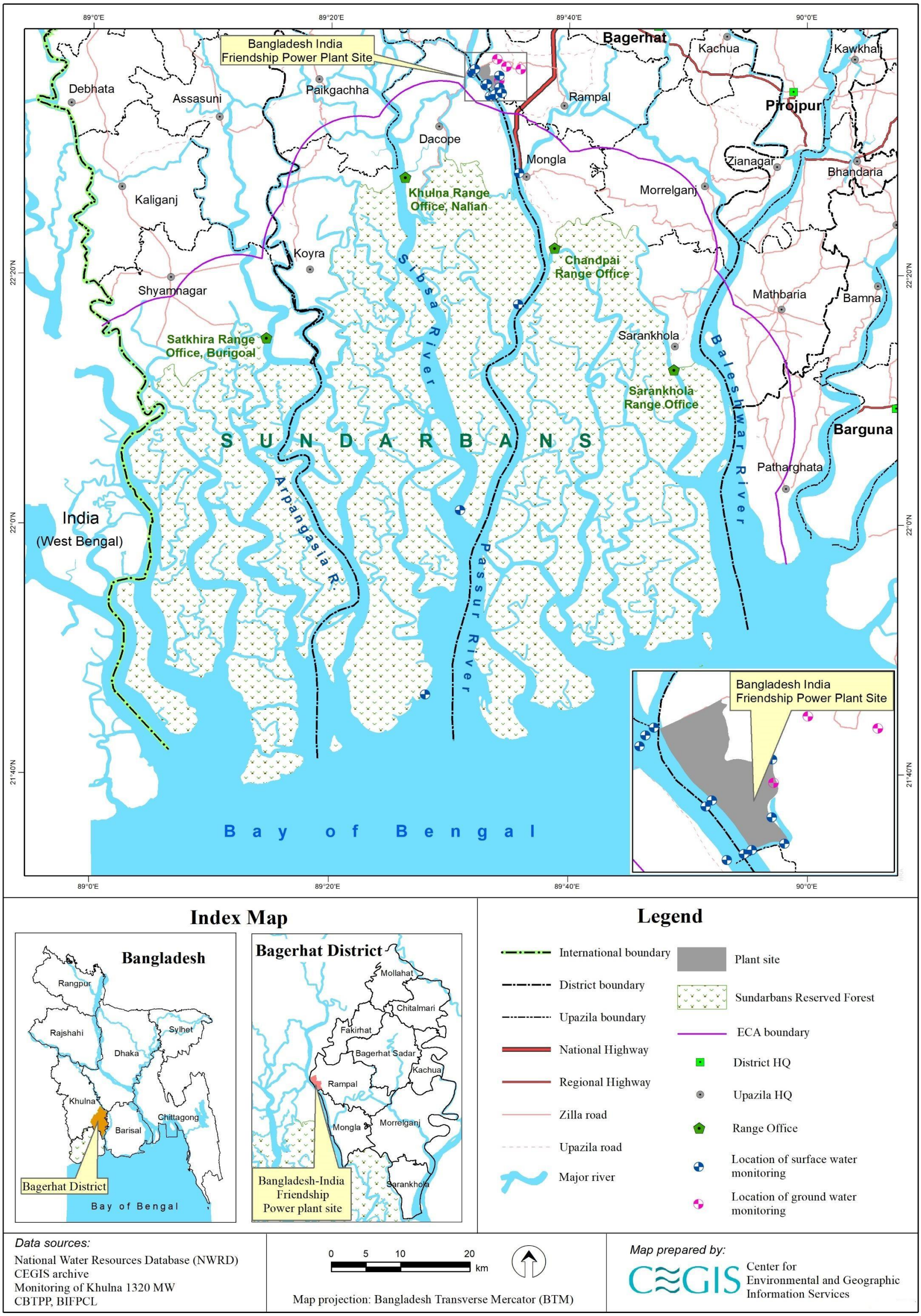


Figure 2.10: Surface Water and Groundwater Quality Monitoring Location

Table 2.6: Testing Methodology of Water Quality Parameter

Parameters	Methods/Measuring Tools	Unit	BD Standard (Drinking Water Quality; ECR' 2023)
Temperature	Horiba U-50 multimeter	0C	20 - 30
Salinity	Horiba U-50 multimeter	ppt	N/A
pH	Horiba U-50 multimeter	-	6.5-8.5
TDS	Horiba U-50 multimeter	ppm or mg/L	1000
TSS	Gravimetric method	ppm or mg/L	10
DO	Horiba U-50 multimeter	ppm or mg/L	6
TH	Titrimetic	ppm or mg/L	200-500
COD	CRM	ppm or mg/L	4
Nitrate (NO3-)	UV-VIS Spectrophotometers	ppm or mg/L	45
Pjosphate	UV-VIS Spectrophotometers	ppm or mg/L	6
Sulphate (SO42-)	UV-VIS Spectrophotometers	ppm or mg/L	250
Oil and Grease	Liquid-liquid extraction with hexane, treatment with silica gel and gravimetric determination	ppm or mg/L	0.01
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	0.01
Mercury (Hg)	Mercury Analyzer	ppm or mg/L	0.001

Table 2.7: Monitoring Sites and Characteristics

SL	Monitoring sites	Site Characteristics
(a)	Power plant & adjacent areas	Total 11 sampling points were selected and the values were averaged to represent the water quality status of power plant adjacent surface water bodies. These 11 sampling points are situated in the same river system or network and embedded within 1km radius of power plant area. 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 is situated at least 13km downstream of the power plant. This point is a confluence area of Passur River and Mongla-Ghasiakhali channel. Around this point, the terrestrial ecosystem is mostly dominated by agricultural lands followed by rural settlements.
(c)	Harbaria	Harbaria site is situated around 15 km downstream of the Mongla/Ghasiakhali and Passur confluence. This site is dominated by Sundarbans Forest and heavily influenced by the activities of mother vessels unloading and small cargo movement for carrying of clinker, coal and LPG gas. It is to be noted here that the tidal effects of Bay of Bengal are very prominent here.
(d)	Akram point	Akram point is located around 35 km downstream of the Harbaria point. This site is situated at the confluence point of Passur and Sibsa River. 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 the Bay of Bengal.

2.3.6 Monitoring Results and Discussion

Status of Surface Water Quality

In-situ Tested Parameters

The in-situ tested results obtained up to the 37th monitoring period (August 2023: Monsoon season) are described below:

- The observed pH values ranged between 8.3 and 7.21. The highest value (8.3) was found at the Right Bank of the Passur River at South West corner of the Project boundary and the lowest (7.21) was observed at the Left Bank of the Passur River at 100m u/s of North West corner from the Project boundary. However, the values indicated are slightly basic during this Monsoon season and completely comply with the ECR'2023. During the monitoring period, the temperature varied from 31.7^{0}C- ^{0}C among the monitored sites. The maximum water temperature (31.7^{0}C) was recorded at the Left Bank of Passur River at 100m u/s of the west corner from the Project boundary. On the other hand, the lowest temperature was recorded in the Hiron point of the Sundarbans area. Salinity concentration ranged between 2.8 ppt. to 0.1 ppt. among the monitoring sites. Maximum salinity was recorded Hiron point of Sundarbans. This higher salinity concentration was due to the tidal flow from the direction of downstream to upstream. Among the sites, the DO level was found to be highest (7.9 mg/L) in the Hiron point of the Sundarbans area.

The laboratory-tested results obtained up to the 36th monitoring period (January 2023: winter season) are described below:

- TDS (Total Dissolved Solids) was found to be highest (21000 mg/L) at the Akram point of Sundarbans. In general, the TDS values increase in Pre-monsoon and winter seasons than in monsoon and post-monsoon periods which could be the contribution of less rainfall and decreased upstream flow to its dilution in the rainy season (Izonfuo and Bariweni, 2001)[2]. Similarly, the TH was also found to be highest (5250 mg/L) in the Akram point of Sundarbans. Unlike TDS, TH is affected by the insufficient freshwater supply due to low rainfall during winter and pre-monsoon periods and seawater i.e. saline water intrusion toward upstream (Rahman et al., 2013) which contains a huge quantity of minerals including calcium and magnesium and ultimately make the water hard.
- On the contrary, TSS was found to be higher in Pre-monsoon and winter seasons than those of monsoon and post-monsoon seasons which may be due to relatively low precipitation and less upstream freshwater flow, urban runoff, industrial wastes, bank erosion, bottom feeders (such as carp), algae growth or wastewater discharges, etc. During the monitoring period, TSS was found to be highest (25 mg/L) at the Left Bank of Passur River at 100m u/s of the North-West corner from the Project boundary.
- Among the monitoring sites, the Right Bank of Passur River at the southwest corner of the Project boundary got the highest COD value i.e. 496 mg/L during the monitoring period. Over the year, COD concentration was found to be higher in pre-monsoon followed by winter as these seasons had insignificant rainfall compared to those of other seasons which increased the density of organic matter. However, the Nitrate value was found highest (13.96 mg/L) in the Passur Ghashiakhali confluence area. On the other hand,

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

Phosphate was found highest (2.53 mg/L) at the Left Bank of Passur River at Project site Jetty than the other monitoring sites whereas the Sulfate was found highest (194.84 mg/L) at the Akram point of Sundarbans. Moreover, during the last monsoon period, Arsenic concentrations ranged between 0.001 mg/L to 0.003 mg/L among all the monitoring locations. On the other hand, the concentration of Pb ranged from 0.003 to 0.012 mg/L. (The variations in concentration of different parameters over the monitoring periods are shown in **Figure 2.11** to **Figure 2.23.**

Findings

The physicochemical properties of Passur River change with the tidal intrusion in different seasons. During the 37th quarterly monitoring, pH was found slightly basic. Salinity, Temperature, and Dissolved Oxygen level was found in fair and favourable for the aquatic life forms. TDS and TH have been found relatively the same for the same seasons of the last consecutive years. On the other hand, Nitrate (NO_3^-) and Phosphate (PO_4^{3-}) levels were found to exceed the standard set by the ECR'2023. The Sulphate concentrations were found relatively higher in the post-monsoon and winter periods than in the monsoon seasons. In the case of metal pollution, no significant variation was recorded for As and Pb but this time the value was found to be 0.003 mg/L and exceeded the previously obtained values from all locations i.e. 0.001 mg/L which slightly exceeded the ECR' 2023 standard as set in the ER'2023. Oil & grease concentration was found less than 2.0 mg/L at all sites like the previous monitoring periods which is less than the recommended concentration.

2.3.7 Status of the Groundwater Quality

The in-situ tested results obtained up to the 37th monitoring period (August 2023: Monsoon season) are described below:

- pH was found to range between 7.1 to 7.6 among the monitoring sites which seemed to be slightly alkaline but not breach the ECR '23 (6.5-8.5) and the temperature was found to range between 29^{0}C to 30.1^{0}C where the highest temperature was recorded in Kapashdanga i.e. 30.1^{0}C. Similarly, the salinity was found to be higher in the Kapashdanga site (0.4 ppt.) than in the other two sites. However, DO and TDS values ranged between 3.8-4.1 mg/L and 350 mg/L -1300 mg/L respectively. Though the TDS concentration in the monsoon season was found to have breached the ECR'2023 (1000 mg/L) in general, TDS values were hardly observed to breach the ECR '23 in other seasons.
- On the other hand, TSS values were found to range between 1 mg/L to 3 mg/L at all locations which completely complied with the national standard (10 mg/L). TH and COD values were observed to range between 190 to 1200 mg/L and (28-36 mg/L) respectively among all the monitoring sites. Nitrate values (0.78-6.31 mg/L) were found to comply with the national standard (45 mg/L). Similarly, Sulphate concentration (0.88 -14.7 mg/L) was also found to be complied with the national standard (250 mg/L).
- Moreover, Arsenic concentration was found highest in Kapashdanga (0.042 mg/L) which is very close to the national standard. The higher amount of Arsenic in Kapashdanga is not seen to have prevailed at all seasons but for the winter and pre-monsoon seasons of 2022 and 2023, the exceedances are being observed. The owner of the tube well has been notified about the exceedance and guided accordingly. The prominent sources of arsenic contamination in groundwater in Bangladesh are still a matter of debate as no single cause

can interpret the contamination processes (Islam et al., 2010)[3]. The most widely discovered two theories for the background of arsenic contamination of groundwater in Bangladesh may be the pyrite oxidation and iron oxyhydroxide reduction (Saha and Rahman, 2020)[4]. However, PB concentration was found to range n between 0.002-0.003 mg/L which completely complies with the national standard (0.01 mg/L). The variations in concentration of different parameters over the monitoring periods are shown in **Figure 2.24** to **Figure 2.35.**

Remarks

This concluding remark represents that the physical characteristics of groundwater quality are still in good condition with slight variations in pH and salinity. The reason is saline water intrusion and infiltration due to the excessive withdrawal of groundwater by the surrounding communities during the dry season but during the monsoon season, the water becomes less saline as the aquifer recharges during the monsoon season. During the monitoring tier in May 2023, TDS values were found higher than the ECR'2023 which might be because Before monsoon, the water chemistry is governed by the weathering of carbonate and silicate minerals, reverse ion exchange and evaporation processes, which resulted in high EC, TDS, TH and major ions in the groundwater.[5] On the other hand, during winter and pre-monsoon concentration was found to breach the national water quality standard two times at Kapashdanga. The reason behind this exceedance is very hard to interpret (Islam et al., 2010) but the most widely discovered two theories for the background of arsenic contamination of groundwater in Bangladesh may be the pyrite oxidation and iron oxyhydroxide reduction (Saha and Rahman, 2020).

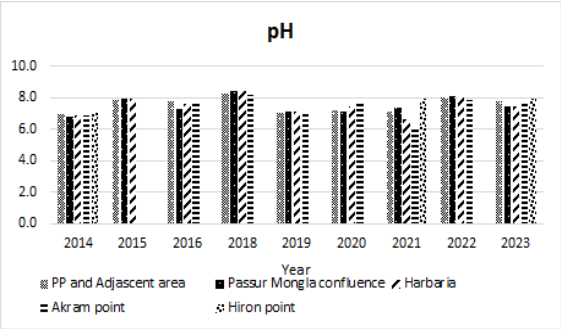


Figure 2.11: Variations in pH Values in Different Monitoring Sites

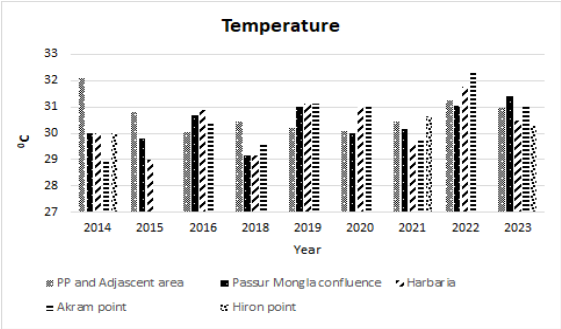


Figure 2.12: Variations in Temperature Values in Different Monitoring Sites

[3] M.S. Islam, F. Islam, W.W. IWA., Arsenic contamination in groundwater in Bangladesh: an environmental and social disaster. IWA Water Wiki (2010).

[4] N. Saha, M.S. Rahman., Groundwater hydrogeochemistry and probabilistic health risk assessment through exposure to arsenic-contaminated groundwater of Meghna floodplain, central-east Bangladesh. Ecotoxicol. Environ. Saf. 206 (2020), Article 111349, 10.1016/j.ecoenv.2020.111349.

[5] E. Manikandan, N. Rajmohan, S. Anbazhagan, Monsoon impact on groundwater chemistry and geochemical processes in the shallow hard rock aquifer, CATENA, Volume 195, December 2020, 104766.

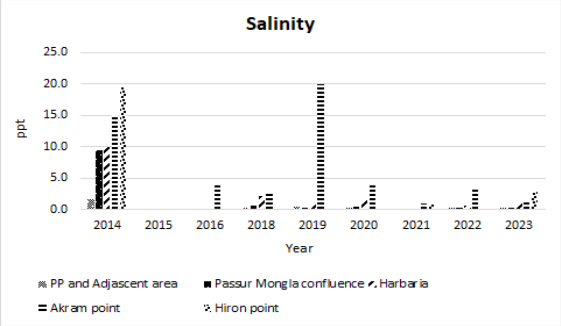


Figure 2.13: Variations in Salinity Values in Different Monitoring Sites

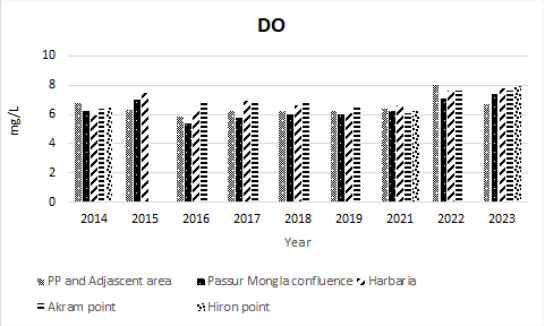


Figure 2.14: Variations in DO Values in Different Monitoring Sites

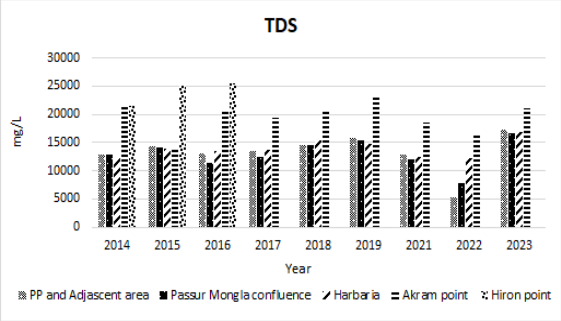


Figure 2.15: Variations in TDS Values in Different Monitoring Sites

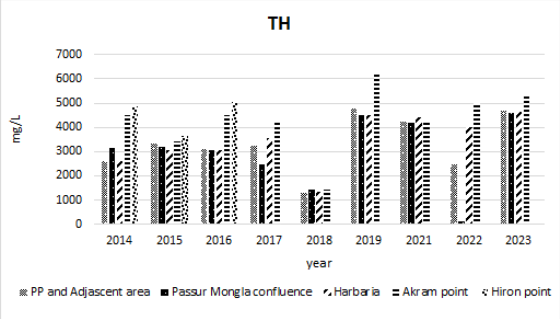


Figure 2.16: Variations in TH Values in Different Monitoring Sites

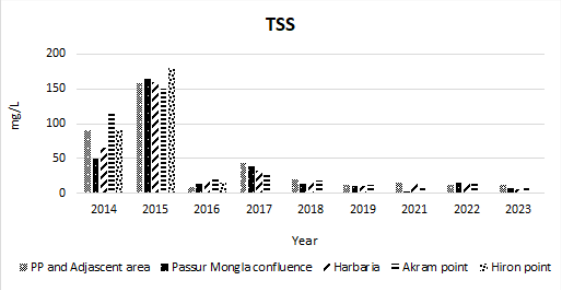


Figure 2.17: Variations in TSS Values in Different Monitoring Sites

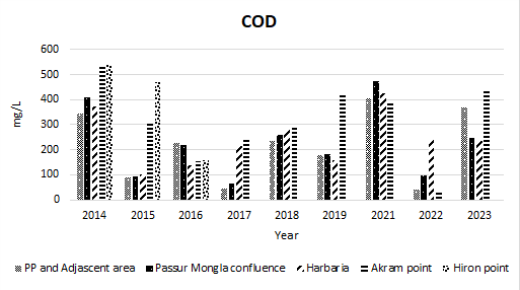


Figure 2.18: Variations in COD Values in Different Monitoring Sites

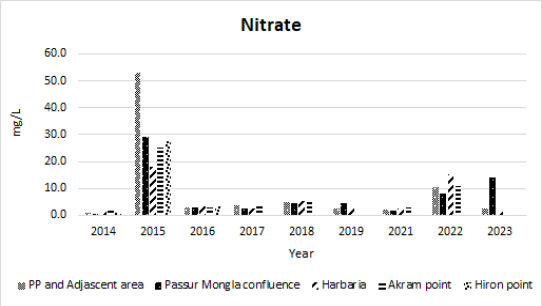


Figure 2.19: Variations in Nitrate Values in Different Monitoring Sites

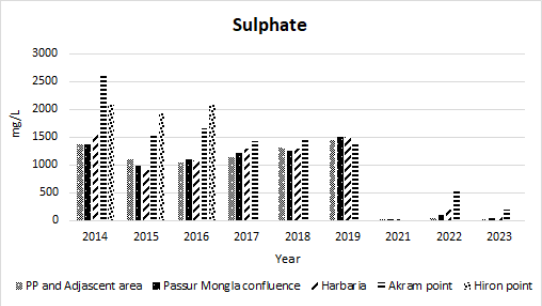


Figure 2.20: Variations in Sulphate Values in Different Monitoring Sites

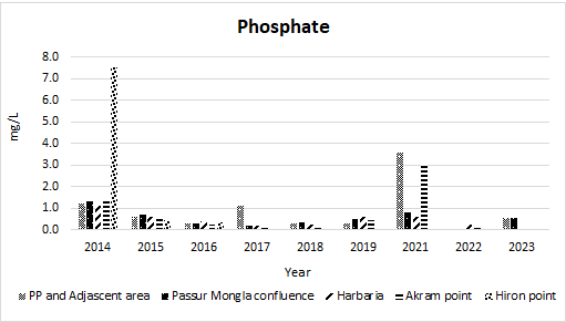


Figure 2.21: Variations in Phosphate Values in Different Monitoring Sites

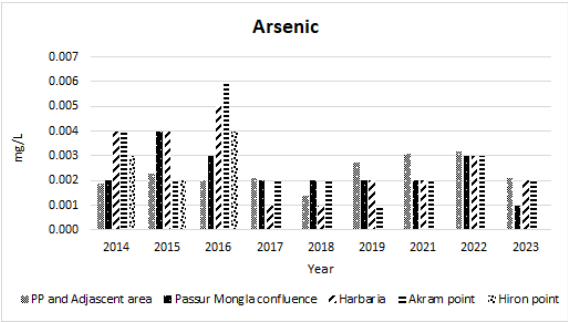


Figure 2.22: Variations in Arsenic Values in Different Monitoring Sites

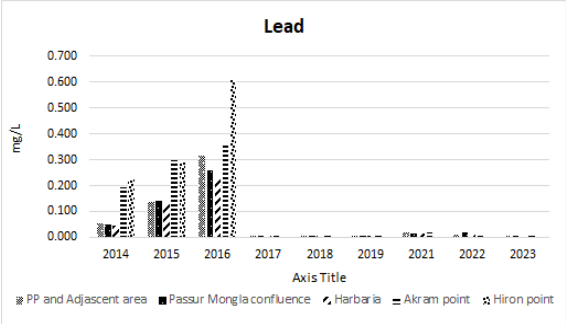


Figure 2.23: Variations in Lead Values in Different Monitoring Sites

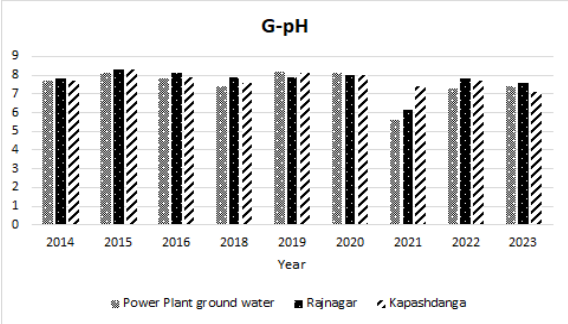


Figure 2.24: Variations in G-pH Values in Different Monitoring Sites

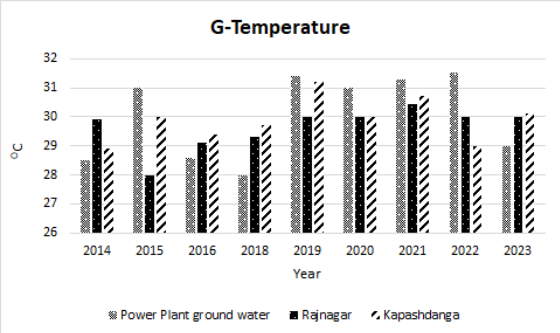


Figure 2.25: Variations in G-Temperature Values in Different Monitoring Sites

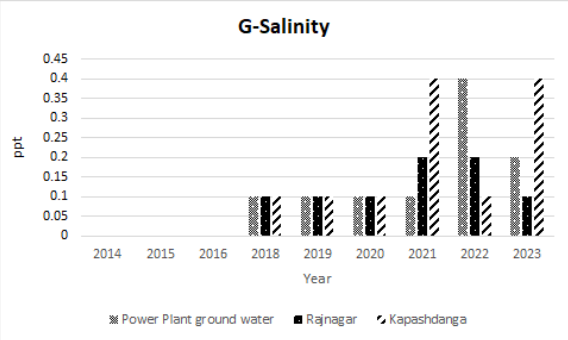


Figure 2.26: Variations in G-Salinity Values in Different Monitoring Sites

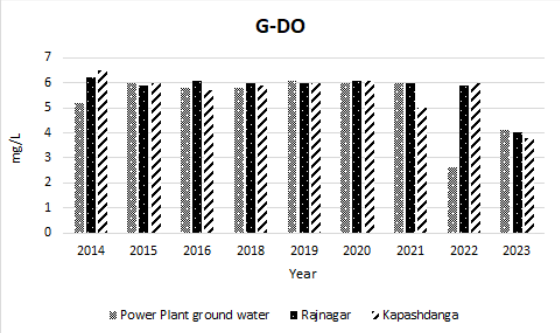


Figure 2.27: Variations in G-DO Values in Different Monitoring Sites

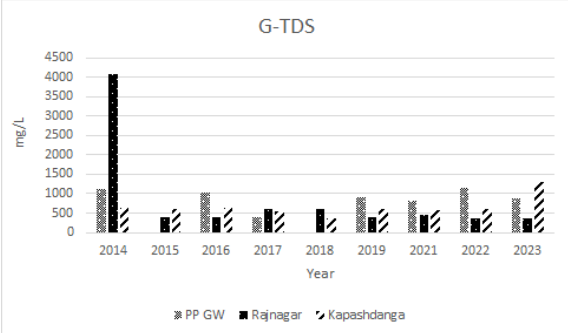


Figure 2.28: Variations in G-TDS Values in Different Monitoring Sites

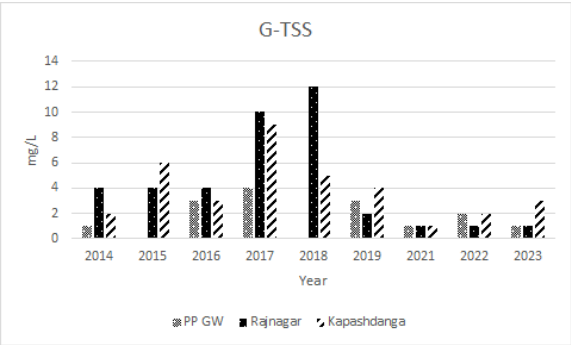


Figure 2.29: Variations in Monsoon G-TSS Values in Different Monitoring Sites

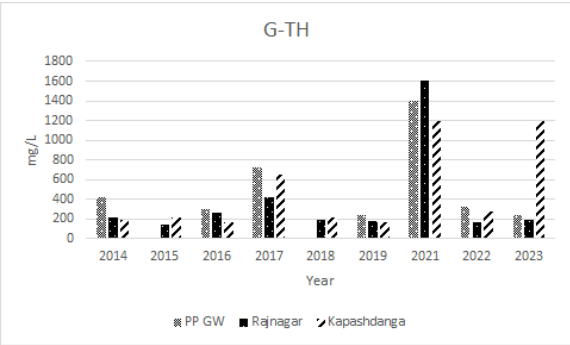


Figure 2.30: Variations in Monsoon G-TH Values in Different Monitoring Sites

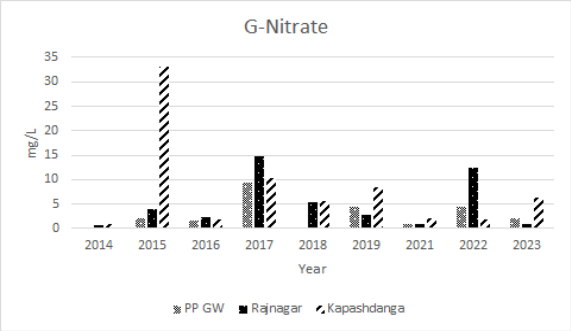


Figure 2.31: Variations in G-Nitrate Values in Different Monitoring Sites

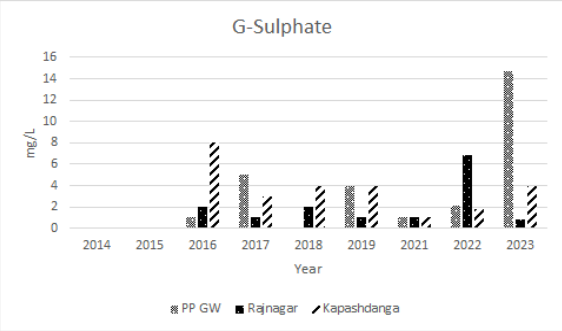


Figure 2.32: Variations in Monsoon G-Sulphate Values in Different Monitoring Sites

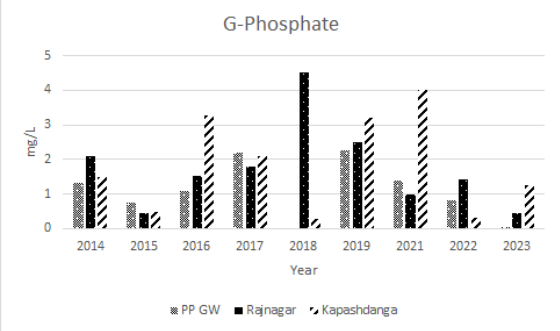


Figure 2.33: Variations in Monsoon G-Phosphate Values in Different Monitoring Sites

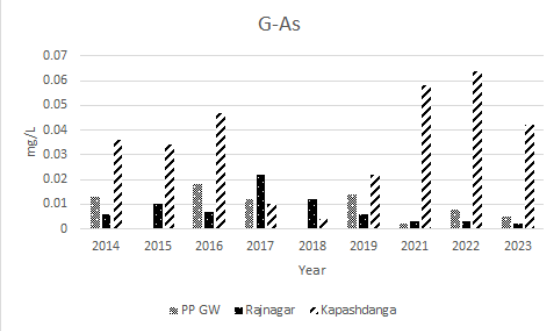


Figure 2.34: Variations in Monsoon G-Arsenic Values in Different Monitoring Sites

2.4 Land and Agricultural Resources Monitoring

2.4.1 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. The sampling locations with their corresponding coordinates are stated in Table 2.8. Locations of collected soil samples are presented in **Figure 2.36.**

Table 2.8: Land Resources Monitoring Plan

Site No.	Monitoring indicators	Location	GPS (Decimal Degree)		Sampling Frequency	Methods/ Tools/ Techniques
			Northing	Easting		
1	Plot use, Soil fertility and nutrient, Chemical properties of soil (pH, Pb, Cd), Crop production and damage	Mouza: Baranpara, Union: Gangarampur; Upazila: Batiaghata, District: Khulna	22°37′57.0″	89°30′59.1″	Bi-yearly (April and October)	In situ field sampling and Laboratory Testing in SRDI
2		Mauza: Chunkuri-2, Union: Bajua; Upazila: Dacope, District: Khulna	22°34′51.0″	89°32′20.0″		
3		Mouza: Kapalirmet/Buridmial Union: Burirdanga, Upazila: Mongla; District: Bagerhat	22°32′18.9″	89°36′8.8″		
4		Mouza: Chakgona, Union: Rajnagar Upazila: Rampal, District: Bagerhat	22°34′18.3″	89°34′25.3″		
5		Mouza: Basherhula, Union: Rajnagar; Upazila: Rampal, District: Bagerhat	22°36′14.0″	89°34′25.0″		
6		Mouza: Bidyarbon, Union: Burirdanaga; Upazila: Mongla, District: Bagerhat	22° 33′ 42.0″	89° 34′ 40.0″		

2.4.2 Methodology

Plot/land use, soil fertility/nutrient status, soil contamination with heavy metals and soil salinity are considered as the major indicators for land resources monitoring. 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 the 34th quarterly monitoring visit (November, 2022) and sent immediately to laboratory for analysis. The analysis data has been incorporated with this monitoring report.

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.

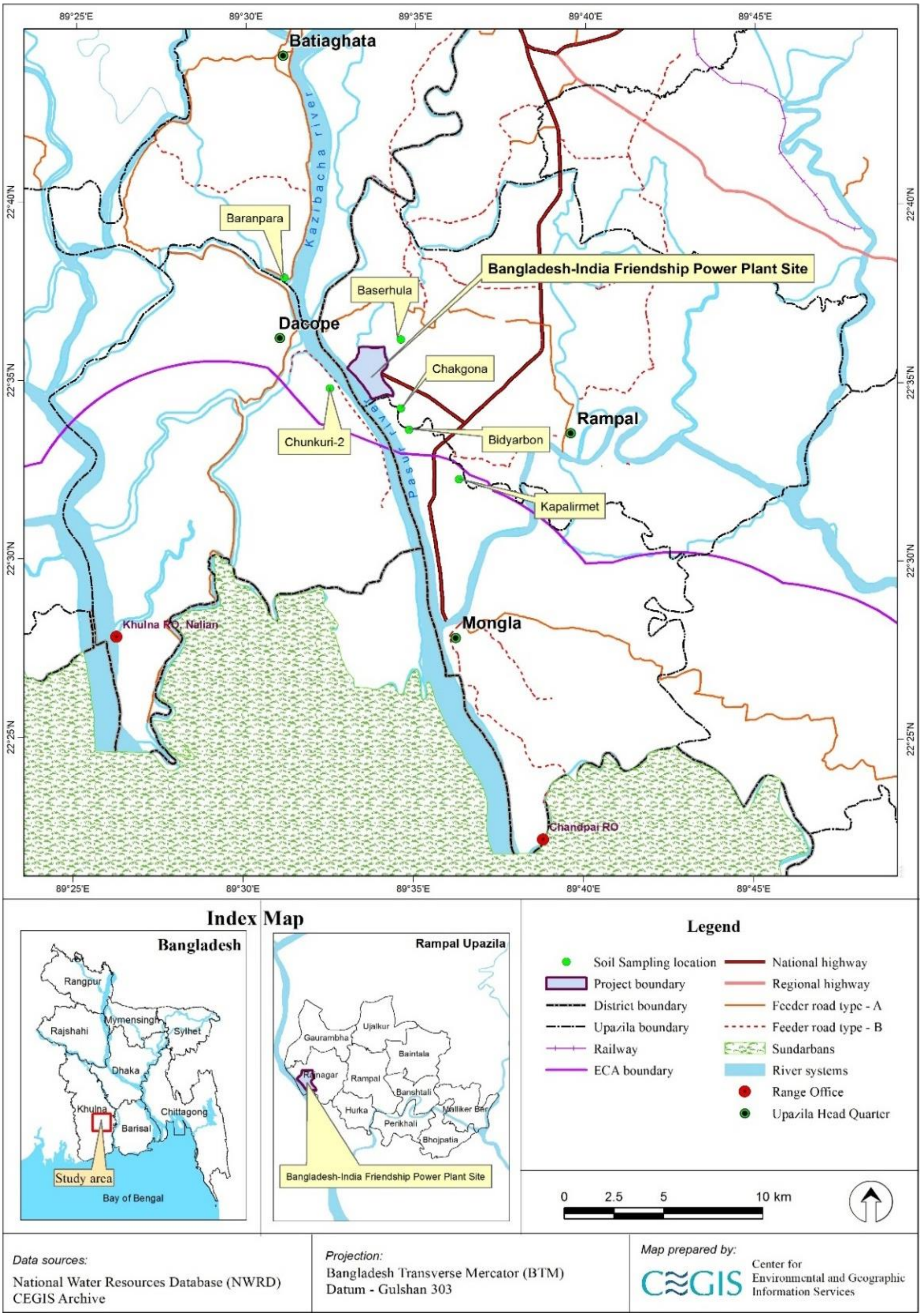


Figure 2.35: Location of Soil and Agricultural Resources Monitoring

Monitoring Indicators

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. The structural change of soils in the sampling plots can 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:

$$ESP = \frac{[Na]^+}{CEC} X100$$

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 following.

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

Soil Repources Monitoring

2.4.3 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 (37th monitoring) report.

2.4.4 Status of Soil Quality of Monitoring Plots

Soil quality (dry season) of the monitoring plots are given below:

Monitoring Plot-1 (Baranpara)

Soil fertility and health is largely depending on salinity of the study area. According to the last soil chemical analysis, all salinity related parameters (EC, SAR, ESP) has been decreased of which EC decreases for second consecutive year. This might be due to the decrease of both mono-valent cation (Na and K) and divalent (Ca and Mg) cations. K, Na and Ca concentration has been decreased for the first time in last three years while Mg decrement continues for two consecutive year. Decrease of overall salinity is good for soil health and fertility. pH is also decreasing.

Top soil organic matter has been increased compared to last dry season. Nitrogen and Phosphorus follows the similar trend. This might be an effect of good agricultural practice. Only Sulphur concentration decrease this year. Boron and Manganese concentration jumped back after last year drop while iron concentration continues to increase for three consecutive year.

Only Zinc concentration has been decreased in this monitoring spot. Lead concentration has been deceased after last year jump while cadmium concentration has been increased significantly during this monitoring. But both of the element's concentration remains within the maximum permissible limit in soil. The changes in concentration for the selected parametes are shown in **Figure 2.37** to **Figure 2.52**.

Monitoring Plot-2 (Chunkuri-2)

Good agricultural practice was found in this monitoring plot. As a result, soil condition has improved from the previous monitoring in terms of salinity. All salinity related parameters (EC, SAR, ESP) have been decreased during this monitoring of which EC reduced to historical low of last 5 years. The monitored base cations, both monovalent (Na and K) and divalent (Ca and Mg), concentration have been decreased.

Among the base cations, Na, K and Ca concentration has been dropped after two years rise while Mg concentration continues to decrease for two consecutive year. Decrease of overall salinity is good for soil health and fertility. pH is also decreasing. Compared to the previous dry season, the organic matter in the top soil has decreased. Due to the monitoring plot's exposure to the surrounding river, soil erosion may be an issue. The trends for nitrogen and phosphorus are similar.

Only the concentration of sulfur increased this year. Regarding micro elements (B, Fe, Mn and Zn) concentration, all showed decreasing trend for two consecutive year. While cadmium concentration has increased significantly during this monitoring, lead concentration has decreased since the previous year's peak. However, neither element's concentration exceeds the permissible limit in soil. The changes in concentration for the selected parametes are shown in **Figure 2.37** to **Figure 2.52**

Monitoring Plot-3 (Kapalirmet)

This monitoring plot was used for fish cultivation during pre-monsoon and post monsoon period. Decreasing salinity was a common scenario of this monitoring plot due to leaching and continues lentic ecosystem. During this monitoring this situation altered as EC, SAR and ESP concentration increased. This might be caused due to intrusion of saline water in this monitoring spot as Na concentration has been increased. Besides this, K and Ca concertation has been reduced after two years rise while Mg concentration continues to decrease for second consecutive year. pH is also decreasing.

Due to submerged condition, all essential elements (Organic matter, N, P and S) concentration has been increased. Among the micro elements, Zn concentration jumped after two years drop while Fe concentration continues to increase. B and Mn concentration has been decreased for second consecutive year. Lead and cadmium presence have been decreased and found within the permissible limit. The changes in concentration for the selected parametes are shown in **Figure 2.37** to **Figure 2.52.**

Monitoring Plot-4 (Chakgona)

Overall salinity of this area has been decreased after last year increase. Both monovalent (Na and K) and divalent (Ca and Mg) concentration has been decreased after two years rise. pH is also decreased. Organic matter has been increased, so is other macro elements (Nitrogen, Phosphorus and Sulphur. This might be an impact of decreasing soil salinity and erosion. While Mn and Zn concentrations increased after dropping last year, the trend of increasing Fe concentration continued this year for the third year in a row.

In this monitoring plot, B is the only micro element that is declining. Lead concentration has been deceased after last year jump while cadmium concentration has been increased significantly during this monitoring. But both of the element’s concentration remains within the maximum permissible limit in soil. The changes in concentration for the selected parametes are shown in **Figure 2.37** to **Figure 2.52.**

Monitoring Plot-5 (Basherhula)

Overall salinity has been decreased in this area. All salinity related parameters follows the similar trend. This might be due to decrement of base cations concentration (Na, K, Mg and Ca). The concentrations of base cations have been decreased in two years. pH is also decreasing. Organic matter concentration has increased after last year drop. Nitrogen, Phosphorus and Sulphur concentration follows the similar trend.

All micro nutrients show (B, Fe and Mn) increasing trend except Zn. Boron and Mn concentration has been increased after last year drop while iron concentration has been continuing to increase for third consecutive year. Decrement of lead is observed in this monitoring period while Cd concentration has been jumped. The changes in concentration for the selected parametes are shown in **Figure 2.37** to **Figure 2.52.**

Monitoring Plot-6 (Bidyarbon)

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 SAR and ESP is decreased in this area where base cations (Na, K, Mg) are also decreased except Ca. pH is also decreased. All the essential elements concentration (organic matter, Nitrogen, Phosphorus and Sulphur) has been increased in this monitoring which might be due to reduced salinity and good agricultural practice.

B and Zn concentration has been increased after last year drop while Mn concentration jumped after last year drop. Concentration of iron has been continuing to increase for third consecutive year. Lead concentration has been deceased after last year jump while cadmium concentration has been increased significantly during this monitoring. But both of the element's concentration remains within the maximum permissible limit in soil. The changes in concentration for the selected parametes are shown in **Figure 2.36** to **Figure 2.51.**

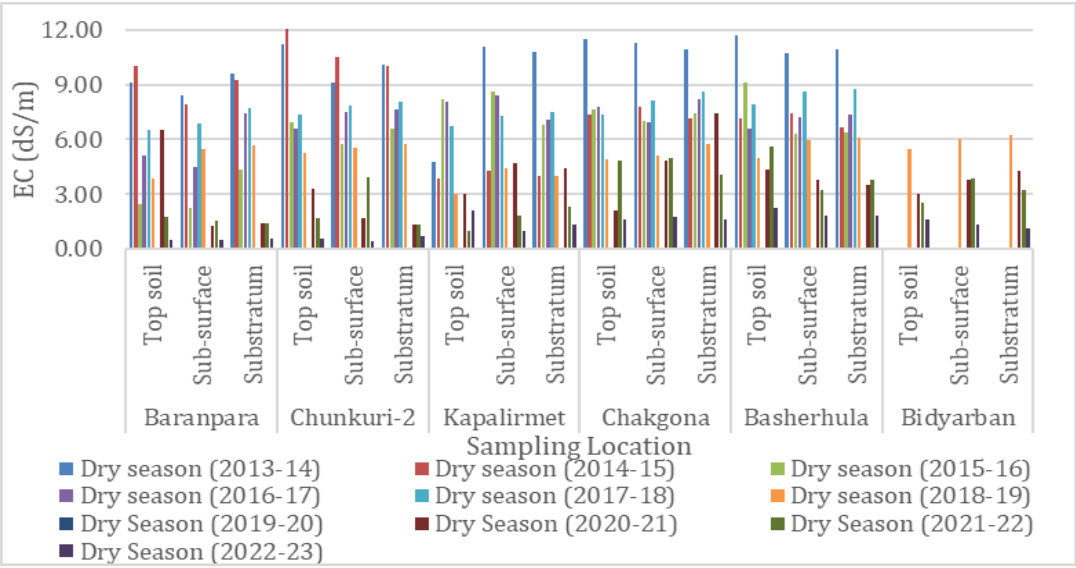


Figure 2.36: Changes of EC (dS/m) in Dry Seasons in Sampling Locations throughout the Monitoring Period

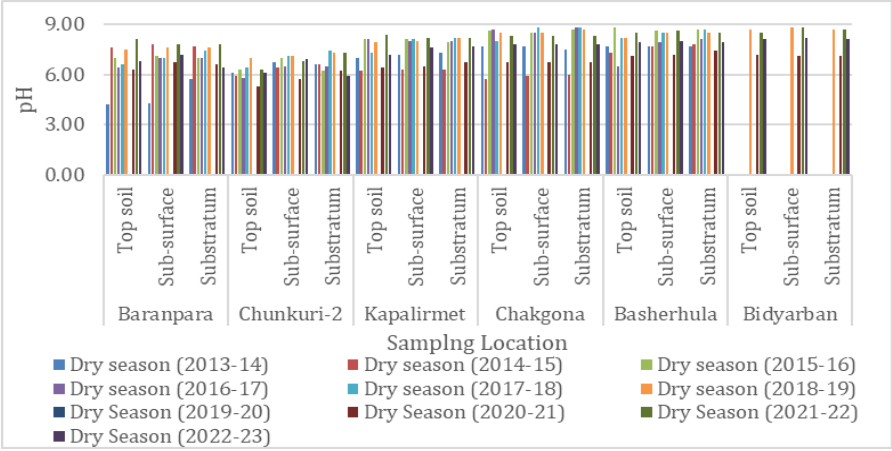


Figure 2.37: Changes of pH in Dry Seasons in Sampling Locations throughout the Monitoring Period

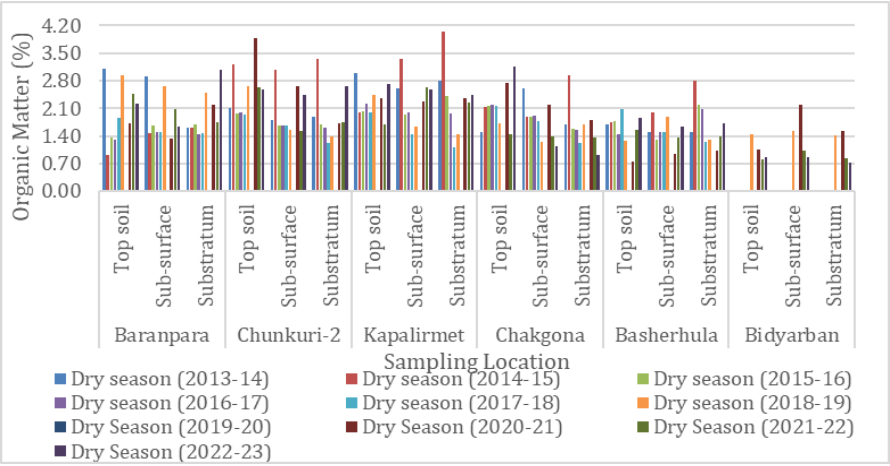


Figure 2.38: Changes of Organic Matter (%) in Dry Seasons in Sampling Locations throughout the Monitoring Period

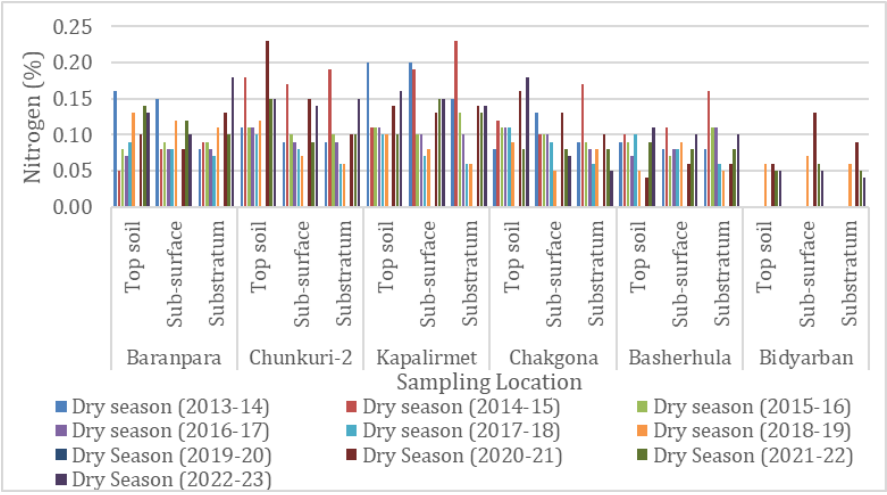


Figure 2.39: Changes of Nitrogen (%) in Dry Seasons in Sampling Locations throughout the Monitoring Period

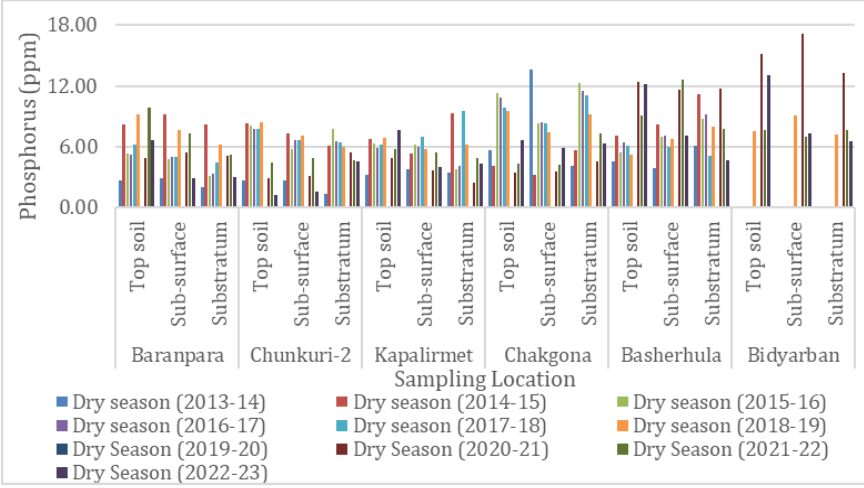


Figure 2.40: Changes of Phosphorus (ppm) in Dry Seasons in Sampling Locations throughout the Monitoring Period

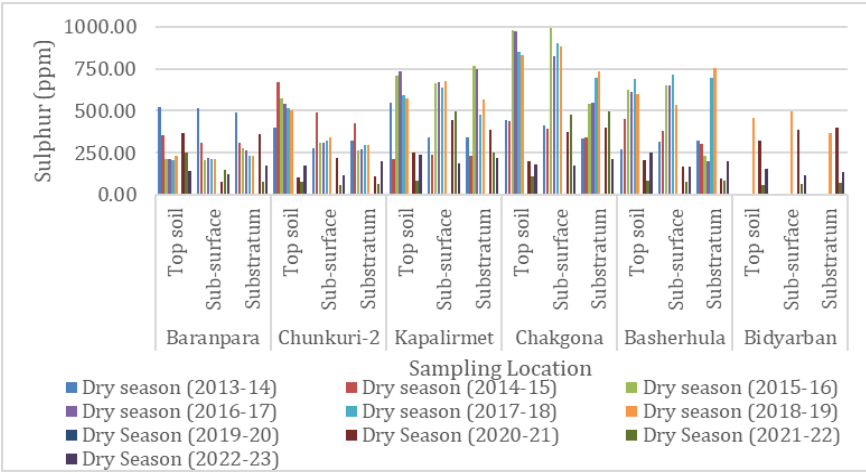


Figure 2.41: Changes of Sulfur (ppm) in Dry Seasons in Sampling Locations throughout the Monitoring Period

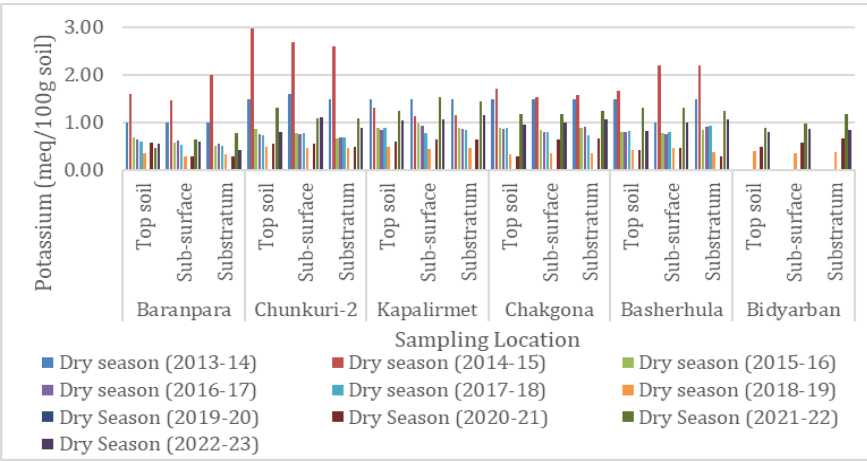


Figure 2.42: Changes of Potassium (meq/100g) in Dry Seasons in Sampling Locations throughout the Monitoring Period

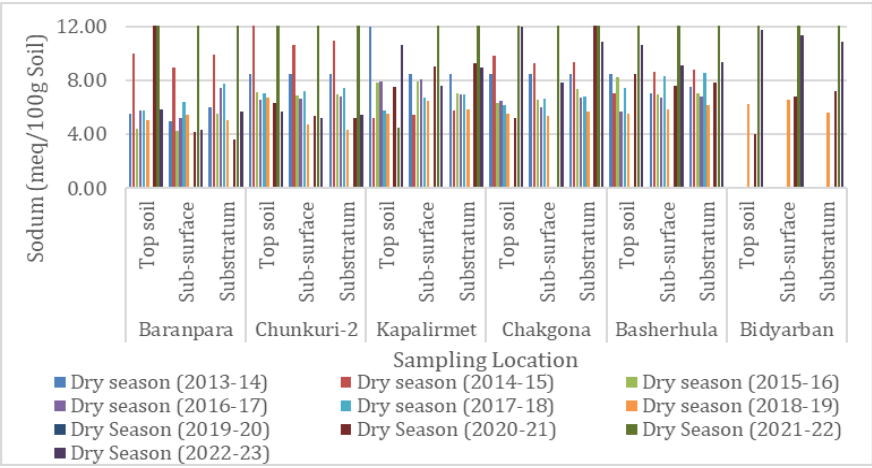


Figure 2.43: Changes of Sodium (meq/100g) in Dry Seasons in Sampling Locations throughout the Monitoring Period

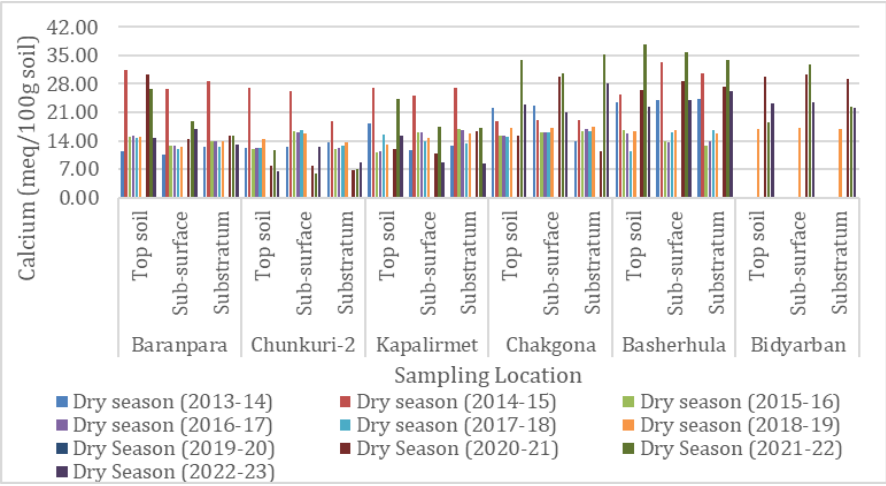


Figure 2.44: Changes of Calcium (meq/100g) in Dry Seasons in Sampling Locations throughout the Monitoring Period

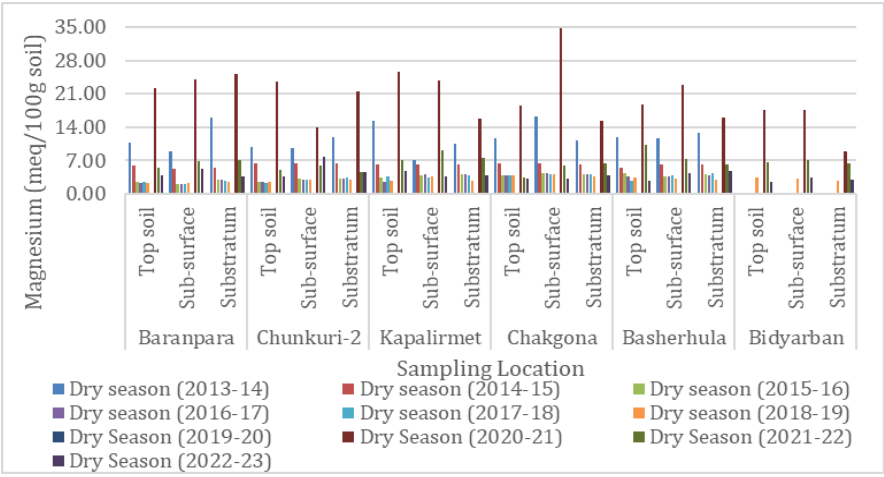


Figure 2.45: Changes of Magnesium (meq/100g) in Dry Seasons in Sampling Locations throughout the Monitoring Period

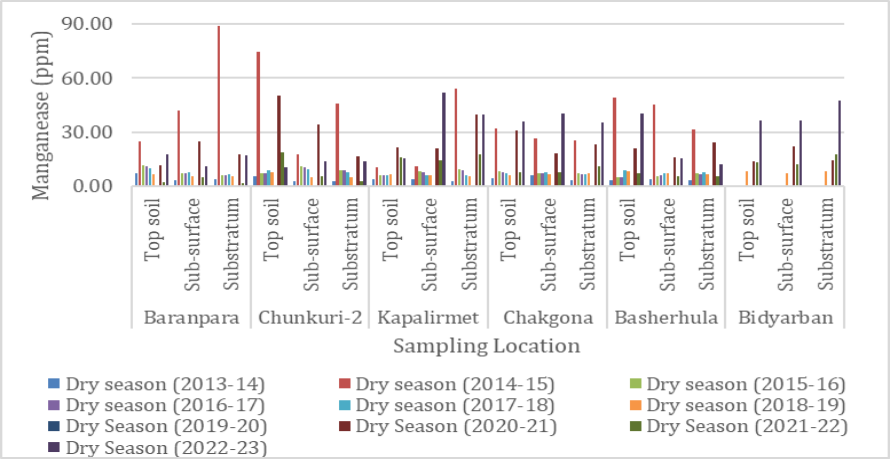


Figure 2.46: Changes of Manganese (ppm) in Dry Seasons in Sampling Locations throughout the Monitoring Period

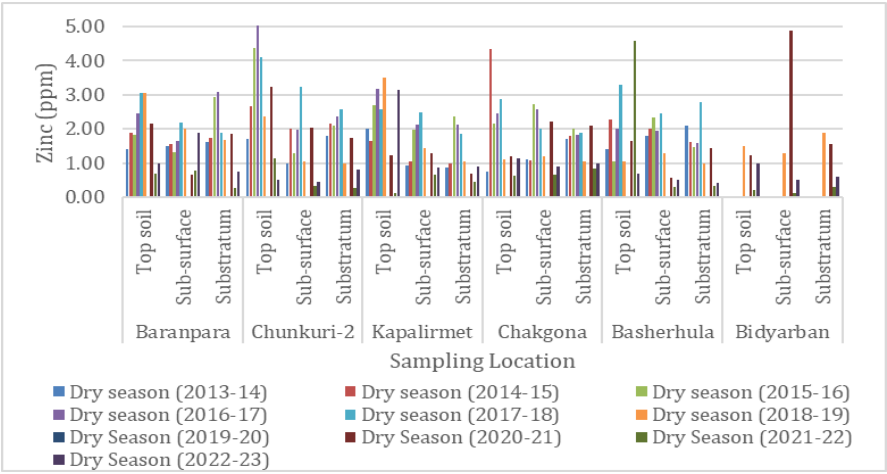


Figure 2.47: Changes of Zinc (ppm) in Dry Seasons in Sampling Locations throughout the Monitoring Period

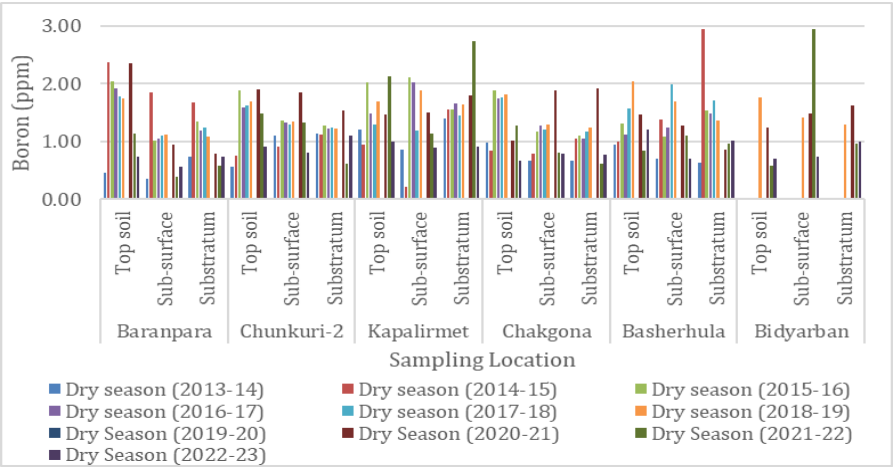


Figure 2.48: Changes of Boron (ppm) in Dry Seasons in Sampling Locations throughout the Monitoring Period

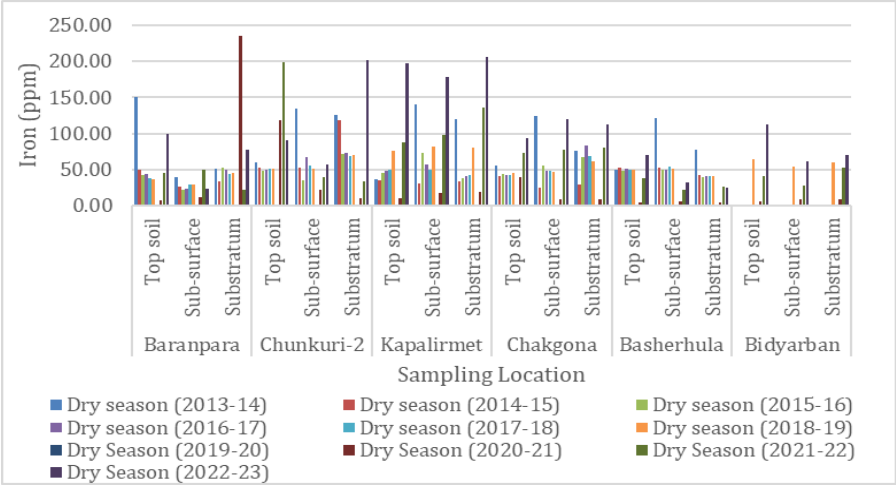


Figure 2.49: Changes of Iron (ppm) in Dry Seasons in Sampling Locations throughout the Monitoring Period

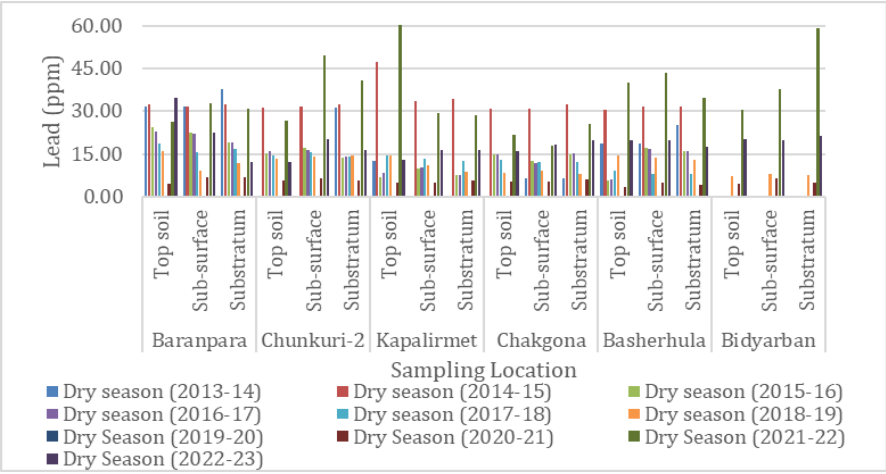


Figure 2.50: Changes of Lead (ppm) in Dry Seasons in Sampling Locations throughout the Monitoring Period

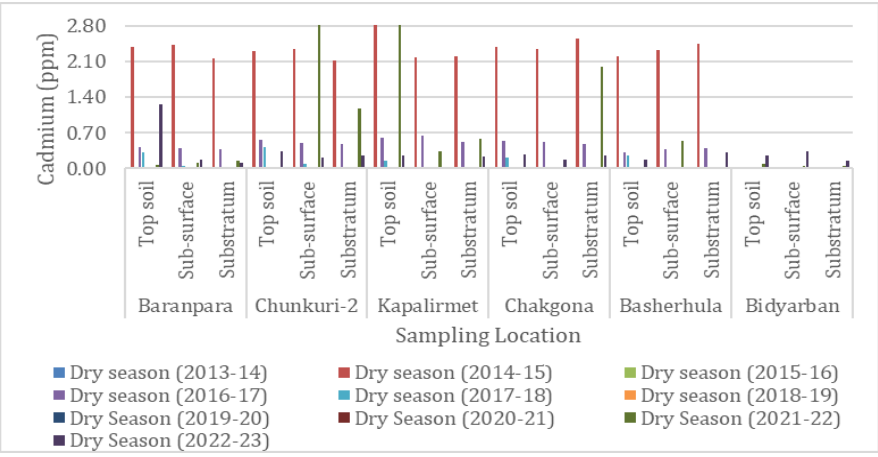


Figure 2.51: Changes of Cadmium (ppm) in Dry Seasons in Sampling Locations throughout the Monitoring Period

2.5 Water Resources Monitoring

Bangladesh is a riverine country. Rivers in different hydrological regions have different characteristics. Rivers in the northern part have fluvial characteristics while it is tidal in the south. The Passur River is one of the dynamic and major rivers in the southern part of Bangladesh. The Rampal power plant is being constructed along the left bank of the Passur River. It is always important to monitor the morphological characteristics of the river at regular intervals to assess the dynamics of the river in case of any development works. Monitoring river dynamics like erosion, accretion, and shifting of the bankline of the Passur River on a half-yearly or yearly basis may facilitate the proper planning and management of the development work.

2.5.1 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 identified the locations of erosion and accretion as well as the shifting of bankline. The steps of image processing and analysis are 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 from May 2023 to November 2023 were collected. After that, satellite images were geo-referenced to have the same projection system. Then, it was found that one image differs from another image. Under these circumstances, images were co-registered to avoid distortion with each image.

Delineation of Banklines

After the collection and processing of images, banklines were delineated for the mentioned period using the Arc-GIS tool. Then, banklines were analyzed and superimposed to assess the erosion-accretion and shifting of the river during the period from May 2023 to November 2023.

2.5.2 Monitoring of Erosion & Accretion and Shifting of the Banklines

For monitoring the erosion and accretion at the Power Plant area, Mongla, Harbaria, and Akram point areas, banklines of the Passur River were superimposed on 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 May 2023 to November 2023 (**Figure 2.52**) although there is a red color (represents erosion) in a few locations along both banks during its passage from Chalna to Hiron Point which may be considered as insignificant.

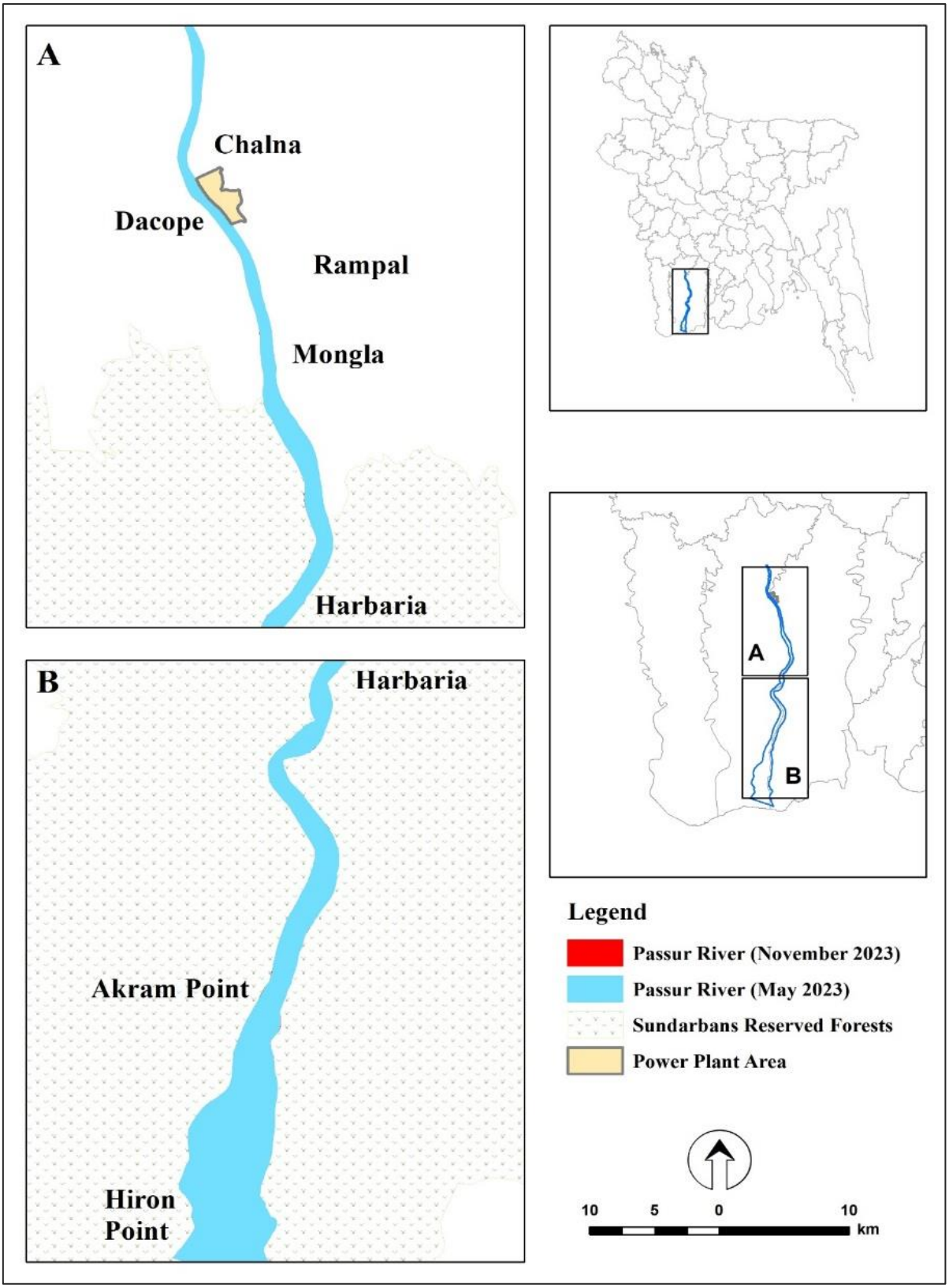


Figure 2.52: Riverbank Erosion and Accretion of the Passur River from March 2022 to July 2022

2.5.3 Tidal Water Level Data Analysis

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 January 2023 to 25 December 2023. Based on the relationship of the water level between Mongla Port and Hiron Point, the lag time and peak attenuation from Mongla Port to the 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, the daily peak tidal water level was taken into consideration for the period from January 2023 to 25 December 2023. 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 2.53**.

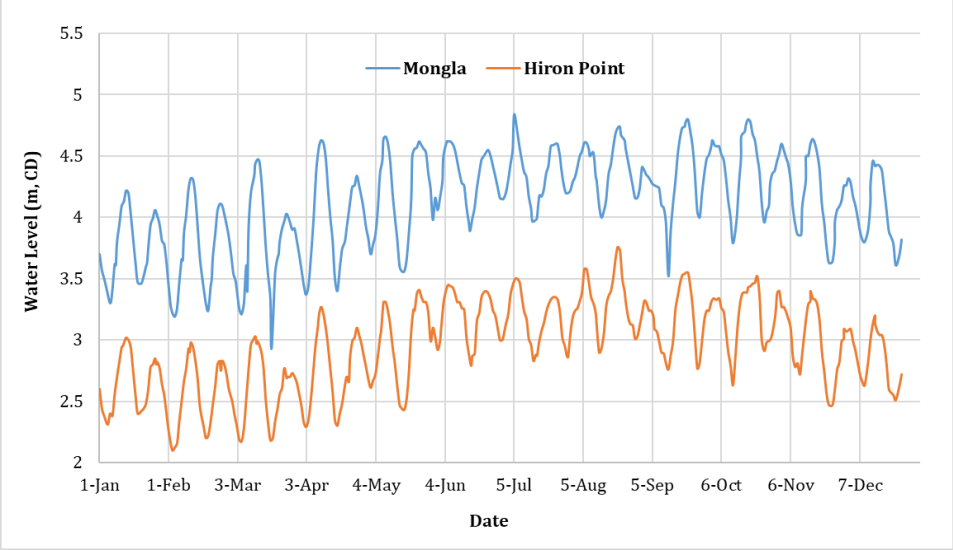


Figure 2.53: Peak Water Level at Hiron Point and Mongla Port for the period from January 2023 to 25 December 2023

Moreover, the maximum water level and corresponding time during the 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, water level data for the year 2023 from January to March as well as April to June 2023 were analyzed respectively. It was found that during the no-moon period, a peak water level of 2.95 m in February 2023 at Hiron Point travels through tide upstream at Mongla Port where its peak water level is 4.30 m on the same day (**Figure 2.54**). The peak attenuation between these two stations is 1.35 m during a no-moon period in February 2023. It was also found that the travelling time or lag time to reach this peak is around 1 hour 50 minutes. Additionally, peak attenuation for the months of January and March 2023 are 1.22 and 1.30 respectively. While the lag time is 1 hour 40 minutes and 1 hour 30 minutes correspondingly for the month of January and March 2023 (**Figure 2.54**). 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 January to March 2023 is about 1 hour 40 minutes while the peak attenuation is nearly 1.29 m.

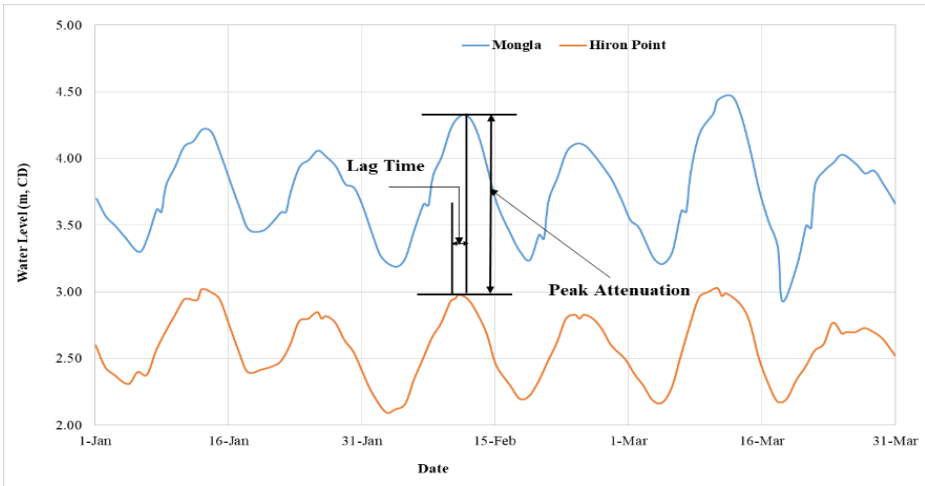


Figure 2.54: Process of Calculation of Lag Time and Peak Attenuation during the Period from January to March 2023

Furthermore, analysis was done from April to June 2023 (**Figure 2.55**). It was found that the peak attenuation during the month of April and May are 1.41 and 1.34 respectively while it is 1.20 for the month of June 2023. On the other hand, the lag time to reach peak water level from Hiron Point to Mongla Port for the months of April and May is 1 hour 14 minutes and 1 hour 15 minutes respectively. It is about 1 hour 20 minutes for the month of June 2023 (**Figure 2.55**). The average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from April to June 2023 is about 1 hour 17 minutes while the peak attenuation is nearly 1.32 m.

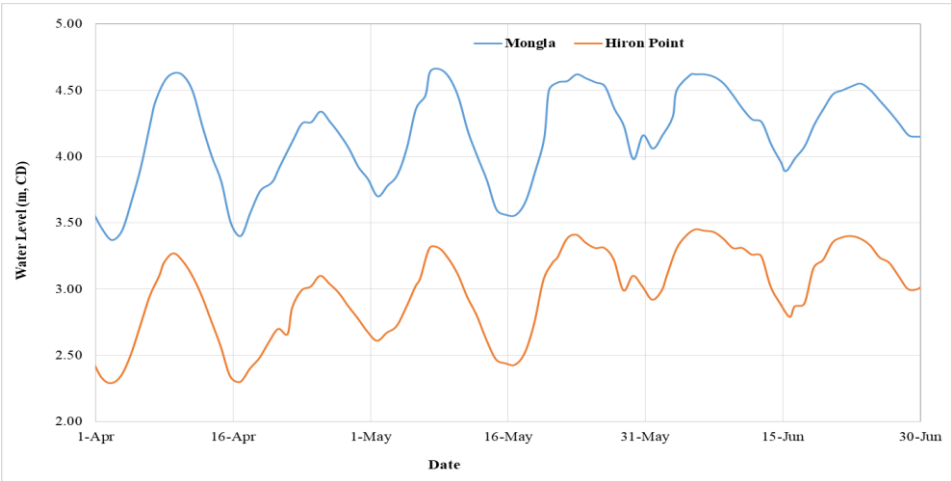


Figure 2.55: Peak Water Level at Hiron Point and Mongla Port for the Period from April to June 2023

Furthermore, it was found that during the no-moon period, a peak water level of 3.34 m in July 2023 at Hiron Point travels through the tide to upstream at Mongla Port where its peak water level is 4.59 m on the same day (**Figure 2.55**). The peak attenuation between these two stations is 1.25 m during the no-moon period in July 2023. It was also found that the travelling time or lag time to reach this peak is around 1 hour 50 minutes. Additionally, peak attenuation for the months of August and September 2023 are 1.10 and 1.25 respectively. The lag time is the same as 1 hour 10 minutes correspondingly for the months of August and September 2023 (**Figure 2.56**). 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 2023 is about 1 hour and 24 minutes while the peak attenuation is nearly 1.20 m.

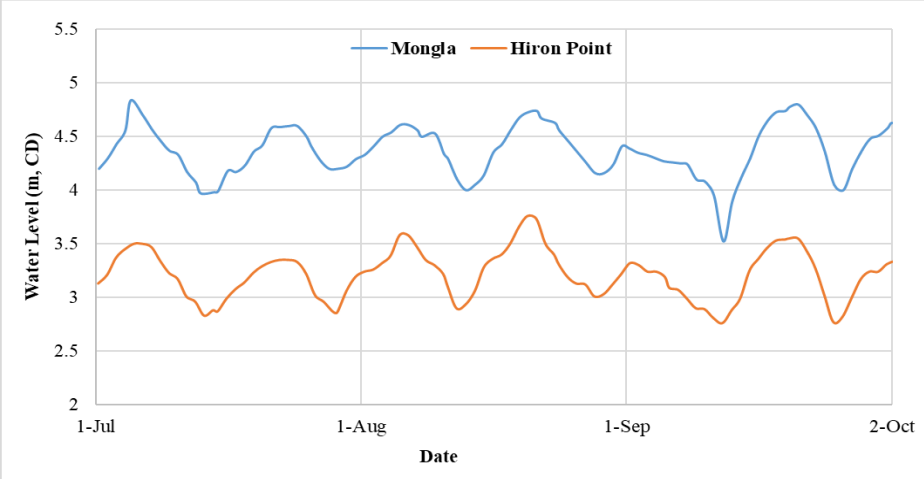


Figure 2.56: Peak Water Level at Hiron Point and Mongla Port for the Period from July to September 2023

Besides, analysis was done from 1 October to 25 December 2023 (**Figure 2.57**). It was found that the peak attenuation during the month of October and November are 1.29 and 1.31 respectively while it is 1.29 for the month of December 2023. On the other hand, the lag time to reach peak water level from Hiron Point to Mongla Port for the months of October and November is the same which is 1 hour 55 minutes while it is about 1 hour 10 minutes for the month of December 2023 (**Figure 2.57**). In addition, the average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from October to December 2023 is about 1 hour 40 minutes while the peak attenuation is nearly 1.30 m.

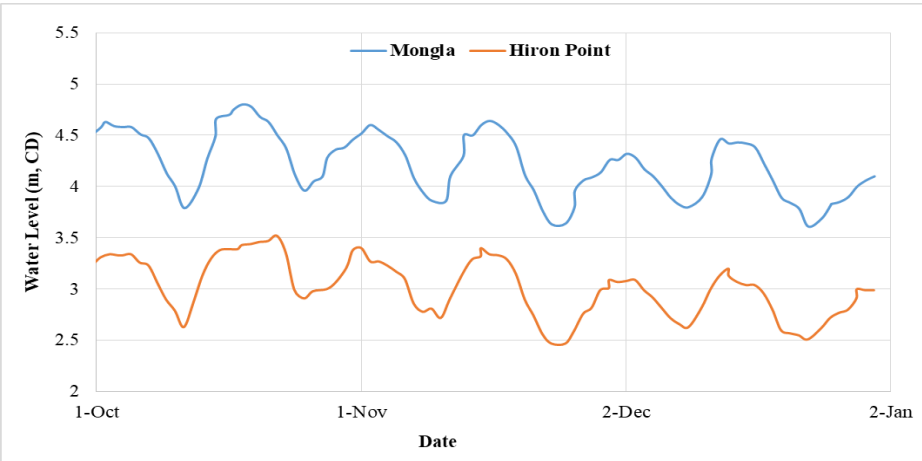


Figure 2.57: Peak Water Level at Hiron Point and Mongla Port for the Period from October to December 2023

In summary, it was found that the average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from January to December 2023 is about 1 hour 31 minutes while the peak attenuation is nearly 1.28 m. The relationship between Hiron Point and Mongla Port was used to extrapolate the lag time and peak attenuation at the 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 a certain peak at Hiron Point needs 1 hour 45 minutes to reach at Rampal Jetty area where peak attenuation is near 1.51 m.

2.5.4 Monitoring of Chemical Properties of Riverbed Sediment

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

2.5.5 Methodology

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 37th monitoring (September, 2023). The sediment quality assessment will be incorporated in 38th 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.

Location

The sampling locations are selected in both near places of project area and inside the Sundarbans. The sampling locations are stated in **Table 2.9**. Locations of collected samples are presented in **Figure 2.58**.

Table 2.9: Location of Sediment Monitoring Plan

Site No	Monitoring Indicators	Location	GPS (Decimal Degree)		Sampling Frequency	Methods/Tools /Techniques
			Northing	Easting		
1	Heavy metals (Arsenic-As, Mercury-Hg, Lead-Pb); pH and Sulfate (SO_4)	Project Site	N-22°35′21.2″	E-89°32′53.4″	Bi-yearly (January and July)	In situ field sampling and Laboratory Testing at BCSIR
2		Moidara River	N-22°34′33.4″	E-89°33′38.8″		
3		Mongla Port	N-22°30′57.1″	E-89°35′0.3″		
4		Harbaria	N-22°17′44.2″	E-89°32′53.4″		
5		Akram Point	N-22°01′07.6″	E-89°30′34.4″		

2.5.6 Process of Sediment Samples Collection

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 was also taken to validate the sampling points.

Samples Collection and laboratory analysis

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. Collected sediment samples have been handed over to BCSIR, Dhaka for laboratory analysis immediate after 33rd monitoring. After the analysis the data will be incorporated in 38th monitoring report.

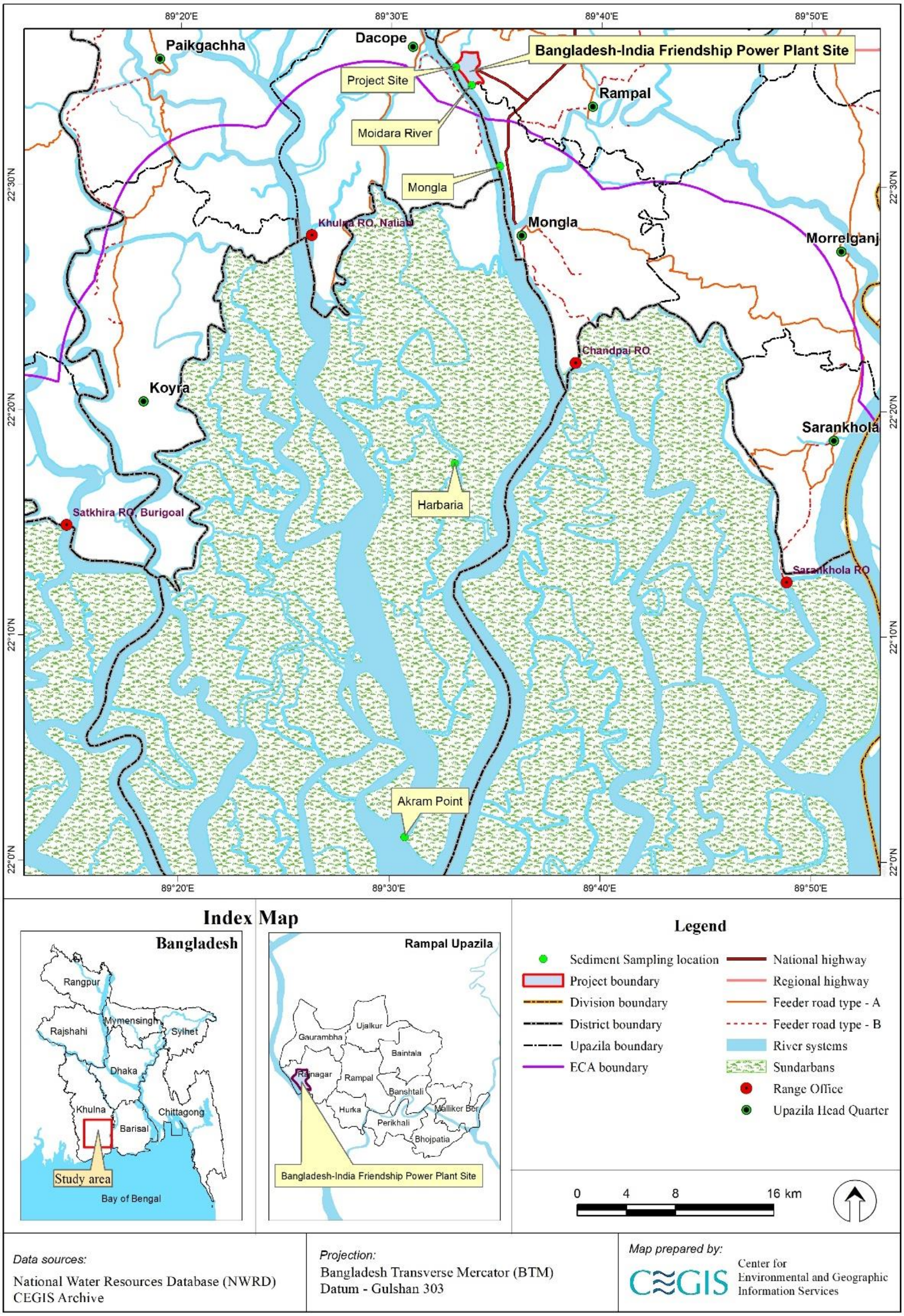


Figure 2.58: Location of Sedment Sampling

2.6 Transportation Monitoring

2.6.1 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. The survey was conducted from August 29th to August 31st, 2023 at three pre-selected locations around the project site. 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 2.59.** Vehicles were categorized based on the available vehicle types around the project area.

2.6.2 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: Factors used for PCU Calculation

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

Source: Roads and Highway Department, Bangladesh

2.6.3 Results of Monitoring

The summary results of vehicular movements at three different locations presented in **Table 2.11**.

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
Khudir Bottola	853	877	545
Gonai Bridge	273	285	428
Gonabelai Bridge	124	84	111

Source: Field Survey, August, 2023

From the traffic survey results it has been found Khulna Mongla Road at Khudir Bottola received the highest traffic volume like always as compared to the other two locations namely Khulna Mongla Road at Gonai Bridge and Power Plant access road at Gonabelai Bridge. The traffic survey results also implies that, compared to the previous survey results, the overall traffic volume has been found to be lower at all surveyed locations. One of the major contributing factors behind the lower traffic volume

may be due to less rigorous construction activity. In other words, as the construction works are approaching towards the end traffic volume has decreased in the said monitoring locations. The detail survey findings regarding the traffic volume surveys as well as the detail calculations are attached in **Appendix E1, E2, and E3.**

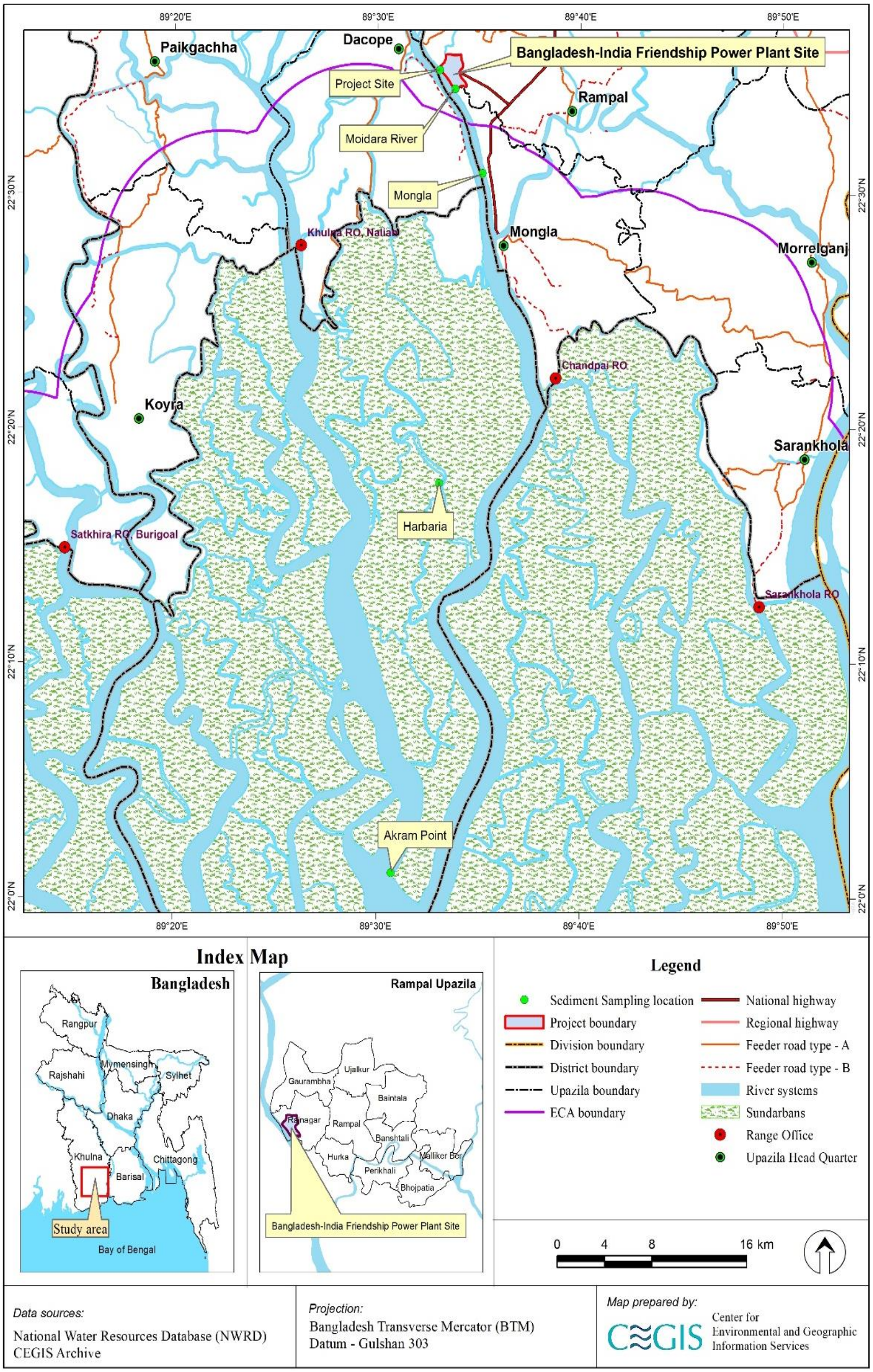


Figure 2.59: Locations of Traffic Survey

3. Biological Environment

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

3.1 Fisheries Resources

The monitoring of 36 quarters for the session of 2014-15, 2015-16, 2016-17, 2017-18, 2018-2019, 2019-20, 2020-21 as well as of 2021-22 was completed and reported earlier. This chapter contains the findings of 37th quarter and a comparison with the earlier 36 quarters.

3.1.1 Methodology

Location of Monitoring Sites

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

Table 3.1: The Sampling Locations for Monitoring of Fisheries Resources

Sampling Site	Capture Habitat Location	Sampling 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
Sl. No.	**Culture Habitat Location**	**Sl. No.**	**Culture Habitat Location**
1	Bhekatkhali Khal, Rajnagar	3	Chunkuri-2
2	Kapasdanga-Muralia		

Selection of Parameters

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

Shrimp/fish farm practice was monitored by viewing stocking pattern, growth rate and mortality rate. Fish production monitoring was divided into capture and shrimp/fish farm production.

Fish Habitat Status

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

Fish Migration

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

Fish Diversity

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

Fish-Shrimp Culture Practice

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

Fish Production

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

3.1.2 Status of Monitoring

Followed by the quarter monitoring of the 2014-15, 2015-16, 2016-17, 2017-18, 2018-19, 2019-20, 2020-21, 2021-22 and 2022-23 (upto 36th quarter monitoring), 37th quarter monitoring of session 2023-2024was conducted during the period from 23 August - 08 September, 2023. No fishing activities were observed at Haldikhali (B), Bhodra (D) and Jongra (G) point during the field visit in this quarter monitoring.

Fish Habitat Status

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

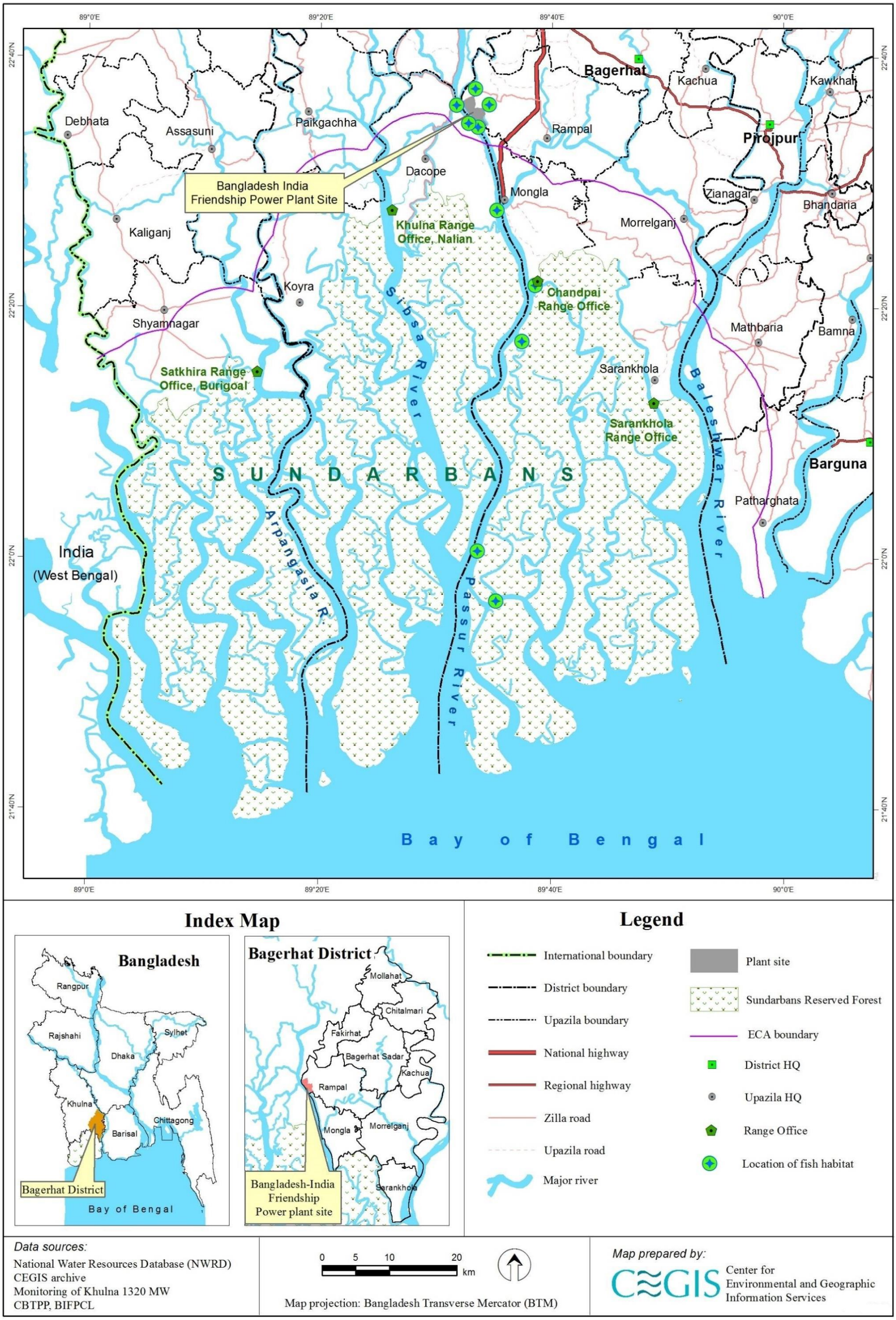


Figure 3.1: Fisheries Resources Monitoring Locations

Habitat Classification

Habitat classification was analyzed by using the length-wise distribution of different fish species in the sampling sites. The length of different life stages of fish species was identified and evaluated from literature review. Linkage distance was calculated with the similarity in distribution. The entire stretch of the Passur River System consists of three major behavioral habitats. The sampling sites were classified on the basis of abundance of different life stages of fish species in those habitats. The following **Table 3.2** show the classification of seven (07) sampling site for 1st to 15th quarter monitoring and ten (10) sampling sites from 16th to 36th quarter monitoring according to the ToR in respect of habitat uses for previous quarters of fisheries monitoring.

Table 3.2: Classification of Habitat use

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 • 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

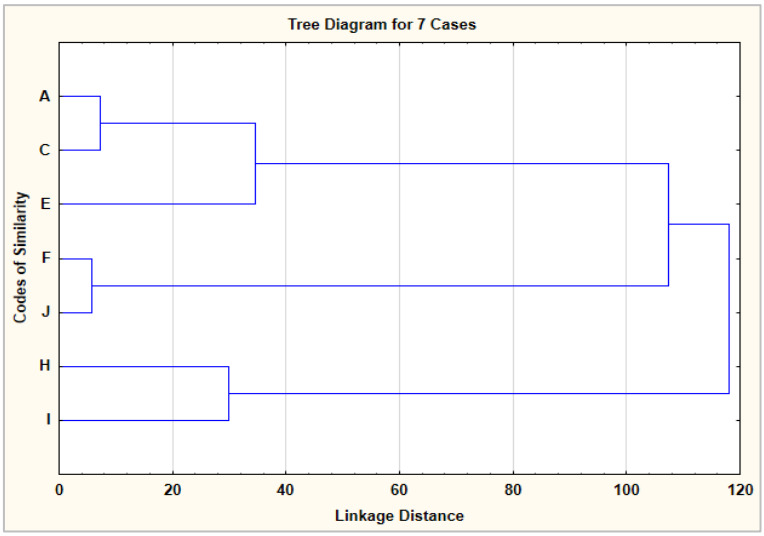
Monitoring Quarter	Type of Habitat Use
	• Nursing Ground
16th (April, 2018)	• Feeding ground • Growing ground • Nursing ground
17th (July, 2018)	• Spawning and Nursery Ground • Nursery Ground with Feeding and Growing Capacity • Growing and Feeding Ground • Omni-ground
18th (November, 2018)	• Ground for 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
26th (November, 2020)	• Nursery Ground • Omni-Ground including Spawning and Nursery Ground, and Maturation Ground
27th (January, 2021)	• Nursery Ground • Omni-Ground including Spawning and Nursery Ground, and Maturation Ground
28th (April, 2021)	• Spawning and Nursery Ground • Ground for Maturation and Feeding
29th (September, 2021)	• Nursery Ground • Ground for Maturation and feeding
30th (November, 2021)	• Feeding Ground • Omni Ground including Nursery ground, and Maturation and Feeding Ground
31st (February, 2022)	• Nursery Ground • Maturation and Feeding Ground
32nd (May, 2022)	• Spawning and Nursery Ground • Maturation Ground
33rd (July, 2022)	• Spawning and Nursery Ground • Feeding and Maturation Ground

Monitoring Quarter	Type of Habitat Use
34th (October, 2022)	• Feeding Ground • Ground for Maturation
35th (January, 2023)	• Spawning and Nursery Ground • Ground for Maturation and Feeding
36th (Feb, 2022)	• Spawning and Nursery Ground • Omni Ground including Nursery Ground, Maturation and Feeding Ground

During the 37th quarterly monitoring conducted in 23 August-08 September of 2023-24 Session, the sampling sites were divided into two major classes as shown in **Figure 3.2**. The classification of functional habitat from 2014-2015 to 2022-2023 has been attached in **Figure D.1** of **Appendix IV**.

1. Spawning and Nursary Ground: The sampling sites, Chandpai (F) and Chalna (J) were found to support mostly length groups of <2 cm, 2-3cm and 3-5cm of available fish species. Field findings revealed that the mentioned sampling sites were found to be used as spawning and nursery grounds of observed fish species.

2. Maturation and Feeding Ground: The sampling sites, Akram Point (A), Charaputia (C), Harbaria (E), Mongla (H) and Maidara (I) were found to support mostly length groups of 5-10cm, 10-20cm and >25cm of available fish species. Field findings revealed that the mentioned sampling sites were found to be used as nursery ground, maturation and feeding ground of observed fish species.



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

Figure 3.2: Habitat Classification on the Basis of Different Life Stages of Fish Species

The 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 2023-24, the JI value between Charaputia (C) and Chandpai (F) sampling sites were the highest (**Figure 3.3**) which indicates the maximum similarity in species occurrence between the two sites out of seven (07) sampling sites of available fishing. Jaccard Co-efficient of Similarity of Habitats respecting fish species occurrence from 2014-2015 to 2022-2023 has been attached in **Figure D.2** of **Appendix IV**.

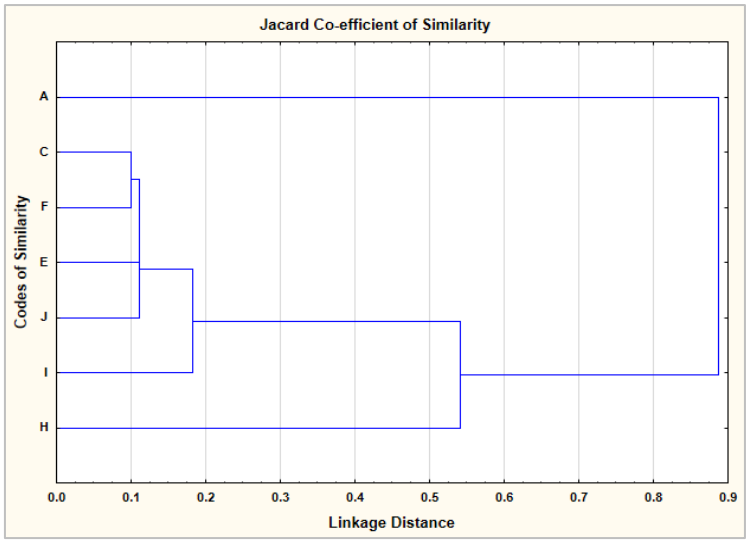


Figure 3.3: Dendogram Showing Similarity in Binary Species Composition in Three Sampling Sites

Fish Diversity

Shannon-Weiner Index

In this monitoring year of 2023-24, species evenness also varies among the sampling sites. Highest Shannon-Weiner index was found at Mongla Point (0.76) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at Maidara (0.16) (shown in Table 3.3). 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. The observed fish species during in-situ catch is shown in **Figure 3.4**.

Fish Species Richness (FSR)

Fish species richness was identified through Simpson's Index[6]. Considerable difference is noticed in the fish species richness (FSR) in different habitat classes (**Table 3.4** and **Figure 3.5**). In this monitoring phase, species richness varies with the sampling sites. Maximum FSR was obtained at Charaputia (n=32), while very low FSR was recorded at Mongla (n=03). Different scenarios of richness were found in this quarter in comparison to the previous monitoring years. Among habitats in the down-stream of the Passur River system, Akram point was home to rich assemblage of *Baila, Paissa and Kathali Chingri*, Charaputia was rich of *Baila, Chaka Chingri and Chela,* Harbaria was rich of *Chaka, Golda and Motka Chingri*. The occurnce of species as observed from 2014-2015 to 2022-2023 has been attached in **Table D.5** of **Appendix IV.**

Table 3.3: Site Wise Species Diversity using Shannon-Weiner Index

Sampling Site	Species Number	Shannon-Weiner Index
A	9	0.48
B	-	-
C	32	0.60

[6]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.

Sampling Site	Species Number	Shannon-Weiner Index
D	-	-
E	20	0.72
F	23	0.67
G	-	-
H	3	0.76
I	11	0.16
J	20	0.60

*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). The Site-wise fish species richness (FSR) in the Passur River System from 2014-2015 to 2022-2023 has been attached in **Figure D3** of **Appendix IV.**

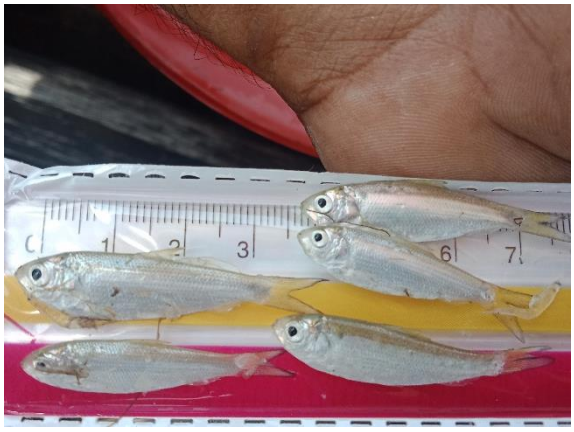
Table 3.4: Site Wise Rich Species Number

Site	No. of Rich Species	Site	No. of Rich Species
A	2	F	5
B	-	G	-
C	5	H	2
D	-	I	1
E	6	J	4

Pangasius pangasius

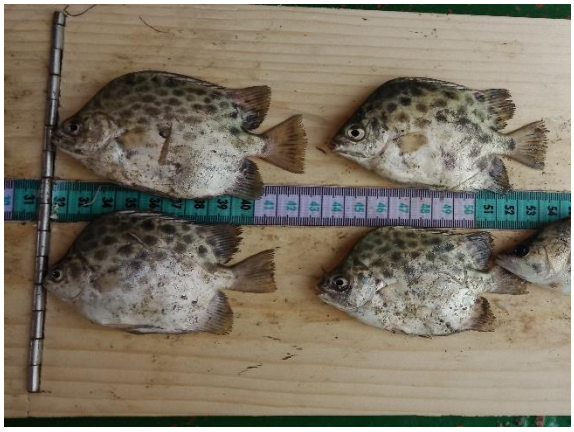
Lates calcarifer

Tenualosa ilisha



Gudusia chapra

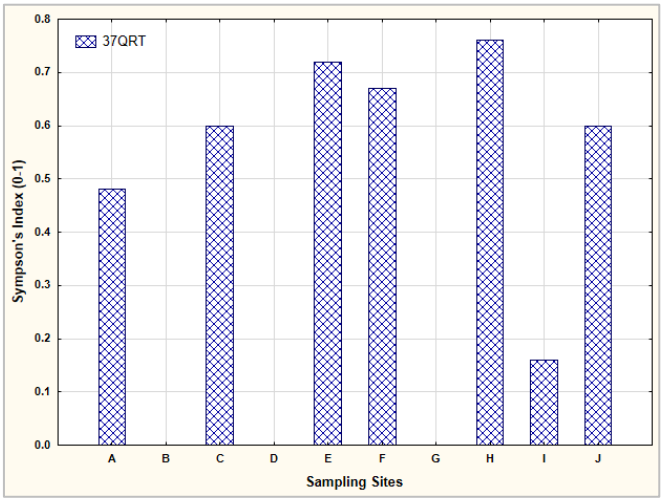
Mugil cephalus



Scatophagus argus

Source: CEGIS Field Survey, September 2023

Figure 3.4: Photos of Some Observed Fish Species in 37th Quarter Monitoring



(FSR is identified though Simpson's Index)

Figure 3.5: Site-wise Fish Species Richness (FSR) in the Passur River System

Fish Community Structure

Fish community structure was analyzed through counting the length-wise fish individuals. The following figure shows that Juvenile were dominant at Chandpai and Chalna Point but adult age group were at Akram Point, Charaputia and Harbaria. Habitat distribution of different life stages of Fish species from 2014-2015 to 2022-2023 has been attached in **Figure D.4** of **Appendix IV** and Length wise species distribution has been attached in **Table D.6** of **Appendix IV.**

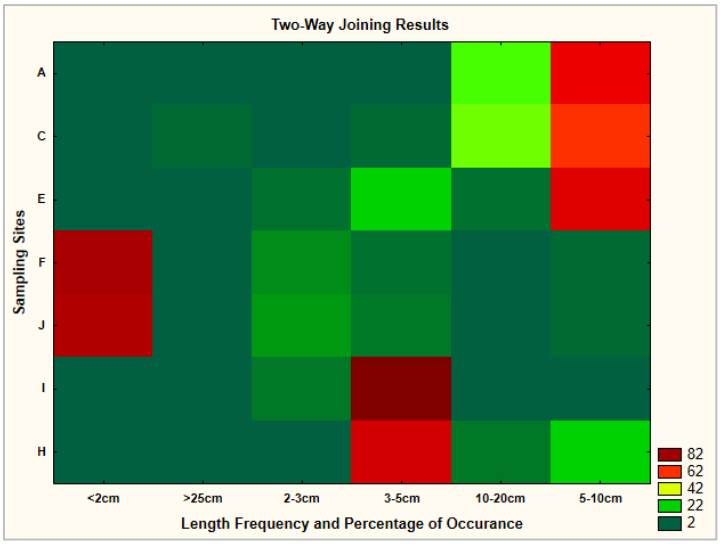


Figure 3.6: Habitat Distribution of Different Life Stages of Fish Species

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 *Chela, Baila, Paissa, Gagra Tengra* and *Gang Koi* attain the maximum abundance among the migratory fish species observed in the 37th quarter of monitoring. The relative abundance of the migratory species is given below in the **Figure 3.7**.

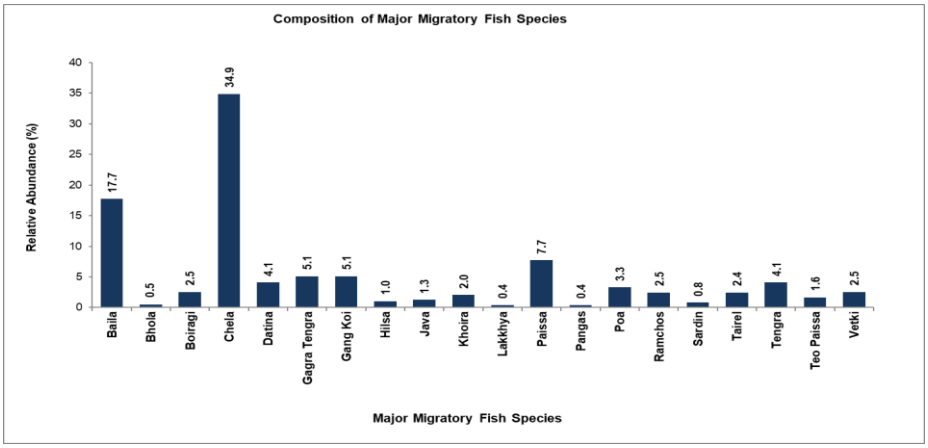


Figure 3.7: Relative Abundance of Major Migratory Fish Species in Sampling Sites

Migration Extent, Time and Purpose

Major fish species showed interesting pattern in distribution for exploiting different purposes mentioned in the following table all along the sampling sites. Among migratory species, Bailla, Paissa and Ramchos were observed to migrate long distance (**Figure 3.8**). The purpose of fish migration observed from 2014-15 to 2022-23 has been attaced in **Table D.7** of **Appendix IV**.

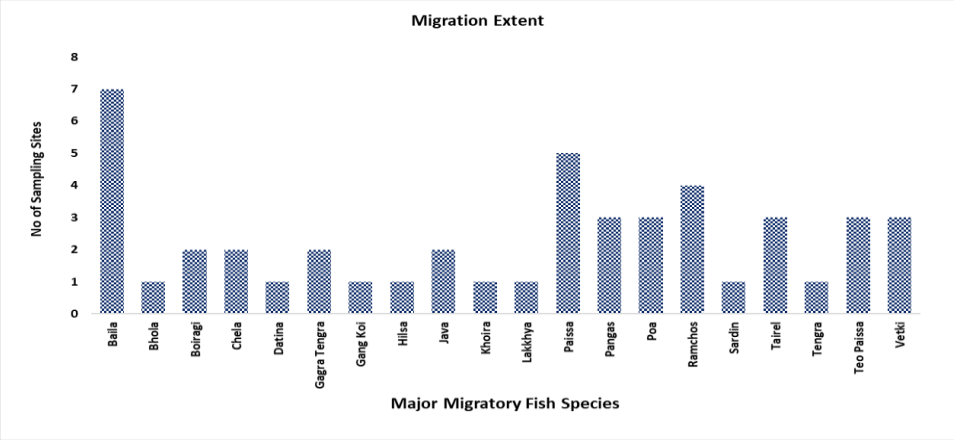


Figure 3.8: Migration Extent of Major Migratory Fish Species in Sampling Sites

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 maximum stocking in case of Bagda Chingri was found at Kapashdanga Gher followed by Rajnagar and Chunkuri-2. In case Paissa, the stocking density was highest at Kapashdanga gher followed by Chunkuri-2 (**Table 3.5**).

Table 3.5: Stocking Pattern of Fish/Shrimp Farm

Name of shrimp farm	Name of species	Stocking Density (No/ha)	Stocking date
Rajnagar (42.09 ha)	Bagda	11404	August, 2023
Kapashdanga-Muralia (115.7ha)	Bagda	14693	August, 2023
	Golda	86	August, 2023
	Harina	13829	July, 2023
	Paissa	17286	July, 2023
	Patari	4	July, 2023
	Rui	43	July, 2023
Chunkuri-2 (6.07ha)	Bagda	329	August, 2023
	Golda	198	August, 2023
	Paissa	412	July, 2023
	Kharsulla	692	July, 2023
	Patari	33	July, 2023

Source: CEGIS Field Survey, August, 2023.

Shrimp/Fish Growth Rate and Mortality

During the 37th quarter of monitoring, maximum growth rate was observed in the Rajnagar shrimp gher. (**Table 3.6** and **Table 3.7)**.

Table 3.6: Growth Rate and Mortality of Fish/Shrimp (1st to 18th QM)

Gher No.	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		14th QM		15th QM		16th QM		17th QM		18th QM	
	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)
1	0.3	15-20	0.2	40	0.25	50	-	-	-	30	0.18	25	0.20	60	-	-	-	-	0.2	20	0.20	60	-	-	-	30	0.03	50	-	-	0.28	0.28	0.38	80	-	-
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	0.38	35	-	-	0.42	0.42	0.30	70	0.30	80
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	0.02	25	-	-	0.4	0.4	0.20	50	-	-

Table 3.7: Growth Rate and Mortality of Fish/Shrimp (18th to 37th QM)

Gher No.	19th QM		20th QM		21th QM		22st QM		23rdQM		25rd QM		26th QM		27th QM		28th QM		29th QM		30th QM		31st QM		32st QM		33 QM		34th QM		35th QM		36th QM		37th QM	
	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)	Growth Rate (cm/day)	Mortality (%)
1	-	-	0.35	50	0.38	-	0.35		-	-	0.38	-	0.42	35	-	-	0.41	20	0.38		0.36	-	-	-	0.36	-	0.39	20	0.38	22	-	-	0.34	15	0.38	10
2	-	-	0.45	80	0.44	-	0.45		-	-	0.48	-	0.45	30	-	-	0.35	90	0.42		0.44	-	-	-	0.43	-	0.42	25	0.41	25	-	-	0.39	20	0.33	30
3	-	-	0.34	40	0.36	-	0.37		-	-	0.32	-	0.38	90	-	-	0.39	30	0.4		0.37	-	-	-	0.33	-	0.37	60	0.35	29	-	-	0.37	15	0.34	15

Source: CEGIS Field Survey, 2014-2023

Fish Production

Capture Fish Production

The present study revealed that the highest catch susceptibility was also found in case of Charpata Jal (6.0 kg/haul) shown in **Table 3.8**. The highest production was observed at Charaputia followed by Harbaria (**Table 3.9**).

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

Site	Habitat	Gear Name/Type	Haul Duration (hr)	No of Haul	kg/haul
A	Passur River	Khepla Jal	0.08	20	0.25
		Khepla Jal	0.08	15	0.3
		Fash Jal	6.0	1	0.5
		Khepla Jal	0.08	10	0.2
C	Passur River	Charpata Jal	12	1	3
		Charpata Jal	12	1	6
		Fash Jal	6.0	1	0.5
		Fash Jal	6.0	1	0.5
		Fash Jal	6.0	1	0.2
		Borshi	4.0	3	0.5
		Khepla Jal	0.08	12	0.2
E	Passur River	Charpata Jal	12	22	5
		Charpata Jal	12	20	4.5
		Fash Jal	6	3	0.5
		Fash Jal	6	4	0.5
F	Passur River	Ilish Jal	3	2	0.5
		Ilish Jal	3	2	0.6
H	Passur River	Bepdi Jal	6	1	0.2
I	Passur River	Khepla Jal	0.08	25	0.25
J	Passur River	Khepla Jal	0.08	30	0.5

*Source: Catch assessment survey, CEGIS, August, 2023; ** Weight of Fry is not considered for catch assessment*

Table 3.9: Total Catch in the Sampling Sites

Sampling Site	Total Catch (kg)	Sampling Site	Total Catch (kg)
A	1.25	F	1.1
B	-	G	-
C	10.9	H	0.2
D	-	I	0.25
E	10.6	J	0.5

**Average Weight 0.15kg/mud crab and average weight 0.6 kg/mud eel*

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

Culture Fish Production

The present study on shrimp/fish farm in the 37th quarter monitoring phase showed that highest fish production was observed only in the Rajnagar Gher followed by Kapashdanga Gher (**Table D-8** of **Appendix-IV).**

3.2 Monitoring of Ecosystem and Bio-diversity

3.2.1 Indicators Selection

Indicators for terrestrial and aquatic ecosystems were selected considering 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, Birds are considered as very much 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 good indicators. Numbers of wetland where migratory birds usually come in each migration season have also been considered to observing migratory bird habitat suitability of the area.

In course 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 are at northern sites as maximum time of the wind rose south to north direction and anticipated impacts will be taken place in this area. Beside this, Sundarban Reserve Forest is located at 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.

Random quadrate vegetation survey has been conducted to determine the plant diversity, at selected homesteads. A total of 36 plant species (excluding undergrowth) has been recorded from 16 number of surveyed sample quadrates which Shanon-Winner Diversity Index were 2.39. Details of the survey result is presented in **Table 3.10** below. Species diversity of homestead plants followed lower than the previous monitoring period due to deaths of some threes at one monitoring site.

Plant Health

The vegetation community structure of this area is dominated by tree species. Indiscriminate saltwater shrimp farming is a major threat to plant health in the area. So, the plant health of this area is not satisfactory. The expansion of shrimp farming in this area has increased soil salinity. Because of this, overall plant succession, growth and productivity varied from day to 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 homestead.

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

Number of Diseases Affected Trees

A total of three disease affected tree was recorded from Rajnagar and Chalkghona sites. All of which monocot and the species were Palmyra Palm, Date Palm and Coconut. At the Rajnagar site, four Date Palm has been died due to effect of land filling by sand. Symptom was trunk narrowing and leaf blast. Except these sites, plant health status has showed improve at other two sites. Here should be mentioned that, none of the plant health issues are revealed for the Project operation. Following table (**Table 3.11**) represents the time series data on unhealthy plants in studied homesteads.

Vegetation canopy status

Species Representation in Different Canopy Layers of Homestead Vegetation

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

Estimated Canopy Cover in Homestead Vegetation of Sampling Sites

Canopy cover increased significantly at most sites. This is due to the expansion of the leaves for the availability of soil moisture required in the monsoons. **Table 3.12** represents the canopy status of different monitoring sites. Canopy coverage of the studied homesteads has been represented in following table.

Table 3.10: Plant Species Composition of the Sampled Homesteads

Species Name	Local Name	Family	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	Pteridaceae	-				18			20									38	**2.39**
Albizia richardiana	Chambol	Fabaceae					2					21	6	2	2	1			34	
Albizia saman	Rendi Koroi	Fabaceae	1			1	4	4	2	6					1	4			23	
Areca catechu	Supari	Arecaceae					4		3	1	2								10	
Azadirachta indica	Neem	Meliaceae					6	2		9		6	6			3			32	
Borassus flabeliffer	Taal	Arecaceae					11						5			1	2		19	
Carica papaya	Pepey	Caricaceae												1					1	
Cocos nucifera	Narikel	Arecaceae	2	4		1	6		1		4	8	5	3	2	3		2	41	
Acacia Auriculiformis	Akashmoni	Fabaceae					2												2	
Diospyrus pregrina	Gab	Ebenaceae													1	2	1		4	
Excoecaria agallocha	Gewa	Euphorbiaceae	34	11	42	5			7									40	139	
Ficus benjamina	Lokkho Pakur	Moraceae									1								1	
Ficus hispida	Dumur	Moraceae										6		1			1		8	
Bombax ceiba	Shimul	Bombacaceae															1	2	3	
Mimusops elengi	Bokul	Sapotaceae									1					1			2	
Hibiscus tiliaceus	Bola	Malvaceae								1									1	
Acanthus ilicifolius	Hargoja	Acanthaceae				3													3	
Lannea coromandelica	Jigar	Anacardiaceae	6	12	6														24	
Lawsonia inermis	Mehedi	Lythraceae							1										1	
Limonia acidissima	Kotbel	Lamiaceae													1				1	
Mangifera indica	Aam	Sapindaceae					2	2			2				3		7		16	
Manilkara zapota	Safeda	Sapotaceae							1										1	
Moringa oleifera	Sazna	Moringaceae									2					1			3	
Musa sp	Kola	Musaceae			10			1			25	5		3					44	
Phoenix sylvestris	Khejur	Arecaceae			17					2			8	3	1	2	3	1	37	
Phyllanthus emblica	Amloki	Phyllanthaceae							1										1	
Psidium guajava	Peyara	Myrtaceae							1										1	
Sonneratia apetalla	Kewra	Sonneratiaceae	2							1									3	
Swietenia mahagoni	Mahagoni	Meliaceae					6	2			11	28	20	7	1		5	3	83	
Syzygium cumini	Jaam	Myrtaceae					1								1		1		3	

Species Name	Local Name	Family	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		
Tamarindus indica	Tentul	Fabaceae							2										2	
Terminalia arjuna	Arjun	Combretaceae													1				1	
Terminalia catapa	Kathbadam	Combretaceae					3							1	1		1		6	
Nypa fruticans	Golpata	Arecaceae																2	2	
Vachellia nilotica	Babla	Fabaceae				1		1											2	
Zizyphus sp	Kul boroi	Rhamnaceae				3									2				5	

Source: CEGIS survey, upto August, 2023.

Table 3.11: Proportion of Healthy and Unhealthy Plants in Studied Homesteads

Location	Plant Name	Tot. No. of Plant	No. of Unhealthy Plant																													
			Apr, 2014	Jun, 2014	41913	42005	42095	Aug, 2015	Oct, 2015	Oct, 2016	Jan, 2017	Jan, 2018	Apr, 2018	Jul, 2018	Nov, 2018	Jan, 2019	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020	Nov, 2020	Jan, 2021	Apr, 2021	July, 2021	Nov, 2021	Feb, 2022	May, 2022	Jul, 2022	Dec, 2022	Feb, 2023	May,2023	Aug, 2023
Rajnagar	*Cocos nucifera*	17[7]	NS	10	5	5	15	4	5	3	4	6	6	9	4	4	3	2	3	10	3	7	11	10	10	10	3	1	2	4	5	7	1
	Phoenix sylvestris	25	NS	15	4	4	22	9	13	10	2	5	4	7	6	8	9	5	3	4	4	5	2	12	2	3	2	2	1	7	3	2	4[9]
	Manilkara zapota	1	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	D	-	-
	Albizia saman	2	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2	-	2	L	-	-
	Excoecaria agallocha	15[8]	NS	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	10	-	-	-	-	12	3	1	-
	Mangifera indica	3	NS	1	-	-	2	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	2	2	-	-	-	3	D	-	-
	Psidium guajava	2	NS	2	-	-	2	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	D	-	-
Borni	*Cocos nucifera*	10	7	3	-	-	3	1	2	1	2	3	1	2		1	1	1	2	1	-	-	-	-	-	-	1	-	-	1	L	-	-
	Phoenix sylvestris	12	-	5	4	4	3	1	4	4	3	4	2	1		-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
	Borassus flabellifer	6	3	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
	Mangifera indica	6	3	3	1	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	1	-
	Excoecaria agallocha	18	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	3	-		3	1	-	-	-	-

Location	Plant Name	Tot. No. of Plant	No. of Unhealthy Plant																															
			Apr, 2014	Jun, 2014	41913	42005	42095	Aug, 2015	Oct, 2015	Oct, 2016	Jan, 2017	Jan, 2018	Apr, 2018	Jul, 2018	Nov, 2018	Jan, 2019	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020	Nov, 2020	Jan, 2021	Apr, 2021	July, 2021	Nov, 2021	Feb, 2022	May, 2022	Jul, 2022	Dec, 2022	Feb, 2023	May,2023	Aug, 2023
	Swietenia mehogani	11	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	Areca catechu	10	-	6	2	2	8	2	2	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Manilkara zapota	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
	Psidium guajava	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kalekarber Dighi	*Cocos nucifera*	56	35	5	1	1	2	2	3	1	1	-	6	3	-	1	3	1	7	4	2	-	-	-	2	-	-	-	-	1	-	-	-
	Phoenix sylvestris	10	-	3	-	-	1	-	1	3	-	3	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	1	-	-	-
	Mangifera indica	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	-	-
	Manilkara zapota	2	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
	Borassus flabellifer	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Zizyphus sp	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
	Psidium guajava	8	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tamarindus indica	2	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chalkghona	*Cocos nucifera*	30[10]	25	19	5	5	34	20	-	2	2	4	5	3	-	3	4	2	4	3	5	-	-	-	-	-	-	-	-	2	-	3	-
	Phoenix sylvestris	10	-	10	1	1	6	5	1	1	-	5	2	3	-	-	1	2	2	1	3	-	1	3	2	1	1	-	-	2	-	3	1
	Albizia saman	3	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Excoecaria agallocha	36	-	-	1	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-	-	1	-	-**	1	-	-
	Manilkara zapota	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
	Psidium guajava	17	1	7	-	-	-	-	-	-	-	-	-	-	1	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mangifera indica	7	2	1	-	-	-	-	-	-	1	-	1	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3	-
	Borassus flabellifer	2	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

Note: NS = Not Surveyed

[7]*Cocos have been cut*
[8] *Cocos have been cut*
[9]*Phoenix death*
[10]*Excoecaria have been cut*

Table 3.12: Vegetation Canopy Cover in Different Studied Homesteads

Location	% of Canopy Cover			
	Rajnagar	Borni	Kalekarber	Chalkghona
Apr, 2014	NS	NS	NS	NS
Jun, 2014	19	26	20	13
Oct, 2014	19	18	24	24
Jan, 2015	17	18	25	22
Apr, 2015	20	12	23	17
Aug-15	20	14	24	21
Oct, 2015	20	20	24	21
Jan. 2016	20	20	22	20
Jul, 2016	21	25	24	21
Oct, 2016	23	25	26	27
Jan, 2017	19	23	25	26
Jan, 2018	15	21	23	25
Apr, 2018	18	21	24	16
Jul, 2016	14	23	24	18
Nov, 2018	11	20	25	21
Feb, 2019	22	21	24	22
Apr, 2019	19	21	25	22
Jul, 2019	18	20	25	22
Nov, 2019	16	18	24	20
Feb, 2020	14	20	24	23
Jul, 2020	11	17	22	17
Nov, 2020	8	22	22	21
Jan, 2021	8	19	24	18
Apr, 2021	8	23	19	21
Jul, 2021	10	24	21	24
Nov, 2021	14	22	24	23
Feb, 2022	11	20	24	20
May, 2022	15	20	24	23
July, 2022	16	26	25	24
Dec, 2022	2	18	25	16
Feb, 2023	2	22	24	23
May, 2023	2	18	23	15
Sep, 2023	6	26	26	25

Note: NS = Not Surveyed

Bird Habitat

Local birds and their nesting behavior

Numerous local bird species are occurred in the study area. Homestead vegetation are the prime habitat for local birds. Existence of vast shrimp farms as well as canals and rivers also favor good number of water dependent bird species in this area. Most of the birds are nesting on tall trees of homesteads. Small bird like Tailor bird, prefer small bushy shrubs. Although, birds do not follow any

local boundaries, a clear conception on available bird species have been gathered through discussions with studied homestead owners as well as physical observation.

Bird species and number of Bird nests in sampling sites

One bird nests of Red Vented Bulbul have found at Borni site in this monitoring tier. The remaining sites not recorded any nest. However, **Table 3.13** represent the bird nest monitoring datasheet over the monitoring periods.

Table 3.13: Bird Nest Monitoring Datasheet

Monitoring Tier	Location	Name of nesting Bird								
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove	Black R. Flameback	Common Myna	RV Bulbul
Apr 2014	R	NS	NS	NS	NS	NS	-	-	-	-
	B	-	-	1	-		-	-	-	-
	K	NS	NS	NS	NS	NS	-	-	-	-
	C	-	1	-	1	-	-	-	-	-
Jun 2014	R	12	4	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C			11		-	-	-	-	-
Sep 2014	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Dec 2014	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Apr 2014	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Aug 2015	R	1	5	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Jan 2016	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Jun 2016	R	10	5	-	-	3	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	1	1	-	-	-	-	-	-	-
Oct 2016	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-

Monitoring Tier	Location	Name of nesting Bird								
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove	Black R. Flameback	Common Myna	RV Bulbul
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Jan 2017	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Jan 2018	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	1	-	-	-	-	-	-	-
Nov 2018	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Feb 2019	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	1	-	-	-	-	-
Apr 2019	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Jul 2019	R	-	-	-	1	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Nov 2019	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Feb 2020	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Jul 2020	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Nov 2020	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-

Monitoring Tier	Location	Name of nesting Bird								
		Little Cormorant	Little Egret	Asian Pied Starling	Tailor Bird	Great Egret	Spotted Dove	Black R. Flameback	Common Myna	RV Bulbul
Jan 2021	R	-	-	1	1	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Apr 2021	R	-	-	1	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	1	-	-	-
Jul 2021	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Nov 2021	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Feb 2022	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
May, 2022	R	-	-	-	-	-	-	1	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	1	-	-
	C	-	-	-	-	-	-	-	-	-
July, 2022	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Dec, 2022	R	-	-	-	-	-	-	-	10	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
Feb 2023	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-	-
May 2023	R	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	1
	K	-	-	-	-	-	-	-	-	-
	C	-	-	2	-	-	-	-	-	-
Note: Location R=Rajnagar, B=Borni, K=Kalekarber, C=Chalkghona										

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 the 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 Occurrence

Dolphin migration route in study area

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

Dolphin occurrence in Passur and Midara River

Dolphin occurrences have been sighted at the Passur and Maidara River surround the project area (From Mongla-Passur Confluence to Maidara to Chalna Ghat) through Boat transact during spring tide. The transect length was 23.8km and survey time was 2hour 30 minutes during neap tide. A total of 6 dolphins have been recorded. All the dolphins were recorded within the Maidara River and none of the individual found in Passur River. The encounter rate is 0.16 individual/km/hour which is lower than previous monitoring tier. **Figure 3.9** represents the survey transact and location of dolphin occurrence within the river channel.

Dolphin occurrence in Dhangmari, Shella Gang and Bhadra Khal

A total of 8 dolphins has monitored from 13.6km boat transect survey in Dhangmari Khal during spring tide. The survey duration was 110 minutes. A total of 8 dolphins were recorded and the encounter rate was 0.29 individual/km/hour. The encounter rate is higher than previous monitoring. The distribution of dolphin occurrence at Dhangmari Khal is presented in **Figure 3.10**.

Five Dolphins were also sighted in Shella Gang and Part of Passur River at Chandpai while 8.36 km transact survey conducted from Joymoni Madyapara to Jhongra PP to Chandpai FO to Joymoni Madyapara (**Figure 3.11**). The encounter rate was 1.10 individual/km/hour. The survey duration was 83 minutes.

During the survey at Bhadra Khal, 10 dolphins have been recorded from 40 min survey time and the 3.56 km inner reach from Bhadra Patrol Post. The encounter rate was 5.06 individuals/km/hr. The encounter rate was higher than the previous monitoring. The distribution of dolphin occurrence at Bhadra Khal is presented in **Figure 3.12**.

Another short survey was conducted Karomjal, Harbaria and Akram Point while passing the river. Dolphin has been notified at all the sites while travelling on boat. However, the survey result is included in **Table 3.14**.

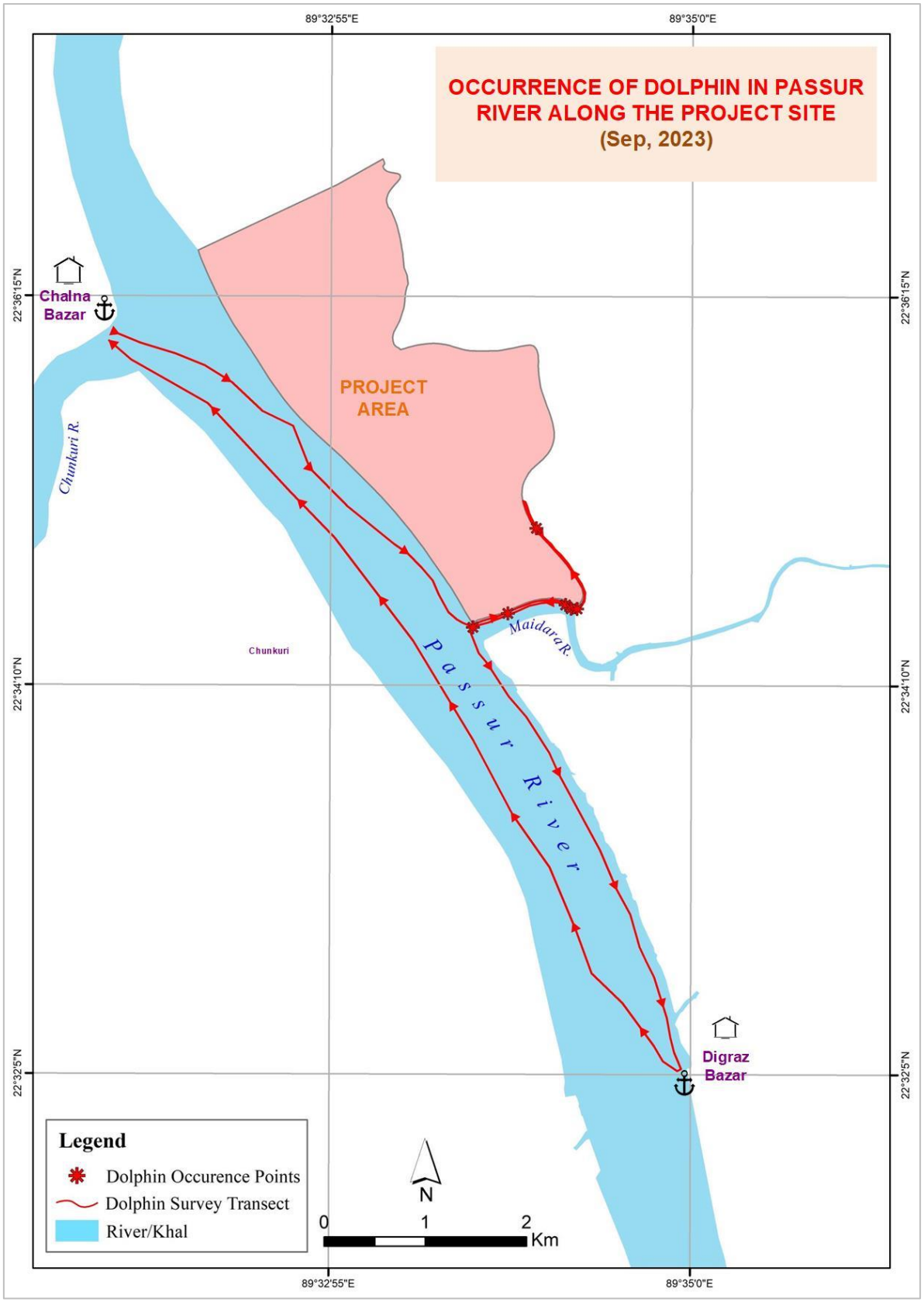


Figure 3.9: Occurrence of Dolphins in Passur and Maidara River along the Project Site

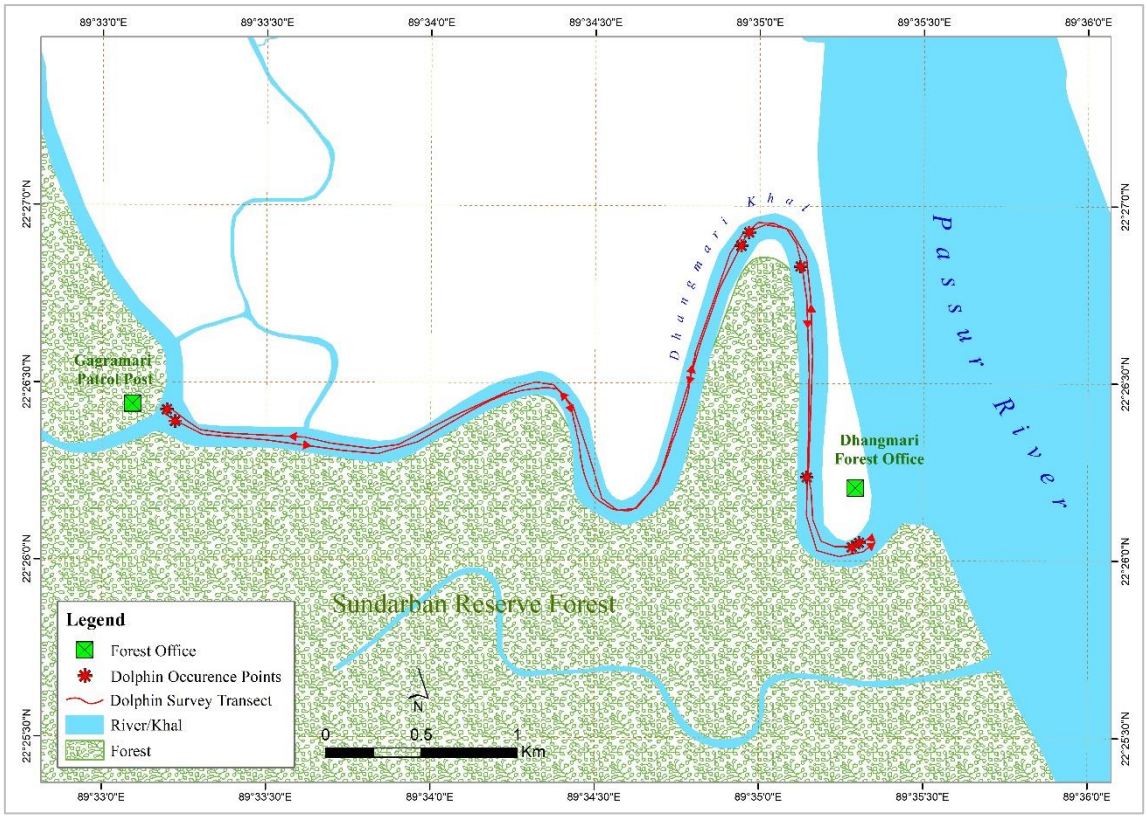


Figure 3.10: Location of Dolphin Occurrences in Dhangmari Khal

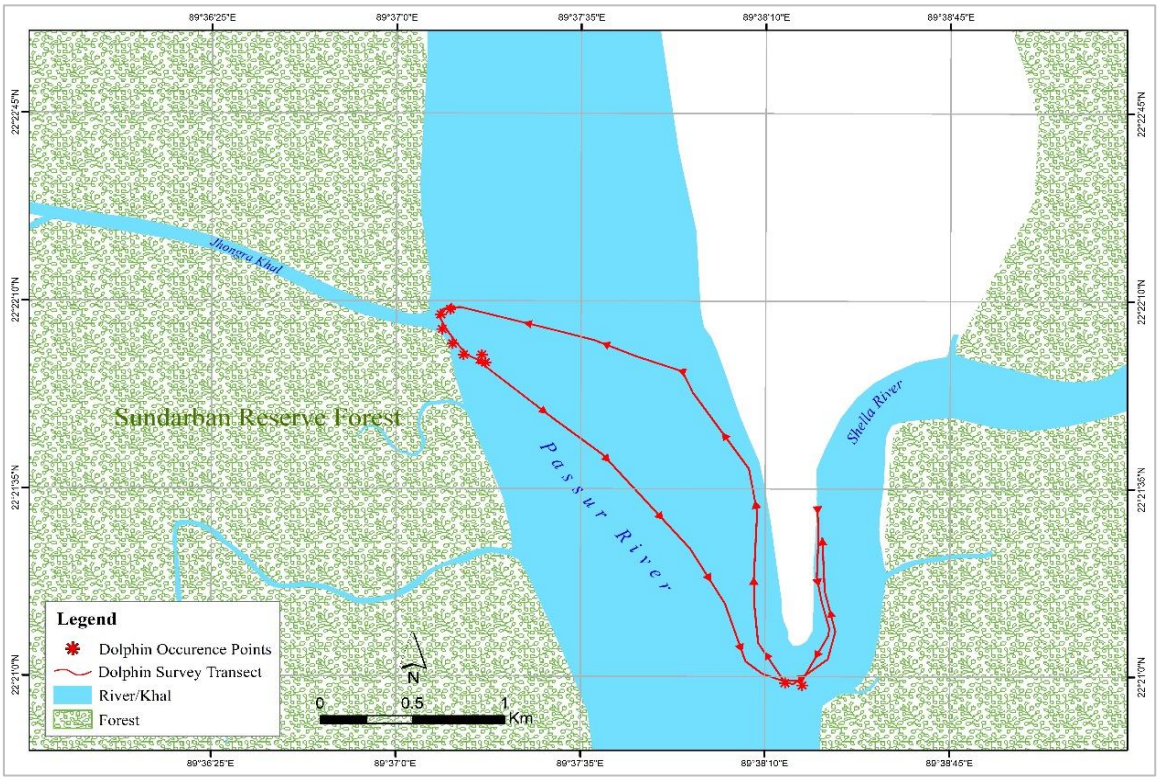


Figure 3.11: Location of Dolphin Occurrences in Chandpai

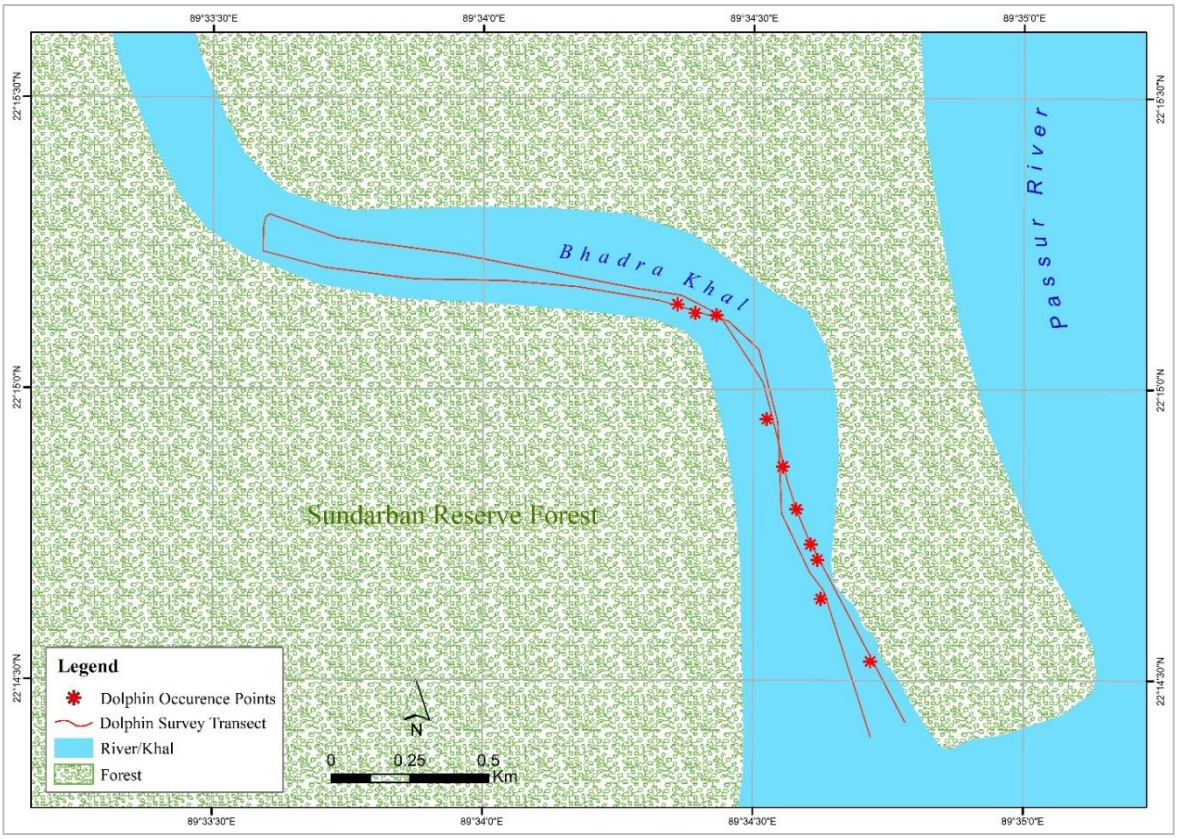


Figure 3.12: Location of Dolphin Occurrence in Bhadra Khal

Table 3.14: Dolphin Observation Datasheet

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Maidara River	Shella River at Chandpai
Apr-2014	FT	Y	NS	NS	NS	Y	NS
	NT	Y	NS	NS	NS	N	NS
Jun-2014	FT	Y	NS	NS	NS	N	NS
	NT	Y	N	N	N	N	NS
Oct-2014	FT	Y	NS	NS	NS	Y	NS
	NT	Y	Y	Y	N	Y	NS
Jan-2015	FT	Y	Y	Y	NS	Y	NS
	NT	Y	Y	N	Y	N	NS
Apr-2015	FT	Y	N	N	Y	Y	NS
	NT	Y	N	N	Y	N	NS
Aug-2015	FT	Y	NS	N	NS	Y	NS
	NT	Y	Y	N	NS	N	NS
Oct-2015	FT	NS	NS	Y	N	NS	NS
	NT	Y	Y	NS	Y	Y	NS
Oct-2015	FT	Y	Y	Y	Y	N	NS
	NT	Y	N	N	NS	Y	NS
Jul-2016	FT	Y	Y	Y	NS	Y	NS
	NT	Y	NS	Y	NS	NS	NS
Oct-2016	FT	N	Y	Y	N	NS	NS
	NT	Y	Y	NS	N	Y	NS
Jan-2017	FT	Y	Y	N	NS	N	NS

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Maidara River	Shella River at Chandpai
	NT	Y	Y	N	NS	Y	NS
Jan-2018	FT	Y	NS	Y	N	NS	NS
	NT	Y	Y	N	N	Y	N
Jun-2018	FT	Y	N	N	N	Y	Y
	NT	Y	NS	N	Y	Y	NS
Nov-2018	FT	NS	N	N	N	NS	NS
	NT	Y	N	N	N	Y	Y
Feb-2019	FT	NS	Y	Y	N	NS	Y
	NT	Y	N	N	Y	N	NS
Apr-2019	FT	NS	Y	N	N	NS	NS
	NT	N	N	Y	N	N	Y
Jul-2019	FT	Y	Y	N	N	Y	Y
	NT	Y	NS	N	N	N	NS
Nov-2019	FT	NS	Y	Y	N	NS	Y
	NT	Y	Y	N	Y	Y	Y
Feb-2020	FT	Y	Y	Y	Y	Y	Y
	NT	Y	N	NS	NS	Y	Y
Jul-2020	FT	Y	N	N	N	Y	Y
	NT	Ns	Y	N	N	NS	Y
Nov-2020	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
Jan-2021	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
Apr-2021	FT	NS	NS	NS	NS	NS	Y
	NT	Y	NS	NS	NS	Y	NS
Jul-2021	FT	Y	NS	Y	Y	Y	Y
	NT	NS	Y	N	N	NS	NS
Nov-2021	FT	Y	NS	N	N	Y	NS
	NT	N	N	Y	N	NS	NS
Feb-22	FT	Y	Y	Y	N	Y	Y
	NT	N	NS	Y	N	NS	NS
May-22	FT	Y	Y	N	N	Y	NS
	NT	NS	Y	Y	N	NS	Y
July-22	FT	N	NS	N	N	Y	Y
	NT	NS	Y	N	N	NS	NS
Dec-22	FT	NS	N	N	N	Y	Y
	NT	Y	NS	NS	N	NS	NS
Feb, 23	FT	NS	Y	Y	NS	Y	Y
	NT	Y	NS	NS	Y	NS	NS
May, 23	FT	NS	NS	N	NS	Y	Y
	NT	Y	Y	NS	N	NS	NS
Sep, 23	FT	NS	Y	N	NS	Y	Y
	NT	NS	N	Y	N	NS	NS

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

3.3 Sundarbans Forest Health Monitoring

3.3.1 Background

The Forest Health Monitoring program aims to ascertain the present condition, detect any changes, and identify trends in indicators of forest health over a specific timeframe. To address issues that pose a threat to the sustainability of forest ecosystems, this program analyzes data from diverse sources, including long-term monitoring plots, aerial surveys, and other biotic and abiotic data sources.

3.3.2 Methodology

Permanent Sample Plot (PSP) Establishment and Layout

To set up permanent sample plots five sites have been selected on the basis of the preliminary survey (**Figure 3.13)**. Among those, four sites are along the Passur River at Karamjal, Harbaria, Akram point and Hiron point, and the fifth one is near Sutarkhali forest office (**Table 3.15**). The sites have been selected considering the distance from the proposed Project site, wind directions, coal transportation route, river systems and vegetation types. During the May-June period, which is crucial for the monsoon season, rivers undergo a turbulent phase. Consequently, accessing Hiron Point, which is situated in close proximity to the sea, becomes challenging. Therefore, the decision was made to exclude Hiron Point for the 37th monitoring period's plot.

Table 3.15: 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
Akram Point	1	Khulna	17	22.0195	89.5129	Hard Clay	40m east from Shibsha River
	2	Khulna	17	22.0187	89.5134	Clay	140m east from Shibsha River
	3	Khulna	17	22.0180	89.5140	Hard Clay	240m east from Shibsha River
Hiron Point	1	Khulna	44	22.7753	89.4610	Sandy	350m east from Gogari Canal
	2	Khulna	44	21.9166	89.2333	Sandy	40m north from Bay of Bengal
	3	Khulna	44	22.1833	89.5000	Hard Clay	648m south east from Shibsha River

3.3.3 Raionale

According to Beets and Whitehead (1996), one widely used method for assessing forest health is the utilization of bio-indicators, which involve tracking growth trends over time and their correlation with the leaf area index. When all variables are held constant, stands with a high leaf area index demonstrate higher biomass and total volume per hectare compared to those with a low leaf area (Beets et al., 2008). Mangrove trees adapt to anaerobic and waterlogged environments by developing additional pneumatophores, which enhance the surface area available for gas exchange. The ecological stability of mangrove forest ecosystems is greatly influenced by crabs. As stated by Lee (1989), crab burrows effectively remove nitrogen in the form of gaseous nitrogen (N2) and nitrous oxide (N2O) from the aquatic ecosystem, while also increasing oxygen levels in the soil layer.

Soil quality is another crucial metric for assessing forest health (USDA Forest Service, 2007). Evaluating soil quality typically requires measurements of its physical, chemical, and biological composition at various depths. Additionally, the diversity of plant species present serves as a bio-indicator of a healthy forest. Assessing the presence of mixed plant species of different sizes and ages, which create distinct forest "layers" that offer habitat for numerous species, helps evaluate this biodiversity (Greenleaf Forestry and Wood Products Inc., 2010). Another bio-indicator worth considering when monitoring forest health is the forest's regeneration capability. A robust ability to regenerate reflects a healthy forest ecosystem. With regards to the Rampal Power Plant installation, a comprehensive study of these bio-indicators will be conducted in the Sundarbans Reserve Forest (SRF). Another reliable measure of forest health is the presence and quantity of lichen. Their presence serves as an indicator of forest health, as they are highly sensitive to air pollutants such as sulfur dioxide, fluoride, and ammonia. The CEGIS team has been periodically monitoring the health of the Sundarbans Reserve Forest to evaluate the potential impacts of the ongoing Rampal Thermal Coal Power Plant Project. The monitoring program is conducted at five locations within the Sundarbans Reserve Forest: Sutarkhali, Karamjal, Harbaria, Akram point, and Hiron Point. The Sundarbans forest health is evaluated quarterly according to a monitoring schedule, with thirty-four surveys completed at the aforementioned locations.

3.3.4 Sampling Design of Permanent Sample Plots (PSPs)

At each site, a transect line was laid out perpendicular to the river or canal bank. Along the transect line, three circular nested subplots of a 12.62m radius have been laid out at 100m intervals to capture the maximum tree species (**Figure 3.13**). Because of the variation in species composition in SRF, observation plots were laid out from the coast, river, or canal-side to the upper slope zone where the forest area is denser. The location of the first subplot was 40m away from the ecotone zone to save the subplot from riverbank erosion. Each subplot was again subdivided into four quadrates (**Figure 3.14**)

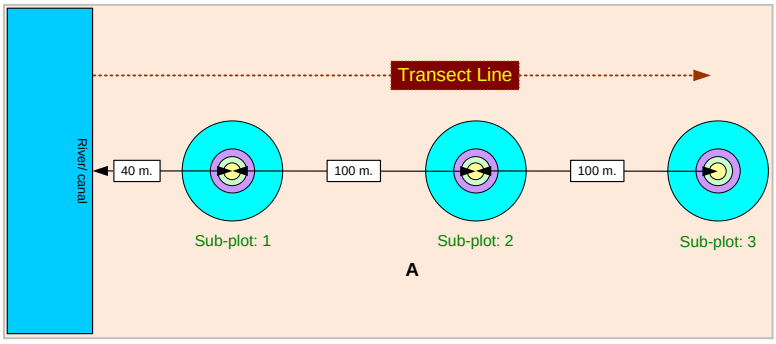


Figure 3.13: Layout of the Subplots and Transect Line Perpendicular from Ecotone (River or Canal Bank)

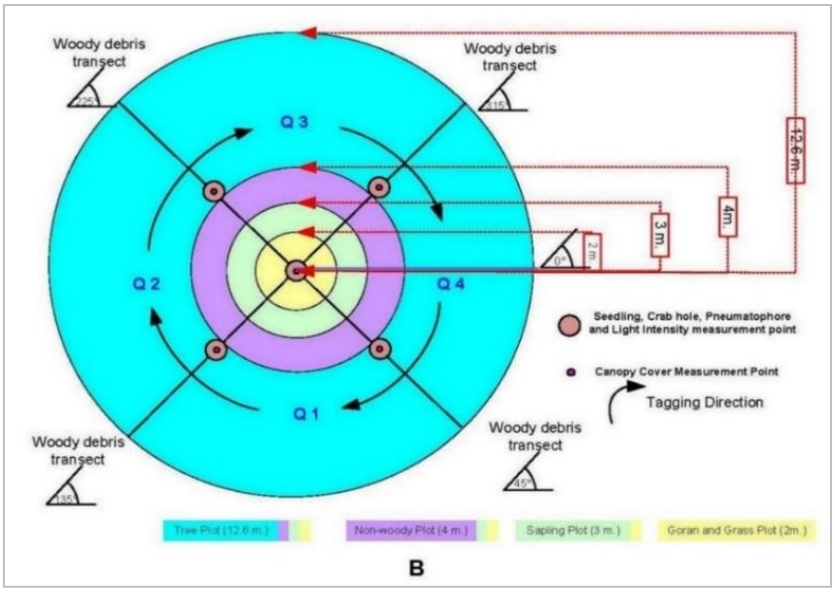


Figure 3.14: Layout of the Survey Activities in Each Subplot

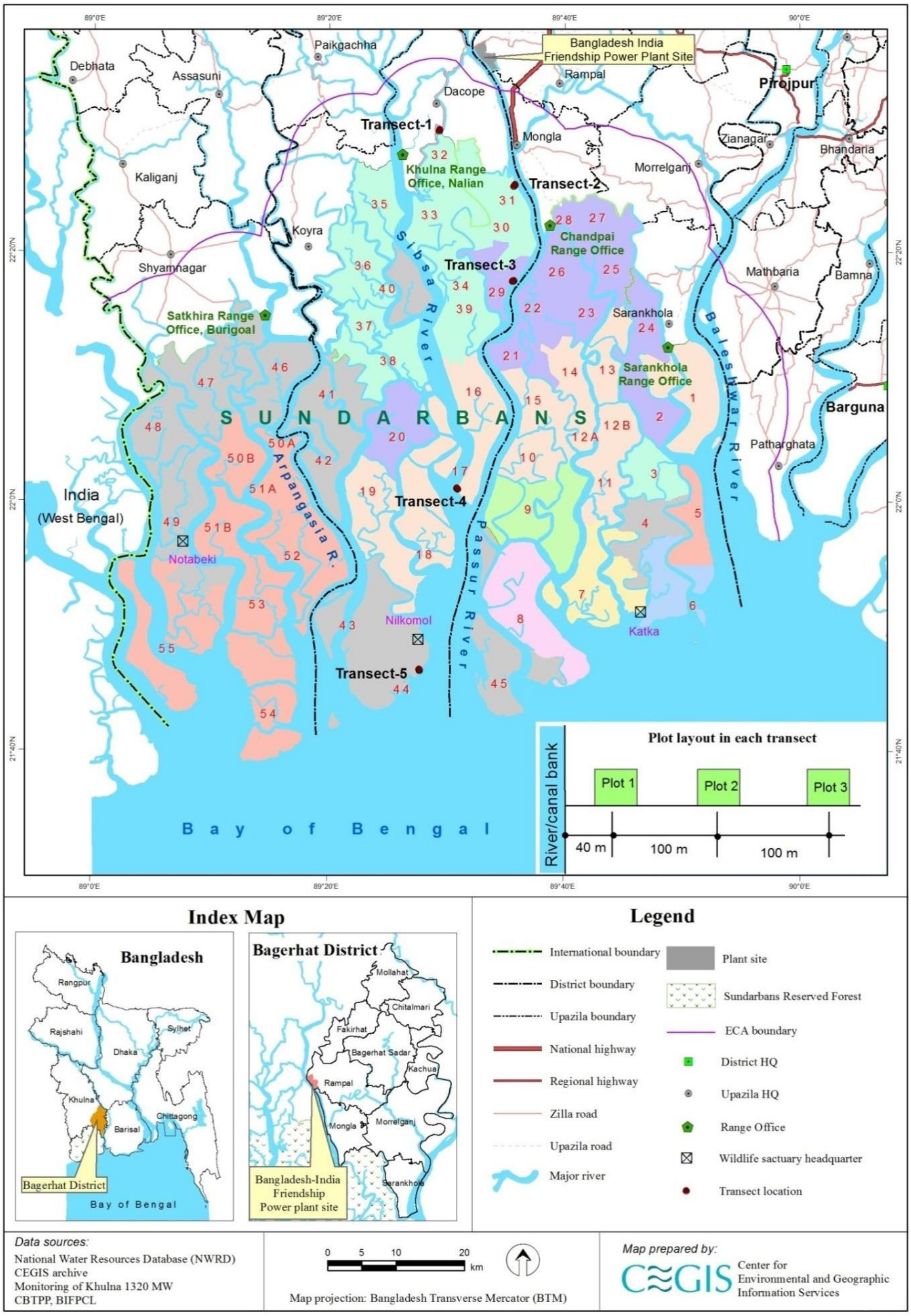


Figure 3.15: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)

3.3.5 Bio-Indicators for Forest Health Monitoring

Monitoring of frequency for different indicators has been determined considering efficiency in time, cost and applicability. The indicators observed in this tier are as follows:

- Seedling Regeneration
- Pneumatophores
- Crab hole density
- Canopy cover
- Leaf area index (LAI)
- Species composition & diversity
- Biomass and carbon estimation
- Leaf phenology and phonological behaviour
- Pest and diseases identification.

Tree Growth

The tag number of trees (DBH ≥ 5cm and lean angle greater than 45^0) is monitored and rewritten if any new tree is found within 12.62 m radius circle of the Permanent Sample Plot (PSP). The tree height and diameter are also taken by the surveyor (**Figure 3.16**).

Figure 3.16: Team Members Measuring Tree DBH inside the Plot

Seedling

Within a circle of a 1 m radius, seedlings (height 1.37 m) were evaluated in each PSP. The number of seedlings was determined each species, and their status was also noted. Within a circle of one-meter radius centered on each of the five points of all the subplots, the total number of living seedlings have been counted. The first point was placed in the center of each subplot, while the other four were placed in the middle of the four transects made of woody debris that face 45°, 135°, 225°, and 315° respectively.

Pneumatophores

The total number of living pneumatophores also recorded within a circular area of 1 m radius centering each of the five points of all the subplots. The first point has been laid out in the centre of each subplot and other four have been in the midpoint of the four woody debris transects that are facing at 45°, 135°, 225° and 315°.

Crab Hole

Crab plays an important role in mangrove ecosystems such as decomposing litter fall thereby increasing fertility. In order to work out the crab density, usually crab hole abundance is monitored. For this purpose, the crab holes have been counted within an area of 1 m radius circle in each subplot's centre and in the midpoint of four woody debris transect.

Canopy Cover

Canopy cover percentage was estimated by a spherical densitometer (i.e. densitometer a gridded convex mirror that provides a simple and inexpensive approach to 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 has not become visible in the mirror (**Figure 3.17**). After leveling the instrument using the level bubble, the dots which had not been occupied by the canopy were systematically counted. In each subplot, the meter readings have been taken at four points facing north, south, east, and west direction in each 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) **(Figure 3.17).** In this monitoring report, LAI was calculated as follows:

Leaf Area Index (LAI) = $\log_e$ (I/Io)/-K leaf area/area of ground (Where, I = Under Canopy Light Intensity, Io = Open Canopy Light Intensity, and K is Canopy light extension coefficient i.e., 0.5). LAI is represented by values ranging from 0 to 10, where 0 is equivalent to an area without a canopy or bare soil and 10 represents a dense canopy (BioScience, 2016).

Figure 3.17: Team Member Taking Canopy Cover, Light Intensity using Densitometer and Lux Meter and Storing Data

Species Diversity and evenness

Tree species data were collected from all the PSPs to identify diversity. Individual tree DBH ≥5cm was considered. The following two indices of the Shannon's index (MacArthur and MacArthur 1961) ***H´*** and Pielou's (1969) index ***J´*** was used to measure woody species diversity or equitability (evenness).

$$H' = \sum_{i=1}^{s} \frac{n_i}{N} \log_2 \frac{N}{n_i}$$

$$H' = \frac{H'}{H'_{max}} (H'_{max} = \log_2 S)$$

Where N is the total number of individuals and the unit of ***H´*** is bit, or the unit of entropy (e.g. *Goldman 2005).*

Species richness R'

Species richness index was measured by Margalef (1958): R'= (S-1)/ Ln (N) Where, S= total species found and N= total number of Individuals

Biomass and carbon stock estimation

Aboveground biomass of tree and sapling was estimated by using *Chave, et al., 2005* allomatric equation. On the other hand, *Komiyama et al., 2008* equation was used to estimate belowground biomass.

- AGB (kg) = ρ× exp [-1.349 + 1.980 ln(dbh) + 0.207× $\{\ln(dbh)\}^2$ – 0.0281$\{\ln(dbh\}]^3$
- BGB (kg) = 0.199 × $(\rho)^{0.899}$ × $(dbh)^{2.22}$

Where, ABG = above ground biomass; BGD = belowground biomass; DBH = diameter at breast height. After calculating biomass, carbon content was calculated based on the assumption that carbon content is 50 percent of the dry woody biomass (*Brown, 1997).*

Different statistical analyzes were performed for different indicators. A one-way ANOVA analysis was tested for pneumatophores, crab hole, canopy coverage, light intensity and seedling density in order to find out whether any difference was made.

Leaf Phenology and Phonological Behaviour

The phonological events such as leaf emergence, leaf shedding, flowering and fruiting and fruit/ propagule dropping time may have affected by Air pollution. Hence, Phonological behavior can be used as bio-indicator of forest health. During field visit leaf emergence, leaf shedding, flowering and fruiting and fruit/ propagule dropping time was investigated through visual observation and recorded for each plot.

Pest and Diseases Identification

Tree diseases play a pivotal role as bio-indicators, offering valuable insights into the overall health of a forest ecosystem. In the context of the Sundarbans mangroves, researchers, as highlighted by Rahman et al. in 2010, have identified key factors contributing to the population reduction of various tree species, including Avicennia spp., Rhizophora spp., Heritiera spp., Pandanus spp., Phoenix spp., and Acanthus spp. The spectrum of diseases affecting these species encompasses leaf blight, dieback, stump and collar rot, trunk gall, root rot, leaf necrosis, and powdery mildew.

Of particular concern is the prevalence of 'top dying' observed in Sundari trees across all Permanent Sample Plots (PSPs) in the current investigation. This disease has impacted a substantial portion, ranging between 30 and 40 percent, of Sundari trees. Understanding the specific diseases affecting mangrove species is crucial for effective forest management and conservation efforts. Pest and disease type of the Sundarbans mangrove forest was investigated through literature review, which was then verified in the field through visual observation.

3.3.6 Monitoring Result and Discussion of SRF Health

Seedling Density

The monitoring of seedlings across different locations, as depicted in **Figure 3.18**, revealed variations in density, with the highest recorded during the 5th and 6th years in all plots compared to the baseline period. Interestingly, the data from this period indicated a consistent increase in seedling numbers across all points compared to the preceding year. This surge in seedlings can be attributed to the dispersal of mangrove seeds during the rainy season, resulting in increased abundance on the forest floor post-monsoon.

The successful recruitment of new seedlings hinges on regeneration and survival rates, influenced by factors such as canopy cover, soil chemistry, pH, salinity, and organic matter. Notably, seedlings in natural forests face challenges, including early-stage mortality due to competition for nutrients and light intensity. Upon closer examination of the data, it becomes evident that Akram point exhibits lower canopy coverage and leaf area index, making it less conducive for the survival of shade-tolerant trees.

Seedlings at Akram point experience additional stressors due to their proximity to the sea. Recent years have seen the forest floor, particularly in the first and second plots of Hiron Point, gradually covered with a layer of sand. This unfavourable development is attributed to dredging activities and the subsequent dumping of dredged materials near the plot site. Consequently, these adverse conditions have likely contributed to a decrease in seedling density and hindered the growth and survival of new plantings at Hiron Point.

However, despite these challenges, statistical analysis using an Analysis of Variance (ANOVA) test has demonstrated significant variability ($P<0.05$) in seedling density at 1000/ha throughout the year and across all five Permanent Sample Plots (PSPs). This underscores the dynamic nature of seedling density, influenced by both natural and anthropogenic factors, which necessitates a comprehensive understanding for effective mangrove conservation and management strategies.

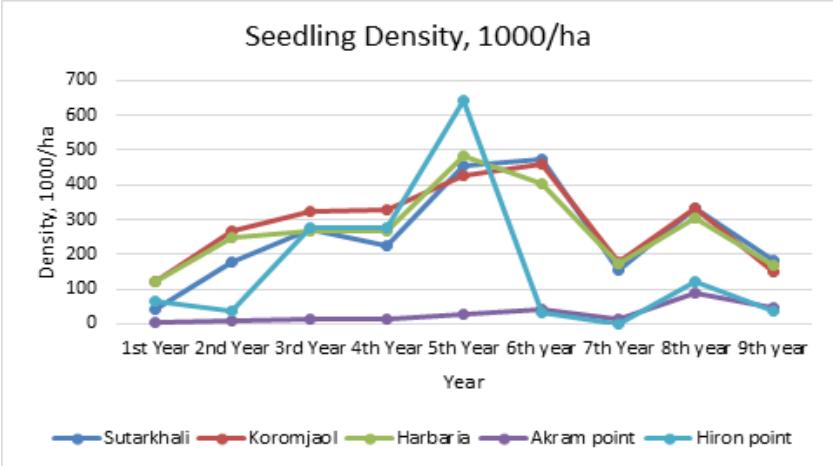


Figure 3.18: Mean Seedlings Density and Statistical Analysis among the Yearly Surveys in Five PSPs

Pneumatophore density

The intriguing dynamics of pneumatophore density, as portrayed in **Figure 3.19**, unfold across five distinct locations over a ten-year span, shedding light on the complex interplay within mangrove ecosystems. Pneumatophores, specialized structures emerging from mangrove roots, play a crucial role in gas exchange. Sutarkhali, Koromjaol, Harbaria, Akram point, and Hiron point present unique

trends in pneumatophore density. Sutarkhali and Koromjaol exhibit initial growth, peaking, and subsequent decline, mirroring Harbaria's trajectory. In contrast, Akram point reaches a peak in the seventh year followed by a decline, while Hiron point displays distinctive fluctuations with peaks in the third, eighth, and ninth years. These variations underscore the intricate interplay of intrinsic and extrinsic factors, encompassing environmental conditions and potential anthropogenic impacts, influencing mangrove ecosystems.

Further enriching our understanding, the data reveals fluctuations in pneumatophore density across these locations over time, with some experiencing growth while others decline. The elevation of the forest floor from the mean sea level (MSL) contributes to this variability, as highly elevated plots with minimal tidal inundation may have fewer pneumatophores. Counting periods also influence the observed density, as pneumatophores are submerged during tidal inundation. Weather conditions and tide variations pose challenges in reaching the monitoring station at specific times, leading to fluctuations in pneumatophore density.

Intriguingly, ANOVA results highlight significant differences ($P<0.05$) in pneumatophore density among the five plots. Sutarkhali, characterized by high species richness and silty, muddy soil, boasts the most abundant pneumatophore growth. Notably, ANOVA results also indicate no significant yearly variation ($P>0.05$) within individual plots. This comprehensive analysis emphasizes the need for nuanced considerations of mangrove-environment relationships, crucial for effective conservation and management strategies in the face of dynamic ecological processes.

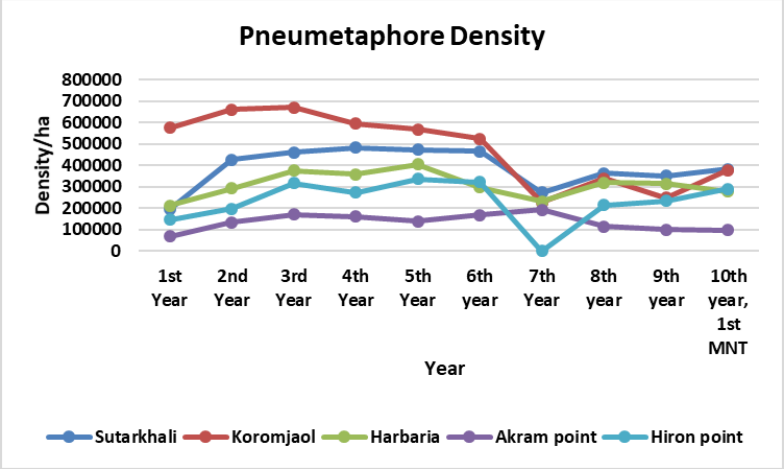


Figure 3.19: Mean Pneumatophores Density and Statistical Analysis among the Yearly Surveys in Five PSPs

Crabhole density:

Crab holes serve as crucial indicators of crab activity within a given area, offering insights into the availability of crabs in that specific location (**Figure 3.20**). Notably, the average crab hole density emerges as highest at Akram point when compared to the other four monitoring sites. This can be attributed to the sandy clay loam forest floor at Akram point, a habitat favored by crabs for burrow construction. The favorable conditions at Akram point contribute to a higher density of crab holes, signifying increased crab activity in this area.

Conversely, Hiron point exhibits the lowest crab hole density among the monitored sites. This is likely influenced by the continuous carpeting of sandy soil in the first subplot and partial carpeting in the second subplot. Such soil coverage may disrupt crab activity, prompting them to dig deeper within the forest floor where the sand does not disturb them. This unique characteristic of Hiron point contributes to its lower crab hole density.

However, it is important to note that crab hole density decreased across most monitoring locations during the current period due to the impact of the monsoon and rain. This seasonal variation underscores the influence of weather patterns on crab activity and hole formation.

Analyzing the data using ANOVA reveals a significant difference in crab hole density among the five monitoring plots, emphasizing the location-dependent nature of crab activity. Interestingly, there is no significant difference in crab hole density from year to year within each plot. This suggests that, despite potential variations caused by tidal inundation and changes in forest floor conditions, the density of crab holes remains relatively stable over time.

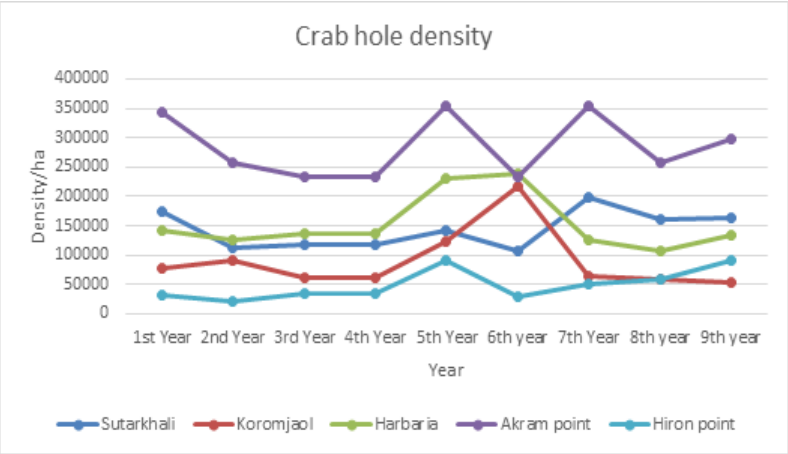


Figure 3.20: Mean Crab Hole Density and Statistical Analysis among the Yearly Surveys in Five PSP

Canopy Coverage (%)

Canopy cover, a crucial parameter influencing the likelihood of successful natural regeneration, serves as an indicator of forest health and stability. Its role in determining the distribution of light, shade, and rainfall on the forest floor makes it pivotal for assessing long-term stability and susceptibility to wind-related damage (Utschig, 1995). Furthermore, canopy cover is recognized as a key indicator of wildlife habitat quality and a descriptor of forest stand structure (Crookston and Stage, 1999).

In the specific context of this study, the observation of a consistent canopy cover percentage within each plot over the years ($P>0.05$) implies a stable condition in terms of canopy coverage **(Figure 3.21).** However, a notable difference in canopy coverage percentage ($P<0.05$) among the five monitoring plots is evident, suggesting spatial variability influenced by climatic and edaphic factors, natural stresses, and pest and disease attacks. Despite these fluctuations, the forest exhibits a high adaptive capacity to regain its cover.

An encouraging finding is that all monitoring sites in this study meet the criterion of having greater than 60% canopy coverage, indicating a positive sign for the overall health of the forest. This aligns with the understanding that a healthy forest typically maintains a canopy cover exceeding this threshold.

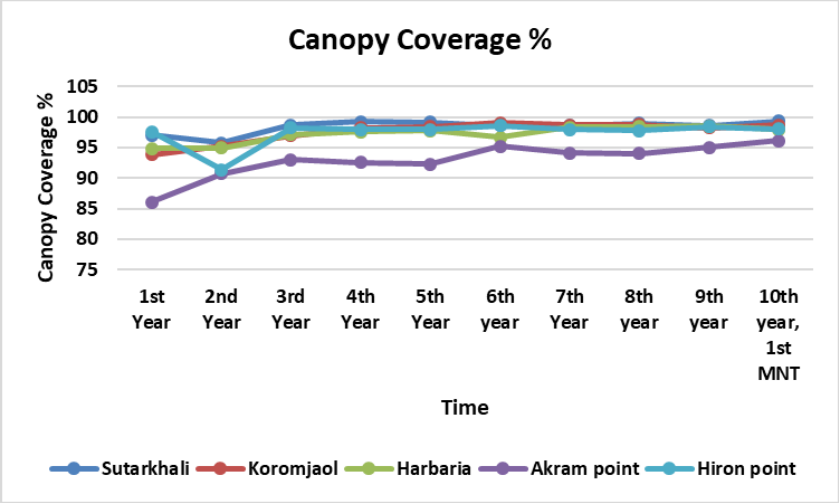


Figure 3.21: Mean Canopy Coverage % and Statistical Analysis among the Yearly Surveys in Five PSPs

Leaf area index (LAI)

The Leaf Area Index (LAI) stands as a pivotal parameter influencing the rate of daily net canopy photosynthesis and, consequently, the exchange of atmospheric CO2. Beyond its impact on photosynthesis, LAI provides insights into light penetration through the canopy, a critical aspect in multi-layered canopies where the upper layer's LAI significantly affects the light received by the lower layer. Moreover, LAI serves as a multifaceted indicator, offering information on radiation, precipitation interception, energy conversion, and water balance within the ecosystem.

The ratio of under-canopy to open-canopy light intensity emerges as a key metric for LAI determination. A lower ratio corresponds to a higher LAI, signifying increased net canopy photosynthesis. Interestingly, ANOVA results indicate consistent light intensity values over the years across all monitoring plots. However, a significant divergence in LAI values exists between plots ($P<0.05$), as depicted in **Figure 3.22**. Karamjol, characterized by high species diversity and a multi-layered stand structure, boasts the highest LAI, while Akram point, dominated by Gewa with low diversity, exhibits the lowest LAI. The species density per hectare further highlights differences, with Karamjol having lower density, allowing more light to reach the forest floor. These distinctions in LAI values underscore the influence of species composition and forest structure on canopy characteristics.

Recognizing the significance of LAI extends beyond immediate ecological considerations. LAI serves as a vital indicator for gauging overall forest health, productivity, and resilience to climate change. By scrutinizing LAI values across monitoring plots, areas requiring specific forest management interventions to sustain or enhance productivity and health can be pinpointed.

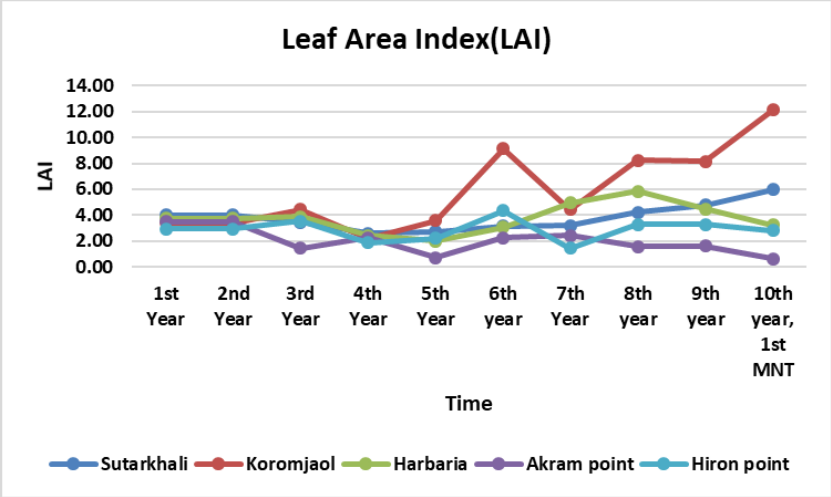


Figure 3.22: Mean LAI % and Statistical Analysis among the Yearly Surveys in Five PSPs

Floral diversity, species richness and species evenness

Floral diversity and species richness play pivotal roles in shaping the functionality and resilience of ecosystems, influencing factors such as productivity, stability, nutrient dynamics, and community structure. Additionally, the concept of species evenness provides valuable insights into the homogeneity within a community. **Table 3.16** illustrates a comparative analysis, showcasing Karamjol's noteworthy higher floral diversity and species richness in contrast to Harbaria, Akram Point, and Sutar Khali. Interestingly, the diversity index unveils a declining trend in species diversity and richness across all plots, except for Karamjol, from their baseline conditions. This decline may be attributed to a combination of natural processes and human activities, including tree logging and increased tree mortality.

Figure 3.23: Illegal Tree Cutting at Sutarkhali

Particularly noteworthy is the observation that Akram Point exhibits lower species richness, indicating its ecological instability relative to other sites. The environmental stressors faced by Akram Point, such as salinity, sedimentation, and high tidal forces due to its proximity to the sea, contribute significantly to this reduced species richness. Similarly, unfavorable weather conditions during the baseline monitoring period at Hiron Point have hindered the collection of species information.

A deeper understanding emerges when considering local insights. Recent field visit at Karamjol, it observed that the construction of structural RCC walking traits and the dumping of construction materials may led to reduce in vegetation at PSP, impacting species density per hectare. These local

observations highlight the intricate interplay between environmental factors, human activities, and the resulting effects on floral diversity and species richness.

Table 3.16: Species Diversity Index, Evenness Index and Richness Index of the Monitoring Site in SRF

Baseline Status

Monitoring site	H'	J'	R'
Sutar Khali	1.02	0.32	1.24
Karamjol	1.57	0.40	2.11
Harbaria	1.41	0.41	1.50
Akram Point	1.03	0.65	0.34

Present Status

Monitoring site	H'	J'	R'
Sutar Khali	0.56	0.40	0.50
Karamjol	2	0.79	1.19
Harbaria	0.93	0.52	0.89
Akram Point	0.74	0.67	0.35
Hiron Point	0.40	0.29	0.50

Carbon density

Table 3.17 provides a comprehensive snapshot of the baseline and current carbon storage status in five diverse locations: Sutar Khali, Karamjol, Harbaria, Akram Point, and Hiron Point. Notably, the data reveals a consistent and positive trend, indicating a noteworthy increase in carbon storage across all locations in the present status as compared to the baseline.

Taking a closer look at Sutar Khali, the baseline carbon content of 111.72 Mg/ha per plot has significantly risen to 142.7 Mg/ha per plot in the present status, reflecting a substantial boost in carbon sequestration. Similar encouraging trends are observed in Karamjol, where the baseline carbon content of 118.09 Mg/ha per plot has transformed into 110.1 Mg/ha per plot in the present status.

Beyond the overall carbon storage figures, the data delves into the distinct categories of Active Carbon (ABC) and Slow-Decomposing Carbon (BGC). In the majority of locations, both ABC and BGC exhibit an increase in the present status compared to the baseline. For instance, in Sutar Khali, baseline ABC registers at 70.51 Mg/ha per plot, escalating to 90.4 Mg/ha per plot in the present status. Similarly, baseline BGC of 41.21 Mg/ha per plot sees an uptick to 52.3 Mg/ha per plot in the present status.

This positive shift in carbon storage is vital for ecosystem health and can be attributed to various factors. Sediment deposition, a critical aspect in coastal environments, contributes to the enrichment of organic matter in the soil, fostering optimal conditions for mangrove growth. This, in turn, leads to a substantial increase in carbon storage within the soil matrix.

Table 3.17: Mean Carbon Density in Baseline and Present Condition of the four Monitoring Sites

Baseline Status				
	Sutar Khali	**Karamjol**	**Harbaria**	**Akram Piont**
ABC Mg/ha per plot	70.51	79.47	45.95	82.10
BGC Mg/ha per plot	41.21	38.62	25.49	41.26
Total carbon	111.72	118.09	71.44	123.36
Present Status				
ABC Mg/ha per plot	90.4	71.8	85.4	66.1
BGC Mg/ha per plot	52.3	38.3	47.2	37.4
Total carbon	**142.7**	**110.1**	**132.5**	**103.5**

Source: CEGIS field visit; August, 2023

Phenological Behavior

From the last visit, Phenological behavior of major mangrove species was summarized in **Table 3.18**

Table 3.18: Phenological Behavior of Major Mangrove Species in the PSPs

Species	Months											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
	Leafing											
Sundari												
Gewa									■			
Amor									■			
Goran												
Kakra												
Passur									■			
	Leaf Shedding											
Sundari												
Gewa												
Amor												
Goran									■			
Kakra									■			
Hental									■			
Passur												
	Flowering											
Sundari									■			
Gewa									■			
Baen												
Amor									■			
Hetal												
Goran												
Kakra												
Passur												
	Fruiting											
Sundari									■			
Gewa												
Goran												
Kakra									■			
Amor									■			

Species	Months											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Urmoi												
Sanagarjon												
Passur												
	Seed/Popagule dropping time											
Sundari												
Gewa												
Goran												
Kakra												
Passur												
Golpata												

Source: CEGIS field survey; August, 2023

During field visit leaf emergence, leaf shedding, flowering and fruiting and fruit/ propagule dropping recorded for each plot **Figure 3.24**.

Figure 3.24: Fruiting at Shundori in Harbaria and Flowering of Amoor in Akram point

The observed disease affected trees are listed in the following **Table 3.19**

Table 3.19: Observed Diseases in Trees

Sl No	Symptoms of Disease or Damage	Species Name
1	Tree has ragged leaves with holes	Sundari, Passur, Gewa, Goran, Amor
2	Black or brown leaves	Hetal, Sundari, Goran, Gewa, Amor
3	Spots or bumps on leaves	Passur, Shundari, Goran, Gewa
4	Twisted or mail formed leaves	Sundari, Amor, Gewa
5	Leaves changing colour before fall	Sundari
6	Branch decay	Sundari, Passur
7	Peeling or broken bark or holes in the bark	Gewa, Sundari
8	Dying branches on one side of crown	Sundari, Hetal, Urmai
9	Canker	Passur, Sundari
10	Gull	Passur
11	Hollows	Sundari, Passur, Gewa, Amor, Goran
12	Fungi	Passur, Sundari
13	Green or brown spots	Goran

Source: CEGIS field visit; August, 2023

4. Social Environment

4.1 Introduction

This safeguard monitoring is a follow-up study that occurred following the guidelines of DoE and Environmental Management Plan (EMP), suggested in the Environmental Impact Assessment (EIA) Report. The objective of the social safeguard monitoring is to ensure compliance during the project's construction phase. The monitoring was held to check the compliance status of the working environment, community safety and security, and impact on livelihoods (due to project intervention), and status of Corporate Social Responsibility (CSR). Additionally, the Corrective Action Plan (CAP) suggested addressing the non-compliance issues based on the findings of the safeguard monitoring.

4.1.1 Methodology

This monitoring was conducted using social data collection tools. There is consultation, informal interviews, and physical observation applied to collect data from the study area as well as the project management unit. The consultations were held at the MSTPP office and Niramoy Medical Center, where relevant project officials provided their feedback in response to the issues of the checklists. In addition, physical observation and informal interviews were held with the workers and local people at different location in the project site and in the study areai.e. Zero Point, Kapasdanga, Barni, Gaurambha, Sapmari-Katakhali, Rajnagar and labor sheds in the project area for getting people's/labors opinions about the safeguard issues. The monitoring locations are shown in **Figure 4.2**.

4.1.2 Findings of Social Safeguard Monitoring

Impact on Livelihoods

According to the local inhabitants and the Project Management Unit (PMU), engagement of local laborers is decreased with the completion or close to completion of the construction activities, and the plant is now in the operation phase where permanent and temporary technical employees are required. Only a few local labors are working (during this monitoring phase) at the project site for non-technical construction activities i.e. cleaning, cooking assistance and other support services etc. According to the statement of local people, up to March 2023 minimum 100 labors were found to go for daily laboring work in the project site in temporarily basis, which has been decreasing in last 2 months. In term of permanent employees in BIFPCL, the proportion of local and Indian employees is 231:18. Employees number will be increased during full operation of the plant and then this proportion might be changed more in favour to the local workers.

Figure 4.1: Fish Depending Livelihood adjacent to the MSTPP

According to the statement of Rajnagar and Gaurambha Union Chairmen, mediators works for supplying the employees/labors in the project site. Though, those employees/laborers are local citizen, but the chairmen could not like to take the responsibility of any unethical occurring by those laborers. However, if there have any bond with the MSTPP authority in favour to those labors then they could take all the responsibility of those labors as a representative of that union. On the other hand, the project authority said that they recruited the local employees on the basis of the birth certificates, authorized by respective local chairman and following all their procedures of recruitment. But it is out of their scope to have a bond with the local chairman in favour to the local labors because it may take another controversy.

Chairmen also stated that, all the surrounding of the power plant there are fish culture dependency activities in the study area. Therefore, project authority should have conscious before discharging any materials in local wetlands, because few months back local fish farmers of sapmari village under Rajnagar Union alleged against liquid discharge from the power plant which causes unexpected loss of their fish production. However, no such complain is yet to be observed more after that incidence whereas the MSTPP authority showed their commitment for retaining the environment standard for all environmental component.

In new scope of employment generation, the MSTPP will influence for further industrial development in the project surroundings which can enhance the employment opportunity in local level. In the meantime, MSTPP is committed for the skill development of the PAPs by generating semi-skilled and skilled labors in the study area. The project authority initiated some training for skill development of the local people and provide some necessary logistics for their development up to the Covid 19 Pandemic Situation in 2020 while it was temporarily halted during Covid Pandemic. The authority has intention to restart the training activities in more organized way considering local needs and potentiality.

Small business opportunities have also been generated by selling local foods and crops beside the approach road and adjacent periphery of MSTPP. Tea-stalls, mobile recharge services, food and beverages, restaurants, vegetable selling shops, fish market, meat shops and mobile banking services have newly developed at project adjacent and peripheries, focusing on the market of MSTPP. Recently the authority strengthens the security system of the project area by fencing the entire project boundary which closed all the unauthorized local connectivity points from where some of the above-mentioned business is also operated. So, local people urge to keep the provision of pocket gate near Sapmari-Katakhali area so that they can smoothly operate their small businesses.

In addition, about 300+ non-motorized vehicles are so far authorized for providing communication facilities in the approach road of the power plant. These vehicles are operated by the owners or sometimes it has been rented to the local poor drivers.

The authority also develops their own market compound, from where the residential officials and workers can easily purchase their daily needs. Total 39 different types of shops have been constructed of which 25% of shops will be distributed among the PAPs who were the owners of the project land.

Working Environmnet

Workers health and safety issues are sensitively monitored for ensuring safe working environment of the workers. Tri-party coordination meeting with the participation of BIFPCL, BHEL, and other sub-construction companies was regularly held to ensure compliance with the working environment, though it is discontinued over last few months because of highly focusing on the trial and operation of the plant. In new labor recruitment process, labors medical tests and safety sense are tested, and passing the tests the labors are recruited for works. Newly recruited workers are included under a health insurance program. Also, necessary medical supports are provided to the BIFPCL workers medicine, diagnosis, general operation, ICU bed with oxygen support, private ambulance service, physiotherapy etc in a minimal or free of cost. Usually, except to the Lab tests all other mentioned services are provided in free of cost for the workers.

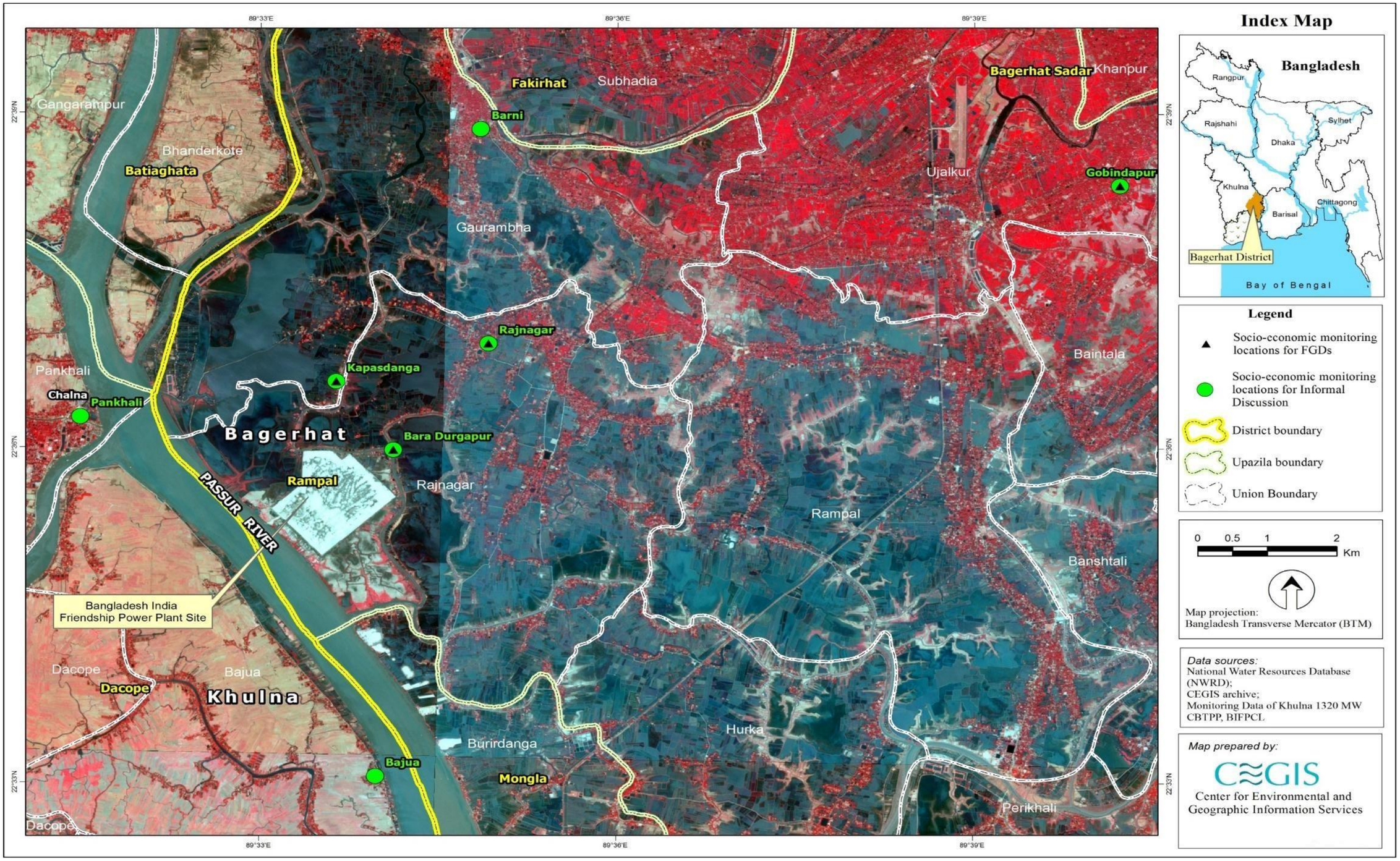


Figure 4.2: Socio-Economic Environment Monitoring Location

The number of construction laborers is decreased with successive completion of the construction activity of the proposed power plant. Some temporary labor sheds are found to be closed and remain unused, however, few are still functional where laborers engaged in major mechanical and technical activities are accommodated. Labor sheds for these laborers are equipped with general basis utility facilities though cleanliness issues were raised from the residential laborers which causes mosquito generation in the surroundings. Some labors are also complained regarding food cost in respect to the quality and taste. Asbestos and debris are found to be managed improperly which has been mentioned in previous monitoring phases but could found significant improvement except a few in terms of asbestos management.

However, it is observed that dust flow is a common problem in the construction in most of the development project, whereas in this project site water is regularly splashing twice in a day even more within and surrounding to the project site for controlling dust flow.

Grievance Redress Mechanism

Community-level grievance redress mechanism is not yet set up where it's need has been mentioned in several times in the earlier monitoring phases. Local-people shared grievances to the monitoring team but were not able to place to the BIFPCL authority because of access restriction. At present, major grievances are observed - disputes in local labor and workers' recruitment, and the allegation of the thief to local workers. In addition, some people raised issue of discharging polluted water from the BIFPCL (once in June or July 2022). Though BIFPCL assigned one of its official for addressing community level issues and he try to communicate with the union chairmen but not possible to address the issues from door to door. But, in rural context interest varies within in individual or small group of members which cannot be managed by the chairmen and others in some cases.

Figure 4.3: Meeting with LGIs at Rajnagar Union regarding Grievance Issues

Corporate Social Responsibility (CSR)

The proposed project is not fully operated yet, however the authority started their CSR activities from the pre-construction and construction phases of the proposed project and they are committed to continue it. Under the CSR activities, they provided free medical facilities, livelihood and skill development trainings, installed ROs for ensuring safe drinking water for the community people, distributed school bags, umbrella, blankets, wheel chairs etc for the local students and other people, and contributed in local cultural and national festivals. In this quarter, except to the existing ROs

operation, and new RO construction as well as handed over, and re-initiating free medical service after halting up during Covid -19 pandemic situation, authority could not able to involve in providing other benefit/support, because of highly engagement of the officials for initiating the operational activity of the plant. According to the response of the local people, this RO services are highly appreciated. They additionally urge for arranging livelihood improvement program by the BIFPCL authority what they initiated few years back. But, the module of this program should be different from the previous, and should include practical field-oriented course which might also be required for operating the MSTPP Project.

RO System Installation

In the surrounding unions of the proposed project, 5 ROs are operated as 2 in the Rajnagar, 2 in Gaurambha and 1 in Burirdanga Union in which four are well functioned and remaining 1 RO in Prasadnagar village under Gaurambha Union is temporarily non-functional, due to complexity in electricity bill payment. Also, there are some disputes about the ROs in Sayrabad village due to some unauthorized pipeline connection in this line that disrupt the water supply for about 100 households from tab no 4 to tab no 6. It has already been informed to the MSTPP authority in previous quarter monitoring phase but no action is yet to be observed in the local level. On the other hand, additional 6 ROs are constructed by the MSTPP at 2 in Hurka Union, 3 in Burirdanga Union and 1 in Mongla Paurashava in which ROs in Burirdanga and Mongla is ready to hand over for the community.

Medical Facilities

Free medical campaign is reinitiated after halting up during Covid-19 pandemic condition and from June, 23 the authority starts their service through maintaining all necessary protocols. In the meantime, OPD, laboratory test and physiotherapy service are continued for the community and resident workers. From May 2023 to July 2023, a total of 3,037 patients were treated under above mentioned four types of medical facilities in the Niramoy medical center. Distribution of these service receivers are presented in the following figure in gender segregated manners.

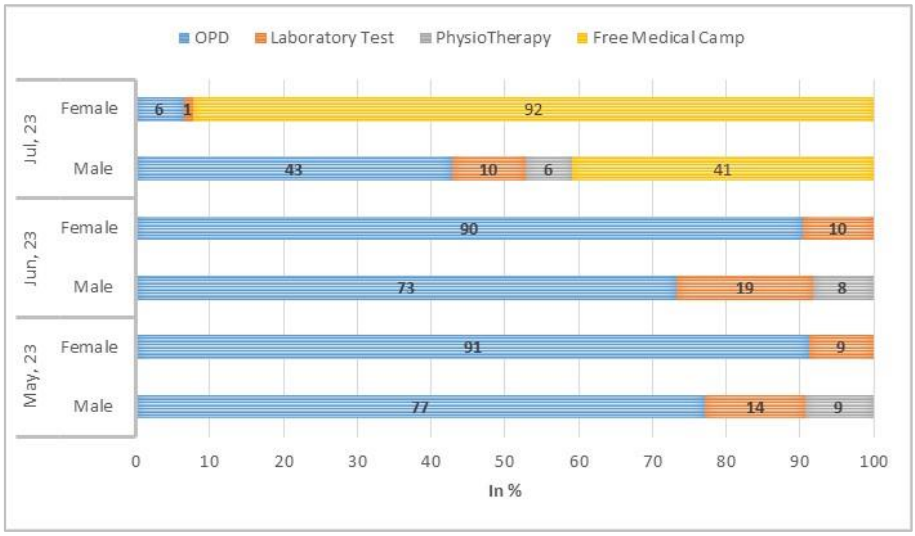


Figure 4.4: Medical Campaign from May 2023 to July 2023

Autonomous Development due to MSTPP

The proposed project insists for autonomous development in the project area and its close surroundings. Babur Bari bazaar and DBBL agent banking facilities are already developed beside the approach road and close adjacent. Also, some village connecting roads have been developed in

connection with the approach road of MSTPP. After developing the proposed project almost three-fourth of the kutcha/brick soling road in Rajnagar and Gaurambha unions have been converted to the pucca road.

Adjacent plot of the MSTPP approach road have get additional benefit in terms of rapid hiking the land price and these lands are mostly purchased by the industrialist for future industrial development.

Figure 4.5: Brick Soling Road Converted to Concrete Road Toward Kalikharber, Rajnagar

4.1.3 Recommendations

a. Recruitment of local labors should be in open circular basis, where the number of requirements and exam date will be explicit in the poster at UP Chairman offices/notice board;

b. Re-consideration about the issue of restriction on new local labor recruitment under Rampal Upazila in terms of allegation of thief to the existing local labors of that upazila;

c. Local work forces should be trained on masonry, carpentering, electrician & electronics, welding, driving, rod binding and machineries operation to prepare them as the semi-skilled working force for this project;

d. Representatives from BIFPCL should present/offer their requirement to the local community at the coordination meeting of that union Parishad, so that it can be easily disseminate to the community. Because most of the local people are unaware about their support services and offers.

e. It is required to installed a grievance box for the local community in the MSTTP main gate, and establish a grievance redress committee (GRC) to monitor and resolve the locally raised problem in associate with MSTTP;

f. Dredged material management plan should be prepared for successfully and properly handling the regular maintenance dredging;

g. Previously sewing and computer training were introduced for the skill development of local people. Outcomes of those trainings should be monitored as a lesson learnt, before initiating further such types of training;

h. Asbestos in the construction yard is not properly managed which is a serious health hazardous issue for the construction workers and it should be properly and carefully handled.

i. Plantation program should be re-initiated to ensure good and sustainable environment for the workers and employees of the MSTPP; CSR activities should be performed prioritizing the PAPs. This should be audited by a third-party monitoring team;

j. Local people are well aware about the new entrepreneurship development in this area. In this regard, the authority can arrange training on potential scope of entrepreneurship development in the project surrounding unions under the CSR activities;

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

l. Unauthorized internal connection of the ROs pipeline should be cut down immediately to ensure uninterrupted service for the expected households.

5. Environmental Compliance

5.1 Introduction

This environmental compliance report aims to highlight any actual or potential breach of compliance with the measures and requirements set forth in the EMP measures in the EIA report at Bangladesh-India Friendship Power Company Ltd (BIFPCL). However, an E&S team from CEGIS recently visited to the plant on 31st August, 2023 for a routine inspection to acquire required information intrinsically considering the bio-physical and other related parameters through a rigorous walk-in visit, meeting with plant officials, general laborers and overall, the close observation of the ongoing work at the plant.

The present environmental compliance monitoring includes the status of EMP implementation based on physical observation, investigation and interviews/discussion to the proponents, project officials, relevant authorities and overall staffs of the entire plant. A comprehensive and detailed checklist was encompassing Environmental and Social Management System and Action Plan; Labour and Working Condition; Community Health, Safety and Security; Biodiversity and Sustainable Management of Living Natural Resources, waste management and other relevant issues. During 37th visit we went across again on those issues and found the same situation. CEGIS raised this issue in the meeting to consider this issue as urgent and project management has assured us to take immediate step to resolve the issue. Along with the previous issues we would like to bring the following issues to the respective authorities for an earlier solution:

- The sensitive and critical issue has come in front is the **Asbestos** management issue. Plenty of Asbestos fibre were observed in the plant premises specially at the boiler and ESP plant site. Lack of proper management, Asbestos can be a serious health hazard causing the lung function decrease, lung cancer and even death if someone inhale plenty of Asbestos fibres. We strongly suggested to take necessary actions to manage the Asbestos as soon as possible. Taking consideration of asbestos issue, BIFPCL has already issued a letter to BHEL to take necessary step on this issue but the respective authority is reluctant to resolve the issue.
- Waste management issues need to be solved as soon as possible. The lavatory waste sewerage facility at labour shed is inadequate that is causing substantial environmental hazard in and around the camp area. Also dumping the construction waste by the side of Maidara river and Coal-water slurry at the jetty area has become a significant threat for the aquatic ecosystem at Maidara and Pashur river respectively mixing by rain water and other ways. Current Dredged material disposal practice seems unsustainable and harmful for the environment and the adjacent biodiversity. Proper dredged material disposal plan is highly recommended. We have discussed this issue in the meeting where a concurrence has made to develop the Dredged Material Disposal Plan (DMDP) as soon as possible.
- Coal Conveyor belt from jetty area to 1st Transportation Point (About 20 to 25 m) found still uncovered and lack of integrated dust control system allowing the coal ash to be dispersed in the air and nearby water body. Also, the grabber of the excavator was not enclosed that is also causing the air and river water pollution. Heap of Sand and other loose material were found uncovered at the labour shed and inside the plant premises.
- In general, 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 monthly and quarterly basis both night and day time at different sensitive areas (Labor colony, township) and compared with the ECR-2023 Standard which are being documented.by EPC contractor. • No noticeable noise detected except some gentle sound during the walk-in visit inside the project boundaries. • 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 ensured through safety audit. • Idle machines / equipment / generators are switched off / throttled down. • Generators with acoustic enclosures are only being used as and when required. Signboards regarding noise permits were not observed at site.	Complied	• Schedule the Heavy noise related work if required and that should be disseminated to the workers and nearby communities before • CEGIS team has suggested to attach precautionary signboard regarding noise management. • Noise silencer should be imposed if any plan to run the work at night
2	Dust generation from construction works	• Limiting activities for producing fugitive dust particle within project area • Vegetation clearance and base stripping should be minimized. • 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	• Monthly and quarterly air quality monitoring in and around the project sites is being conducted and checked with ECR, 2023 standard. • Mixing of cement and concrete may generate some unavoidable dust but the crushed material was well covered and also noticed the water spraying at those areas. • Continuous water spraying on the dusty road was noticed. BHEL has contracted a company for 3 years for this job.	Mostly Complied	• It is strongly recommended to cover all the Stockpiles of sand or any type of loose materials inside the plant premises and at the labour shed/camp. • Face musk should be use wear throughout the workplace.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended 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.	• Unlike the previous visit, some stockpiles of sand and other loose material were noticed uncovered. • Now-a days, earthen stock piles are covered by natural green of tiny grasses. These are acting as shield cover for fugitive dust • No black smoke observed because of plant and equipment are well maintained. • Visual monitoring of dust is also being conducted. Appropriate freeboard was observed in the loaded truck		
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 • 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	• Surface water is regularly monitored. Most of the time the discharge water quality has been recorded within the standard limit (ECR, 2023) • Waste water discharge due to construction activities is minimum and need based only. They are also meeting effluent norms. • Most of the permanent drainage channel were found blocked by depositing earthen materials and other construction waste. • There are two nos. of runoff settling ponds to settle the silt before discharge in to river. • Waste water is being discharged in to the Maidara River without any further treatment. • Temporary chemical lab has been established where turbidity, PH, alkalinity, conductivity, chlorine, iron (Fe) parameters are being tested and monitored. • Drinking water is being supplied from M/S ABM/Canopass (1m^3) RO water processing plant	Mostly Complied at present	• Good housekeeping at workshop and construction site is strongly recommended • All the drainage channel must be cleaned immediately for proper and quick drainage of the stagnant water. • Waste water must have to be treated properly before final discharge into the river.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		hour according to ISO-14001 standard, Arrange monthly Environmental meeting among the mid-level officers through top management when those issues will be discussed under guidance of ECR 1997.	that is also being complied with ECR 2023 (Bangladesh). • A dedicated RO plant (5 m3) has been placed at Padma Abasan (temporary township) for drinking water. • ETP plant construction is almost finished where the effluent will be further treated before final discharge. Training and awareness programs are being conducted regularly through PEP talks, lectures, one to one talk etc.		
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	• During the visit CEGIS team found most of the construction waste are compiled at the demarcated place but more attention is required to manage this practice as some wastes were scattered here and there. • Most of the Labour shed/camp area were found very dirty. Organic and inorganic waste were found on the roads/lanes inside the camp which are spreading the stench around the camp community. • Stockpile of construction and household waste were noticed along with the bank of the nearby river which may pollute the river water during rainy season. (Pic attached) • Lack of proper drainage facilities for the lavatory (Toilet) waste that is deteriorating the ambient environment. • No chemical or gaseous waste noticed during the visit as Chemical wastes are properly stored and labelled	Partially Complied with many lacking	• Strongly advised to keep the footpath of the labour shed clean and waste free. • Riverbank must be waste free and keep clean to save the river water pollution. • Proper and immediate step need to be taken for the lavatory sewerage waste management at labour shed • Special care and training need to be conducted regarding source segregation of the waste • Awareness raising programs regarding waste recycle and reuse should be introduced.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Burning of waste material should be restricted • Quality housekeeping practice must be maintained by regular inspection and checking. • 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	• Limited but Onsite waste collection and disposal facility has been observed. • Source segregation method were absent and not kept in separate labelled container. • Though there are 769 different colored waste containers but not labeled by Bengali or English written sticker that is very important for source segregation of the waste. • Burning of waste materials is strictly banned inside the plant premises. • BHEL has engaged a company name Rahman Brothers in collaboration with the KCC for collection of waste from the disposal. Waste management training has been included in induction training of the labor.		• Team advised again to label the waste container in written by both Bengali and English so that one can easily understand which container is for which type of waste. But still there is no progress in this issue.
5	Compensation and Resettlement	• Proper resettlement action plan (RAP) 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 Compensation under Law (CCL) before resettlement formal agreement with the affected people prior to migration/resettlement • Sufficient standing crop compensation • Compensation for movable structures • Retention of salvageable materials • Compensation for loss of trading income one-time moving assistance grant to cover loss of regular wage income	• 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. • Compensation was paid by the local DC office as per law of the land. • Local DC office facilitates to obtain house of the PAPs (settlers of the project area) in cluster villages provided by the GoB. • Almost 12 affected families were stayed at Foyla cluster villages, at present 6 affected families are found to be resided and remaining are left this shelter because of unavailability of livelihood. • BIFPCL is giving priority to affected people in project employment or trained them as much possible.	In the process of Compliance	• The CSR activities should be oriented towards the affected people or household; CEGIS team advised several times to collect the original copy of compensation disbursement to the affected peoples from local DC office but this is not done yet.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• 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 (women, children, ethnic minorities, indigenous people etc.) Provision of monitoring the compensation and resettlement process	• 136 indirectly affected people were given compensation by the DC Office, Bagerhat. • The project authority has given training on computer and swing to the nearby villagers including PAPs which is stopped at present due to COVID-19. • BIFPCL have also plan to initiate skill development trainings on electronics, driving, health and hazard safety, fittings, welding etc. 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 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.	• BIFPCL are recruiting the local people especially PAPs with the help of local government (UP Chairman and members). • In August, 2023 Total manpower at site was 3000 nos. Out of this, Bangladeshi manpower was 2800 nos. • Previously an NGO "SAMAHAR" was engaged by BPDB to give livelihood training for the affected people. • Provisions has been kept for health facilities to the labors as well as for the communities. • The wage of the labor was found compatible with the national standard. • Labour accommodation is clean but plenty of waste were found on the camp road that is polluting the camp environment. • Quantity of toilet compare to the labour seems inadequate Inadequate drainage facility of lavatory waste made the whole workers camp very unhygienic.	Partially complied	• Drainage and sewerage facility must be improved for proper lavatory waste management. • Dirty water reservoirs must be cleaned immediately. • 1 toilet for 10 people should be ensured Health and financial support should be available for the labour in case of COVID and other health effects.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
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. • 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	• The EPC Contractor is using relatively new equipment and vehicles to reduce the GHGs emission. • Equipment, generators and vehicles were observed switched off during non-operation period. • Green waste is not being segregated from others that can be a major concern for GHG emission. • Transportation vehicles observed with the appropriate load. No waste burning activities noticed inside the plant premises.	Partially Complied	• Segregation of the green and food waste must be the top priority for the waste management team. Solid Waste Management (SWM) system inside the plant should be enhanced

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;	• BIFPCL is running through the HR polices and switching their professionals as per demand of the project. • Based on the conversation with HR manager CEGIS team found all the agreement for the direct workers are well maintained. • No discrimination was recorded among at labor level between local or migrating labor in Bangladesh • BIFPCL has ensured minimum wage and working hours for the labor as per GoB rules and regulation.	Mostly Complied	• Create fund to support the labour and his families in case of any fatalities CEGIS team repeatedly advised for Community GRM but authority is reluctant about this issue. The grievance box may be fixed just at the outside of the main entrance.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		Grievance Redress Mechanism.	• Routine medical checkup and emergency medical care has been ensured Continued in association with COVID management guideline. GRM procedure is available for the project workers and officials but Community GRM is absent. Community GRM box is still not to be fixed at main gate		
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	• CEGIS team visited all part of the construction area and found no children involve in the construction and any other works. • No forced labor has been recorded during the project tenure. • Proper documentation of contract with the worker is being maintained which includes age limit, working hour, wage and benefit. Workers get the safety clearance before initiating any work like – routine checkup of the work places and administrative clearance is being Implemented	Complied	Complied but this should be continued strictly till the end of the pandemic.
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	• BIFPCL has demarcated the specific construction site with appropriate warning sign. • It was impressive to see that all Labors and Project personnel are using appropriate PPEs like reflecting vest, helmet, safety shoes, gloves and face masks. • Fire-fighting system: Fire extinguisher - Foam type-27 no's, Soda type -Nil, DCP type-327 no's and CO2 type- 215 no's have been kept at different places of sites.	Complied	Satisfied but this process must be continued through the entire construction and operational phage.

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
		• 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 (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	• In addition to this, two NOs of fire fighting vehicle, two NOs of ambulance with doctors are also available at sites. • Induction trainings and awareness program were given to 355 NOs of participants work force during month. • Regular Safety talk, safety meetings are being organized at site and also in class rooms. Photo are being attached. • Through safety park, continuous training on different issues is being given. • The OHAS Company named Cholamandalam has been looking into the occupational safety system of this project. • Safety walk-down at a regular interval by the OHS officer has been strengthening the HIRA process. • Emergency contact address was found on the board at the site for any kind of sudden incident. Different type of awareness posters was also observed at the site premises (Pic attached) • The existing temporary hospital are fully running with doctors and 24hr availability of ICU supporting ambulance at the Project site. • Total Recordable Injury Frequency Rate (TRIFR) and Lost Time Injury Frequency Rate (LTIFR) are being followed. Warning sign, speed limit and convex mirror have been displayed at the strategic locations.		

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
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. • The OHAS Company named Cholamandalam has been looking into the occupational safety system of this project. • Zero major accident/ incident happened from 21st April 2021 till now except some minor injuries. Regular Safety talk, safety meetings are being organized at site and also in class rooms. Photo are being attached.	Being Complied	• OHS should be a Continuous process regarding awareness build-up and strict to the safety issues, • Continued the safety training, buildup the awareness and make the labour habituated with the safety procedure
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 satisfied with the residence facilities provided by BIFPCL. No dissatisfaction among the workers observed. • 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 water during work period • 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 occasionally.	Complied	

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			• Grievance mechanism available for the workers that usually address the safety issues. No labour association identified yet to look after workers 'well-being issues		

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 construction is almost completed except some part from Bridge area to Jetty area. • Some sand pile and other loose material were found uncovered that could be a concern for the local communities. • Water is also being sprayed regularly on the stockpiles and registered. • Environmental Monitoring team from CEGIS is routinely communicating with the nearby communities for assessing impacts and related complaints on dust generation issue. • CEGIS team regularly monitors the noise level in the ambient area of the project site like Bajua, Mongla, koigordashkathi and it meets the standard nose level. Community GRM system was absent that is considered as an important tool to identify communities complain	Mostly complied	• Uncovered sand and other flyable material should be covered and watered regularly. • Any complaint regarding noise and dust from local people must be addressed immediately and recorded accordingly in the register. The grievance register box should be placed at the gate of MSTPP so that the communities could easily put their written complain there.
2	Grievance of local people	• Availability and operation of Grievance Redress Mechanism;	• Social liaison officer is working for maintaining relation with local communities especially the CSR activities.	Mostly complied	Recommend and advise in each quarterly meeting to initiate the community

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		Maintaining open communication channel with the local community.	• BIFPCL regularly display the progress of the development through their website (https://www.bifpcl.com/) and disclosure meeting at the local government Though BIFPCL is receiving grievance from local community through local government like Union Chairman or Local Administration. Community Grievance Redress Mechanism (CGRM) has yet to be in action. It should be started as soon as possible.		GRM procedure so that the local community could easily state any grievance properly. But this issue has yet to be done.
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 behavior and communication with the local people; Aware the security personnel about the right of the community people.	• Boundary wall construction is almost completed except some part from Bridge area to Jetty area. • Initiated 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 were observed. And if required entry pass is being checked by the security guard to enter the project site area. • No conflict has been noticed between local communities and project authorities or workers. • Project Security personnel is well trained and instructed by the authority to demonstrate a decent behavior and attitude to the local communities. Though BIFPCL is receiving grievance from local community through local government like Union Chairman or Local Administration, Community Grievance Redress Mechanism (CGRM) has yet to	Complied	• Keep on tack about the communicable disease transmission between the labors and nearby communities Again, a grievance Box is strongly recommended for the community to raise their complaints.

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			be in action. It should be started as soon as possible.		
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 ensure safeguarding to community.	• Continued the medical facilities (consisting medical officer, medical assistant, office assistant) at Plant site for checkup the communicable diseases of the workers and staffs; • Office medical centres of BIFPCL Total 325 patients have taken treatment, Pathology/Lab test has done 48 and Physiotherapy has given 44 patients in April, 2023. • BIFPCL arrange regular weekly health service program (medical consultation and free medicine) for the local community considering the COVID situation. EPC contractor is training up the labors about protective action taken to avoid vector borne diseases and HIV positives and COVID pandemic to prevent transmission to the local community.	Complied	BIFPCL may introduce awareness program for STD and other transmitted diseases from workers to the community.
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 local labors according to their skills and capacities.	• Regular communication is being maintained with the local government and community representatives for labor recruitment • An NGO "SAMAHAR" was engaged by BPDB to give livelihood training for the affected people. • The proponent took a number of initiatives to encourage local students through awarding them scholarships before the COVID situation. These promotional activities are currently shut. • BIFPCL took initiatives and provided computer training for generating ICT skill among local people. Besides, BIFPCL have also plan to	Being Complied	Training related to skilled construction work i.e., masonry, rod binding, plumbing, carpenter, electrician, lineman, elevator mechanic, glazier, iron worker, driving, heavy equipment operator or laborer etc. should be introduced immediately.

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			initiate skill development trainings on electric and electronics, driving, painting, welding, health and hazard safety, fittings, etc. Feedback of the computer literacy training is not at all satisfactory where none of the trainees applied their training skill in income generating activities yet. Therefore, before arranging such training in further, local interest and demand should be assessed.		
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) continuously for developing relation with local communities. • Social expert from CEGIS also use to visit the nearby community at quarterly basis to get their opinions. • Regular consultation meetings are being carried out with the local government and administration • Environmental and social awareness programs are organized and conducted by proponent on a regular basis except during the COVID situation. • BIFPCL regularly display the progress (thru 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.	Mostly Complied	• BIFPCL may use print media, social media, digital media for spreading the accurate updated project information The proponent should aware and clarify the project related important issues to the local people to stopover any rumor.

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

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.	• Permanent drainage system to discharge waste water from the plant premises has blocked by earthen materials and other construction waste. • EPC Contractor is monitoring the water quality on monthly basis at every outlet of the project site and comply with the ECR 2023 standard • Though there are two settling ponds to settle the silt from Rainfall, runoff and other construction water but the waste water is being discharged to the Maidara river body without any proper treatment. This is very concerning in terms of aquatic biodiversity and water quality. • Runoff/wash away of the sediment is comparatively low to zero during this dry season.	Partially complied	• Drainage channel should be cleaned immediately to run the stagnant water from the plant premises.
2	Disturbance to nearby ecosystem due to different construction activities	• No cutting/ felling of trees along the river bank; • 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;	• Most of the civil works has already completed. Now only the mechanical (instrumental and machine fitting) and electrical works are under-way. Thus, the risk of deforestation and disturbance to the nearby ecosystem are minimal now a days. • Limiting the vegetation clearance within the Project boundary especially around the ash impoundment. • Based on the MoU signed with Forest Dept., Bangladesh out of 2 lac saplings in 3 years, 80,000 plantations have already done. 1000 plantation has done by the side of township area and another 2000 will be done soon. • They are maintaining the EMP measures in a desired way for protecting the adjacent ecosystem. • No alien species has been recorded • Wild species like avifauna and mammals are now recorded in the greenery areas of the project site	Being Complied	• Advised to finish the unfinished plantation ASAP. • Regular monitoring of the planted trees. • Reduce the rate of mortality at the sapling stages. • Top soil management should be strictly followed.

		• No plantation of non-native species; • Retaining top soil for future habitat restoration; • No degradation of sensitive habitat.	• 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 started maintenance of the slope protection works • Bank protection works of western bank of Maidhara river has finished • EPC Contractor is monitoring the discharged water quality at each of the outlet from this project on a monthly basis. • The project authority has constructed the permanent jetty as per approved layout. • The Maidara River is showing its natural phenomena without any negative impact due to the construction interventions. • CEGIS team has observed lots of construction waste dumped by the side of Maidara river bank that may cause water pollution. • Selected coal suppliers ensured the appropriate vessels with minimum sound for the coal transportation to avoid the disturbance to Dolphin community.	Complied	• Initiatives should be taken for excavation of silted reach of Maidara River to protect the rainfall runoff washout. • Maidara river bank side should be cleaned immediately • Proper protective measures must be taken to take care of Dolphin community

Table 5.5: Status of Compliance to the Conditions of DoE

Sl. No	Condition of DoE	Compliance Status	Remarks
1	This EIA Report is approved only for 1320 MW Khulna Coal Based Power Plant. Any expansion or extension of this Power Plant will require obtaining further Environmental Clearance with additional EIA Study.	BIFPCL has not yet initiated any plan for expansion or extension of the 2x660 MW Maitree Super Thermal Power Plant.	BIFPCL will comply with the condition prior to initiation of any expansion or extension of the Power Plant.
2	The Coal Specification and Power Plant technology should be maintained as per EIA report. In case any change in design the proponent must obtain consent from DoE.	The Coal Specification and Power Plant technology are being maintained as per EIA report so far. 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 and Infrastructure development activities mostly for the Block–A area. Both units are now under operation	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, to control the emission and pollution an Effluent Treatment Plant, ESP, and FGD etc. have already been incorporated in the technical specification of main Plant as per DoE stipulations. The progress is as follow: • **Effluent Treatment Plant (ETP):** Civil works of ETP has completed and now the mechanical and instrumental works are under way. • **Electro Static Precipitator (ESP):** Under operation • **Flue Gas Desulfurization (FGD):** Under operation.	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
		• **Desalinization plant:** Completed • **Low NOx burner:** Completed **Online air and water quality monitoring system:** Steam and water quality analysis system has already been developed. For air quality monitoring DoE has already installed one device to monitor the online air quality data at Padma Abashan area which is now functional and three other devices will be installed soon. BIFCL has taken initiative to monitor the air quality by installing a device just behind the BIFPCL main office where SPM, SO_x, CO, NO_x, O_3 etc. will be monitored. Along with those measures, environmental compliance monitoring is also being continued in the project site in order to assess the impact on project ambient air quality, discharge water quality and noise level around the project site, working and labor conditions, occupational safety procedures community grievances etc. as per the monitoring plan stated in the EIA.	
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 appropriate mitigation measures conforming EMP and technical specification of main Plant at each of the stages of Project Development. • Proper safeguard measures for the safety of the workers were very satisfactory. Proper PPE and scaffolding structures were observed during the site visit.	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 and Archaeological place in and around the Project site. As a third party, CEGIS is continuously monitoring the potential locations and indicators which are sensitive to coal transportation in the Sundarbans ECA, Sundarbans Reserve Forest and Sundarbans World Heritage Site as per the guidance of DOE and Bangladesh Forest Department (BFD).	Being Complied and suggested to continue this compliance till and during the operation stage.
8	Environment friendly construction and development practices shall be followed that minimize loss of habitats and fish breeding, feeding & nursery sites.	All the construction activities along with the coal transportation system are being followed and will be followed through best practices and according to the EMPs of EIA Report. As the environmental monitoring survey does not have any noticeable anomalies, it can be concluded that the construction work is progressing in environment friendly procedure yet now.	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
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.	Construction related activities are restricted to daytime and sometimes extends to the late evening. The community responses towards construction works of Power Plant are being monitored and recorded regularly. Moreover, BIFPCL has appointed one social liaison officer who is working (24x7) for developing relation with local communities. Along with that quarterly community visit is also being conducted by a CEGIS social expert. Regular consultation meetings are carried out with the local government and administration in order to receive and realize the grievances and accordingly to redress those. There are no grievances related to the noise effects registered yet from the nearby communities.	Being Complied.
10	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed Project period.	• EPC contractor and sub-contractor are providing sanitation facilities but not adequate for the workers. The ambient environment of the labour camp seems unhygienic in terms of waste management. • Drainage facility of Lavatory waste from the labour camp is unsatisfactory.	Being Complied Proper Waste management around the labour shed must be ensured as soon as possible.
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 operating machinery close to sensitive receptor like near the labor camps and residential areas are being avoided.	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 strictly prohibited inside the project boundary. • BHEL has engaged a solid waste management company who is now collecting the solid waste from the project area and dump it to the Khulna City Corporation (KCC) designated places. • Development of environment friendly waste collection and disposal system like Solid Waste Management, STP etc. are being developed at the demarcated place in plant premises. In addition, waste management training has been conducted in a regular basis among the labor.	Being complied
13	Proper and adequate on-site precautionary measures and safety measures shall be ensured	Quarterly monitoring activities are being carried out to examine the potential impacts on habitat of flora and fauna. No significant changes are	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	so that no habitat of any flora and fauna would be endangered or destructed.	yet recorded. Moreover, monthly environmental monitoring has been performed for noticing any harmful air pollutant emission or waste discharge form the project area.	
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 proponent is giving top priorities to occupational health and safety issues. To keep the workers and the plant safe, plenty of precautionary measures has identified during the physical visit of the plant. • An ICU rich hospital with an experienced medical team and ambulance has kept ready to provide the instant services • In case of emergency situation for both BIFPCL and EPC contractor, a contract has been signed with a private hospital (GAZI medical, Khulna) for medical services. • Emergency fire exit, the fire extinguisher, fire alarm has observed available and well-functioning. • As a part of emergency response plan emergency contact numbers contained laminated poster has noticed beside the construction site. Proper PPE and scaffolding have observed during the field visit.	Being Complied
15	To control dust, spraying of water over the earthen materials should be carried out from time to time.	Periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR 2023 standard. Monthly air quality monitoring at three locations inside the project boundary are being carried out. Based on the air quality monitoring findings and seasonal aspects, site specific water spraying is scheduled. BHEL has contracted with an external company for three years (renewable) who are spraying water as per schedule by three (03) water tankers to suppress fugitive dust.	Being Complied
16	Storage area for soils and other construction materials shall be carefully selected to avoid disturbance of the natural drainage.	• Many parts of the permanent drainage channel has blocked by the earthen materials and other construction residuals. This has created the water logging in the drain and thus created an unhealthy situation for the workers and its ambient environment. • Sand piles and other construction loose materials were noticed uncovered. Plenty of construction residuals has been kept by the side of the Maidara river bank.	Partially complied. • Proper housekeeping is strongly recommended. • Strongly advised to cover up the sand pile and other loose material • Construction residuals should be placed at the demarcated place.

Sl. No	Condition of DoE	Compliance Status	Remarks
			Maidara River bank should be cleaned immediately.
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	Silt trap has been developed at the north-east corner of the project site. It is used to depositing the sediments coming with the storm water and finally discharge relatively sediment free storm water through the drainage line.	Being Complied.
19	The entire coal handling system should be designed as an enclosed (and not only covered) conveyor system. There should be integrated dust control system with dust extraction and bag filters at unloading areas and at each transfer points on the conveyor system.	• Entire coal handling system is designed and constructed as an enclosed conveyor system as per DoE requirement. During the field visit it is observed that about 20 to 25 m coal conveyor belt is still uncovered that is allowing dispersion of dry coal ash. 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. • During the 37thfield visit by CEGIS team it is observed that about 100% installation of the closed system coal conveyor belt from jetty to the coal shed has completed.	Mostly Complied
20	Coal Plant should have high-efficiency bag filter for arresting dust emissions.	• Integrated dust control system with dust extraction system/bag filter and dust suppression system at crusher house, unloading points, transfer points has been specified in the technical specification of EPC contract. Refer Section (V), B4 of Technical Specification (Clause no B4.3.1.4). • High-efficient ESP for unit-1 is now under operation that will control the dust emission.	Compliance action initiated.
21	Coal should be stored in a covered storage yard.	Based on the EPC contract package, Section (V), B4 of Technical Specification (Clause No B4.3.1.6), the coal shed construction has already finished and the sheeting work is at finishing stage.	Being complied

Sl. No	Condition of DoE	Compliance Status	Remarks
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. • Out of 4 coal stockyards, construction of 2 stockyard is fully completed and the construction of remaining 02 stackyard in underway. • Automated moisture sensor has observed to protect coal self-combustion.	Being complied
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. • The ash dyke is now under construction stage and will be ready soon	Being complied
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). Erection of Ash silo structures has done beside the jetties in order to transport the dry ash with ships/cargo.	Compliance action initiated.
25	There should be adequate and properly sized and designed dry ash silo with appropriate conveyor system.	Adequate and properly sized dry ash silo with appropriate conveying system have been specified in Technical Specification of main Plant EPC contract package (Section V, Chapter B4). The construction work of ash silos is under construction. **Status:** • Fly ash equipment erection below ESP completed. Fly Ash Intermediate Silo structural erection completed.	Compliance action continued
26	Bottom ash should be extracted, crashed and stored in silos for utilization with proper collection and conveyor system.	Bottom ash shall be extracted, crushed and stored in silos for utilization with proper collection and conveying system during the operation stage of the power plant. The procedures have been included in the technical Specification of EPC contract package. (Section V, Chapter B4). **Status:** • Bottom Ash Intermediate Silo structural erection completed.	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
		FA Pipe rack and piping work are almost completed.	
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. BPDB prepared an assessment (Livelihood Restoration Plan) regarding the rehabilitees (including those who do not own land) for this Power Plant. • As per the recommendation in the LRP, an NGO "SAMAHAR" has completed their assigned tasks regarding this issue. This monitoring has recorded that DC office has rehabilitated around 32 families at Foyla and 17 families at Koigardaskati.	Compliance action continued
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.	• Most of the mechanical and construction residual are being kept at demarcated places. • But during the 36thand 37th field visit it is observed some unused construction materials are scattered in different places without any proper management. • For the solid waste management, BHEL has engaged a company named Rahman & brothers in association with Khulna City Corporation (KCC) for collecting and safe disposal of waste materials form site. • 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. This is not done yet. For this purpose, the Induction training has been provided but not sufficient.	Compliance action initiated Establishment of WMC is behind
30	As described in the report environmental monitoring should be strictly followed and	BIFPCL has engaged CEGIS as a third-party independent entity for conducting environmental monitoring on a quarterly basis in February	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
	monitoring report should be shared with DoE to ensure the environmental management properly.	2014. Accordingly, each quarterly monitoring report has 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 construction stages. BIFPCL is taking appropriate actions based on EMP monitoring report. BIFPCL regularly updates the EMP and OHAS which assist to reduce the risk of accidental events further. • From the preconstruction stage till now BIFPCL has been following the guideline of EMP listed in the EIA report and we have suggested to follow the EMP strictly for the rest of the work.	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 includes 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	• 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.	Compliance action initiated.

Sl. No	Condition of DoE	Compliance Status	Remarks
	Headquarters of the Department of Environment simultaneously.	Each of the monitored environmental data has been incorporated in the Monitoring report and displayed on the BIFPCL website at present.	
35	There should be regularly disclosure of the report through workshops and websites and responses should be taken care accordingly.	CEGIS has been regularly carrying out public consultation at different levels. All the monitoring reports are being kept available on website of BIFPCL (www.bifpcl.com)	Being Complied.
36	Online air and water quality monitoring system should be made functional throughout the life of the Plant.	• Steam and water quality analysis system has already been developed. Air monitoring system in under developing stage. DoE has already installed one device to monitor the online air quality data at Padma Abashan area which is now functional and three other devices will be installed soon. • BIFCL has taken initiative to monitor the air quality by installing a device just behind the BIFPCL main office where SPM, SO_x, CO, NO_x, O_3 etc. will be monitored. All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5).	Compliance action initiated
37	Management Information System (MIS) is to be developed for this coal-based Power Plant. The scope of MIS services will obviously include representing the real time monitored data especially environmental parameters displaying at Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment, BPDB and other concerned agencies/Ministries. The MIS should be web based for accessing every individual to show the real time monitored records.	The MIS will be prepared before commissioning of the Power Plant. For developing MIS, consultant will be engaged earlier. Specifications of MIS system is already included in EPC contract document. Technical Specification like DDCMIS, DDCS, PADO System, HART system, Plant MMS, Information management security system etc. have been included. Moreover, the EPC contractor is going to initiate this activity.	Compliance action initiated
38	JVC should provide all sort of logistics support to DoE and other relevant agencies for monitoring environment related items/events.	BIFPCL is ready and being provided all sort of logistic support as and when required by DoE and other relevant agencies for monitoring of Plant construction activities and environmental items/events maintain the health and safety protocol of the construction site.	Being complied
39	No ground water should be allowed to use for plant purposes.	The Power Plant has been designed considering use of surface water only during all stages of project development and operation.	Ground water is being withdrawn only for supplying the drinking water.

Sl. No	Condition of DoE	Compliance Status	Remarks
		Two (02) RO plant has already been constructed by project proponent to fulfill the demand of potable fresh water and construction purpose. Moreover a 1200 ft deep tube well has observed near the ABM RO plant. Based on the discussion with project authority this tube well is for the emergency usage. Proponent also informed that some time it is used to supply the drinking water.	
40	Conduct stakeholder meetings on regular basis for better performance of the Project as a whole.	BIFPCL has appointed a social liaison officer who regularly visits nearby community to consult with the local people. Besides CEGIS, appointed by the Project authority, is also carrying out consultation with the local people with interviews on regular basis for better performance of the Project as a whole.	Being Complied
41	Additional Environmental baseline data to be collected as suggested in the EIA report and conveyed to DoE and other concern authorities.	All quarterly monitoring reports containing latest baseline data are being collected as suggested in the EIA study and are disseminating to DoE and other concerned authorities as instructed.	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 is 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 about to finish. BIFPCL practiced the submission the detailed work plan seven (7) days before start of any construction activities to the prescribed offices of DOE. This practice will be continued till the end of the project.	Being complied
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

Sl. No	Condition of DoE	Compliance Status	Remarks
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 reported to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DoE) simultaneously. Nature of incident (oil spill, fire, accident. Collision, land slide, etc.). Personnel affected (injured, missing, fatalities, etc.). Emergency support available and its location (standby transport, medical facilities, etc.). Weather conditions Current operations (abandoning the site, firefighting, etc.)	• No single emergency incident has occurred since April, 2021. The COVID restriction has been withdrawal by Gov. with the decreasing infection which also implemented for the MSTPP construction site. • During 37th field visit we observed most of the workers were reluctant to use the face mask. • BIFPCL has given top priority on safety issues as like environment for this project after the bitter experience of two incidents. They have instructed the EPC contractor to establish best practices on OHAS and keep all records for avoiding any incident as like earlier. However, taking numbers of initiatives by the EPC and proponent significantly improve the safety system of the project. • Recent dengue outbreak has considered top priority by the authority. As a part to prevent the dengue outbreak proponent has taken some precaution measures like fogging for mosquito control, aware all project personnel to close their window after sunset, use mosquito net etc.	Complied at present COVID-19 PPE (Specially Face-mask) usage should be ensured Recommended to take Extensive preventive initiatives to control Dengue outbreak
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.	Complied at present.

Sl. No	Condition of DoE	Compliance Status	Remarks
		• EPC have already revised the health and safety management manual to continue the work amid the COVID-19 pandemic. Moreover, CEGIS is monitoring the EMP implementation as a whole.	
49	All pollution incidents shall be reported immediately and simultaneously to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment (DoE) in Dhaka.	BIFPCL has established a proper mechanism for recording such incident as suggested in the ERP	Being complied
50	Appropriate permission would require to be obtained from the Forest Department in favor of cutting/felling on any plant/tree/sapling forested by any individual or government before doing such type of activity.	There is no need of cutting/felling down of any trees outside the project boundary. However, in future, if any such case arises, BIFPCL is committed to obtain appropriate permission from the Bangladesh Forest Department (BFD).	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.	• Limiting the vegetation clearance within the Project boundary especially around the ash impoundment. • An MoU signed with Forest Dept., Bangladesh on 24.02.2015 for implementation of Afforestation Program. Initial target was to plant 2 lac saplings in 3 years. • 80,000 plantations have already done. Recently 1000 plantation has completed by the side of township area and another 2000 will be planted soon. Another 150,000 saplings supposed to be planted ASAP by Bagerhat Social Forest Division.	Being Complied CEGIS Team has strongly suggested to finish the unfinished plantation as soon as possible
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 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	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
		Environment and Geographic Information Services (CEGIS) which has been approved by DoE.	
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 has been operated. After the consecutive accidents, the EHS process has been drastically re-arranged and reshaped. As a result, no major incident has been occurred since April, 2021. Safety walk-down by the EHS team inside the plant premises help to identify and register all kind of accident and incidental hazards if occurred and take immediate remedy measures. • Meanwhile, a number of CSR activities like free medical camp, Boat Medical camp and medicines, free potable water supply to the local people, medical campaign, blanket distribution to the local people, EHS training, infrastructure development etc. were conducted by the BIFPCL authority. Some of these activities were halted from the Covid 19 Pandemic situation where portable water supply service is still continued and the authority get permission to provide free medical services for the community people again and from June, 2023 this service has restarted.	In the process of compliance
55	The Project authority shall extend active cooperation to DoE officials to facilitate their visit to the site as and when necessary.	BIFPCL is extending its all-out cooperation to DoE.	Being Complied
56	Violation of any of the above conditions shall render this approval void.	Noted by BIFPCL	
57	Any injunction on this Project from the Honorable Supreme Court/High Court Division shall render this approval void.	Noted by BIFPCL	
58	Without installation of 275 Meter Height Chimney, Effluent Treatment Plant (ETP), Waste Water Treatment Plant (WWTP), Settling Pond, Desalinization Plant, API Oil Water Separator, High Efficiency Electro Static Precipitator (ESP), 'closed-loop' Flue Gas Desulfurization (FGD), Low NOx Burner, online air and water quality	At present, 1st unit of the Plant is in operation phase and the 2nd unit in underway. Some of the required parameter from DoE are ready, some are under ready and some will be ready before operation phage. **Current status:** • **Chimney:** Shell construction completed in Apr'21 (270 m+5 m flu-can= 275 Meter). Flue liner erection completed and ready for Boiler light up (pic attached).	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
	monitoring system and other pollution control equipment and obtaining Environmental Clearance Certificate, the proponent shall not start operation of the Project.	• **DM water plant:** DM water plant has completed. • **Effluent Treatment Plant (ETP):** Civil works of ETP has completed and now the mechanical and instrumental works are under way. • **Electro Static Precipitator (ESP):** Completed and ready for operation. Air Tightness test completed for all 04 pass. • **Flue Gas Desulfurization (FGD):** FGD for Unit-1 is ready for operation. Absorber tower structure under progress for unit 2 • **Desalinization plant:** Completed • **Low NOx burner:** Completed • **Online air and water quality monitoring system:** Steam and water quality analysis system has already been developed. For air quality monitoring DoE has already installed one device to monitor the online air quality data at Padma Abashan area which is now functional and three other devices will be installed soon. BIFPCL has taken initiative to monitor the air quality by installing a device just behind the BIFPCL main office where SPM, SO_x, CO, NO_x, O_3 etc. will be monitored. Proponent has assured that another three (03) monitoring device will be installed. • **Settling pond:** Two (02) **s**ettling ponds has already been constructed to settle down the silt before discharge in to the river. Moreover, BIFPCL 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.	Complied

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

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 about to finishing 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 is 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. They are importing all the Power Plant related machineries complying with 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.	Coal Transportation for the Proposed 2x660 MW Maitree Super Thermal Power Plant Project has commenced. So far there is no issue noticed regarding 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 stage.

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 entire jetty construction period. They have developed a skilled manpower and system for ensuring the EMP during operation stage as well.	
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 potentially vulnerable 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 during the operation of coal transportation.	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 till now.	Being Complied
8	Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.	During 36th field visit the following anomalies were identified: • During the visit inside the labour shed plenty of household waste were found on the road which was very unhygienic. • Lack of waste bin and lack of proper initiative of source segregation of the organic waste has made the labour shed unhygienic • Lack of lavatory/toilet waste drainage and sewerage facilities causes waste accumulation and malodorous stench.	Partially Complied CEGIS advised to take immediate step to clean the labour camp and other waste related issues to make the environment healthy.

Sl. No.	Conditions	Compliance status	Remarks
		During 37thfield visit the team observed the same situation as before. Authority has been providing sufficient training, instruction and facilities for managing COVID-19 to improve hygienic condition at labor camps and workplaces.	
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.	All the finished construction works including the Jetty has been constructed in accordance with the EMP guidelines sated in the EIA report. Moreover, regular monitoring activities will be carried out to assess the significant changes (if any) for the rest of the unfinished works. The quarterly monitoring reports do not reflect any significant changes of the habitat of flora and fauna of the project influenced Passur river and Sundarbans ecosystem.	Being Complied
10	All the required mitigation measures Suggested in the EIA report along with the emergency response plan are to be Strictly implemented and kept operative/functioning on a continuous basis.	The mitigation measures in terms of environmental health and workers safety are being followed according to the EMP recommendations sated in EIA report. Establishment of FGD, ESP, noise control measures are being implemented to keep the environment safe during the plant operation. To ensure the safety of the workers' health proponent is taking enough steps like using proper PPE, scaffolding, water sprinkling to arrest the dust flow, medical facilities etc.	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 2023 standard. BHEL has contracted with an external company for three years (renewable) who is continuously spraying water as per schedule by three (03) water tankers to suppress fugitive dust from the plant premises. At jetty site the following issues were identified:	Being Complied The anomalies identified in the compliance status should be mitigate ASAP

Sl. No.	Conditions	Compliance status	Remarks
		• Coal stackyard was found hygienic where water was being sprayed at a regular interval to prevent coal self-combustion. • From jetty to 1st transfer point (TP) about 20 to 25 m coal conveyor was observed uncovered that is dispersing coal ash around the environment and the adjacent river. Underneath the TP the floor was identified very dirty by mixing residual coal with water.	
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. From jetty to 1st transfer point (TP) about 20 to 25 m coal conveyor was observed uncovered that is dispersing coal ash around the adjacent river. Also, there was no enclosure in the grabber while coal was unloading from the ship. These are causing dust dispersion which is harmful to the labour and for nearest water body.	Compliance action initiated Conveyor belt and grabber must be enclosed and automatic water spray need to be functional
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). Out of 04 coal Stackyard 02 has completed where Coal Staggered and Reclaimer commissioned.	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. Coal stackyard was found in good condition where coal was being sprinkled by water to prevent self-combustion	Compliance Action initiated.

Sl. No.	Conditions	Compliance status	Remarks
15	Construction material should be properly disposed of after the construction work is over.	Lots of construction materials and construction waste were observed dumped inside the plant premises and by the side of the River in the jetty area. Coal-water slurry is deposited in around the jetty area and TP that was found very unhealthy and dangerous.	Partially complied Good housekeeping practice is strongly recommended. The slurry should remove immediately to protect the runoff to the nearest water body.
16	As described in the report environmental monitoring should be strictly followed and monitoring report should be shared with DOE to ensure the environmental management properly.	BIFPCL has engaged CEGIS for environmental monitoring the environmental management plan in February 2014. Accordingly, each quarterly monitoring report has been submitted and shared with DoE, which are also available at BIFPCL web site.	Being Complied.
17	A third party/independent monitoring bodies excluding BIFPCL should be engaged immediately for monitoring of all the activities during pre-construction, construction and operation phases as per monitoring plan of EIA report and monitoring report must be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	CEGIS, as an independent monitoring body has been engaged by BIFPCL since February 2014 and still continued. From then on, CEGIS has been conducting the monitoring programs quarterly and producing monitoring reports on regular basis which are submitted by CEGIS to BIFPCL for onward submission to the Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment as directed by DoE.	Being Complied
18	Regular monitoring of the susceptible places of the Sundarbans for protecting ecosystem, biodiversity and forest coverage should be made using latest high-resolution image for keeping ambient environment.	The Monitoring activities have been carried out by CEGIS as third-party independent entity. The study includes all of recommended issues vastly. The monitoring report contains analysis of ecosystem, habitat, and biodiversity and forest coverage at susceptible sites of Sundarbans. In addition to this, Forest Department has also suggested some survey & analysis of Sundarbans ecosystem along with the quarterly compliance monitoring report.	Being Complied.
19	Air, water, soil, biological and social data should be monitored 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	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	Being Complied.

Sl. No.	Conditions	Compliance status	Remarks
	submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	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). Steam and water quality analysis system has already been developed. For air quality monitoring DoE has already installed one device to monitor the online air quality data at Padma Abashan area which is now functional and three other devices will be installed soon. BIFCL has taken initiative to monitor the air quality by installing a device just behind the BIFPCL main office where SPM, SO_x, CO, NO_x, O_3 etc. will be monitored. All the environmental monitoring reports are available on the BIFPCL website at present.	
20	There should be regular disclosure of the report through workshops and websites and responses should be taken care accordingly.	All of the environmental monitoring reports and other relevant reports are available on website of BIFPCL (www.bifpcl.com). BIFPCL as well as CEGIS is regularly carrying out public consultation at local level to get the responses from the community.	Being Complied.
21	BIFPCL should provide all sort of logistics support to DOE and other relevant agencies for monitoring environment related items/events.	BIFPCL is ready and 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.	Proponent confirmed that the vessel was covered and most of the work conducted during day time. No spillage and ship breakage incident happened. Noise level was within the control level.	Being complied and suggested to follow this up throughout the project cycle.
23	Vessels of this project should follow the MPA guidelines and protocol to ensure no hindrance to other vessels.	The coal barges were found to sail at a haphazard situation that will hamper other route vessels movement.	Not complied and suggested to sail the ships at a demarcated place where a navigation signboard should be placed.
24	The vessels used for this project should maintain IMO criteria to	No anomalies were identified during the coal transportation so far as reported by the proponent. This	Being complied and suggested to follow this

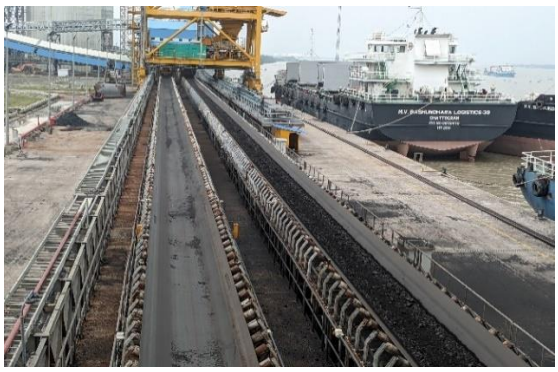
Sl. No.	Conditions	Compliance status	Remarks
	enable identification of substances harmful to the marine environment.	should be strictly monitored by the project authority.	throughout the project cycle.
25	All the vessels should follow applicable MARPOL Convention, Appendix V on the prevention of pollution by garbage from ships.	Proponent is strictly following this issue and informed us that all the barge are following rules of MARPOL convention and no garbage was dumped in the water body from the ship.	Being complied and suggested to follow this throughout the project cycle. The grabber should be enclosed while coal was unloading from the ship to conveyor belt.
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 approved conditions of DoE. The status of EMP implementation is 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.	Most of the development activities including jetty construction works are now completed. Beforehand, BIFPCL submitted the detailed work plan seven (7) days prior to 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 are being generated as per specific format provided in the EIA from the beginning till now. Report's content is disclosed 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;	The Monitoring report of CEGIS are maintaining all the records as suggested.	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
	b) the time(s) at which the sample was collected; c) the point at which the sample was taken; and The name of the person who collected the sample.		
31	The results of any monitoring required to be conducted under this EIA report must be recorded.	CEGIS is maintaining database fort all monitoring data analysis result and submitting to BIFPCL through proper documentation. The report is being shared with DoE on regular basis through monitoring reports.	Being Complied
32	In case of any emergency, the following information shall immediately be reported to Bagerhat District Office, Khulna Divisional office and Headquarters of the Department of Environment (DOE) simultaneously: a. Nature of incident (oil spill, fire, accident, collision, land slide etc.) b. Personnel affected (injured, missing, fatalities, etc.) c. Emergency support available and its location (standby transport, medical facilities, etc.) d. Weather conditions Current operations (abandoning the site, firefighting, etc.)	Emergency Reporting/ Emergency response Plan has been prepared and maintained for the Jetty construction (already finished) and will be followed for the coal transportation issues in future. As Coal transportation and its management is very sensitive to Environment and human body, Health and safety management manual have been revised for better and precautious implementation of OHAS. Though BIFPCL has already put a top priority on OHAS issue, extra care will be ensured for this coal related issues. 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	Proponent is committed to follow this issue and informed us that all the barge are following rules of National Oil Spill Contingency Plan (NOSCOP).	Being complied and suggested to follow this throughout the project cycle.
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 DoE 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 all kind of	Complied at Present.

Sl. No.	Conditions	Compliance status	Remarks
		accident/incident during coal transportation will be set up before operation stage based on the EIA and DoE recommendations. Moreover, monitoring activities is continued for checking any significant changes in natural ecosystem.	
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 EMP. 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 and constructed 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.	based on the discussion, Proponent is abiding by this guideline accordingly.	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

Random Pictures

Meeting with Prponent



Uncovered conveyor belt

Uncovered bin for food waste making odors

Uncleaned darin with food waste

Garbages are kept scatteredly

Uncoverd stockpiles along the road

Uncoverd stockpiles along the road

Coal dust spilliage from the jetty area

Unmanaged construction waste materials

Unmanaged construction waste materials

Coal spillage in the jetty area

Coal dust spilliage from the crane

Ash was blown during loading time

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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			
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			

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

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• 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 • Adequate fire precautions in place (for example, fire extinguishers, escape routes etc.)			

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

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

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• 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 • 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 37th Monitoring Program (August, 2023)

Monitoring Team

Groundwater Quality Monitoring

Measuring DBH

Measuring Canopy

Measuring the Canopy Cover

Counting Pnematophore and Crab Hole

Collecting Data

Collecting Forest Soil

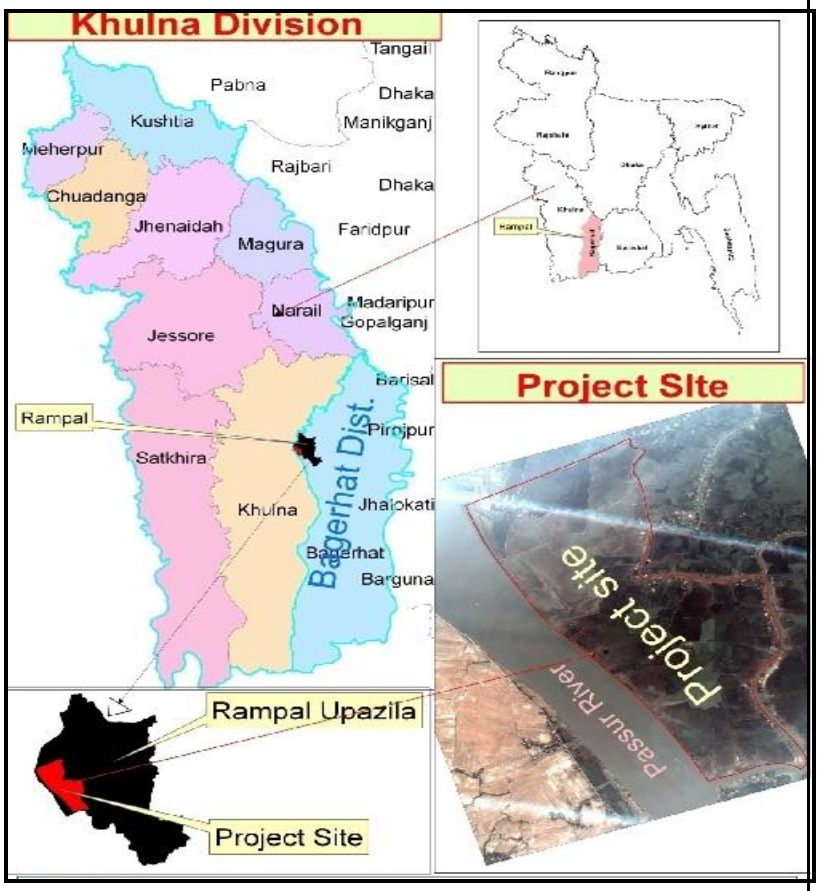
Collecting Plankton Samples

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

Monitoring Parameter	Indicators
	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
	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	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
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	
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	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	127.6	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	120	188	140	190	144	146	88	74	57	35	119	59	91	73	61	32	11.1	28	15	18	4	16	$(5000)^{8hr}$
	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	100^{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	65^{24hr}
	PM_{10}	814.6	90	74	102	97	31	48	116	44	11	11	99.5	56.9	40.4	147.8	52	64.4	109.9	126.3	106.1	63.94	82.27	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	165	210	230	164	136	127	102	77	22	31	108	66	78	79	69	27	25	30	21	20	4	11	$(5000)^{8hr}$
	O_3	33	26	26	23	21	16	1	1	1	0	0	1	08	25	04	4	8	6	4	1	34	22	100^{8hr}
NW Corner of the PP area	$PM_{2.5}$	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	65^{24hr}
	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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	110	178	110	210	140	133	87	77	38	47	127	31	74	80	45	43	21	32	20	16	7	0	$(5000)^{8hr}$
	O_3	25	19	17	36	44	11	8	2	0	1	1	3	05	10	05	7	6	8	1	5	18	2	100^{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	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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	175	210	190	150	196	96	96	81	73	41	98	63	85	77	59	24	20	20	17	18	6	0	$(5000)^{8hr}$
	O_3	26	29	22	19	15	9	6	4	0	0	3	5	08	6	04	6	6	2	3	4	7	52	100^{8hr}
Chunkuri-2,	$PM_{2.5}$	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	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	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
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	
Bajua Dacope	**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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	190	205	170	170	33	133	75	70	33	38	79	36	94	69	58	42	23	27	25	20	10	0	$(5000)^{8hr}$
	O_3	27	24	18	22	41	21	2	1	1	0	2	2	03	5	05	2	4	5	9	8	2	38	100^{8hr}
Pankhali, Dacope	**$PM_{2.5}$**	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	65^{24hr}
	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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	230	217	250	188	177	125	105	101	55	29	112	48	83	87	49	34	29	30	14	14	9	0	$(5000)^{8hr}$
	O_3	49	38	36	27	11	13	5	2	2	0	0	3	06	0	06	6	8	8	8	3	22	26	100^{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	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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	230	320	220	211	24	110	84	71	29	31	97	44	72	79	52	29	20	33	28	17	15	48	$(5000)^{8hr}$
	O_3	57	52	37	26	09	15	8	3	1	2	1	4	04	9	02	3	1	9	7	3	5	40	100^{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	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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	65	58	70	64	56	112	81	62	47	32	110	67	73	84	57	31	20	20	25	16	16	48	$(5000)^{8hr}$
	O_3	13	12	13	11	14	12	4	2	2	0	1	4	08	0	02	2	6	4	3	5	8	40	100^{8hr}
Akram Point, Sundarbans	**$PM_{2.5}$**	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	65^{24hr}
	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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	49	60	50	46	163	NO	92	64	21	37	101	58	79	69	52	21	25	28	17	14	38	24	$(5000)^{8hr}$
	O_3	11	14	9	10	27	NO	8	1	0	0	2	3	0	0	03	3	4	5	3	1	9	90	100^{8hr}
Hiron Point,	**$PM_{2.5}$**	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	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	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
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	
Sundarbans	**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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	52	62	65	60	60	NO	93	NO	40	NO	121	43	NO	72	71	NO	NO	22	21	NO	NO	2	$(5000)^{8hr}$
	O_3	14	13	11	9	23	NO	2	NO	0	NO	0	4	NO	0	04	NO	NO	6	6	NO	NO	16	100^{8hr}
Khulna City, near Khan Jahan Ali Bridge	**$PM_{2.5}$**	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	65^{24hr}
	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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	330	370	330	296	101	89	94	98	68	36	104	66	79	81	69	36	28	121	19	23	11	24	$(5000)^{8hr}$
	O_3	59	67	57	39	21	7	4	2	1	0	2	3	07	07	09	9	7	4	5	6	6	18	100^{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	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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	46	32	30	18	21	9	0	$(5000)^{8hr}$
	O_3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	9	4	9	1	5	19	11	100^{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	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	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	200^{8hr} (ECR, 1997)
	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	80^{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	80^{24hr}
	CO	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	38	34	32	23	21	8	0	$(5000)^{8hr}$
	O_3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	5	7	9	6	7	6	6	100^{8hr}

Locations of Monitoring	Pollutants	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	28th QM, April, 2021	29th QM, Aug, 2021	30th QM, Nov, 2021	31st QM, Jan, 2022	32nd QM, May, 2022	33rd QM, July, 2022	34th QM, Oct, 2022	35th QM, Jan, 2022	36th QM, May, 2023	37th QM, August, 2023	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
Weather		**Sunny**	**Rainy/Cloudy**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Rainy/Cloudy**	**Rainy/Cloudy**	**Sunny**	**Sunny**	**Rainy/Cloudy**	**Rainy/Cloudy**	
SW Corner of the PP area	**$PM_{2.5}$**	27.12	18.71	44.18	55.35	49.13	38.25	56.83	46.83	41.78	34.84	39.63	56.81	44.72	53.38	65^{24hr}
	PM_{10}	68.1	80.28	107.16	106.13	103.88	59.17	83.46	91.25	74.32	56.18	57.26	81.45	66.62	67.47	150^{24hr}
	SPM	108.4	98.26	149.73	163.48	155.14	99.44	144.48	159.45	139.42	106.28	109.27	144.17	112.77	52.28	200^{8hr} (ECR, 1997)
	SO_2	18.35	19.91	26.63	14.74	16.26	14.49	16.28	21.54	15.22	11.04	10.18	19.56	18.62	3.04	80^{24hr}
	NOx	12.12	8.82	16.62	37.16	22.31	19.87	21.64	39.5	22.49	23.18	17.64	18.61	13.32	30.46	80^{24hr}
	CO	28	0	2	0	0	1	0	1	1	0.3	0.6	0.8	0.7	0.438	$(5000)^{8hr}$
	O_3	8	8	8	9	16	42	11	12	18	12	19	20	22	21.77	100^{8hr}
Shapmari area	**$PM_{2.5}$**	19.14	20.35	29.17	52.74	48.64	41.2	44.65	39.86	36.71	41.2	49.63	43.95	53.16	44.65	65^{24hr}
	PM_{10}	83.22	71.06	84.3	112.04	83.1	64.28	71.35	58.29	68.79	64.29	58.48	58.71	80.42	54.76	150^{24hr}
	SPM	106.3	95.24	119.22	170.33	139.26	116.48	118.49	128.34	158.14	118.62	123.62	111.63	142.81	43.17	200^{8hr} (ECR, 1997)
	SO_2	27.41	17.44	14.15	18.32	14.06	11.77	14.55	14.48	13.96	12.58	16.71	17.48	16.51	7.21	80^{24hr}
	NOx	18.77	10.17	14.18	29.9	21.65	21.394	20.85	20.44	20.47	18.4	25.45	15.72	27.41	33	80^{24hr}
	CO	44	4	0.013	0	0	1	1.1	1	1	1	0.4	0.8	0.9	0.282	$(5000)^{8hr}$
	O_3	9	6	2	6	9	28	41	49	8	16	14	21	28	21.83	100^{8hr}
NW Corner of the PP area	**$PM_{2.5}$**	21.61	21.93	46.73	68.26	58.81	22.66	41.98	42.81	54.16	39.36	46.32	55.86	52.33	46.66	65^{24hr}
	PM_{10}	77.69	76.76	110.43	131.84	97.61	48.19	61.48	73.42	63.26	58.03	64.18	81.08	70.84	58.91	150^{24hr}
	SPM	100.04	101.33	160.3	180.43	161.8	77.149	104.73	123.76	132.77	108.2	139.24	146.79	140.73	45.76	200^{8hr} (ECR, 1997)
	SO_2	19.68	16.21	25.82	16.19	16.58	13.58	12.19	11.79	10.47	13.29	14.66	19.51	18.19	6.6	80^{24hr}
	NOx	17.53	10.55	18.91	34.1	27.42	20.49	18.39	20.25	23.96	20.63	21.43	29.29	24.64	41.6	80^{24hr}
	CO	30	2	0.012	0	0.2	1	1.4	1	0.6	0.4	0.2	0.7	0.8	0.234	$(5000)^{8hr}$
	O_3	9	8	8	12	14	17	34	12	8	11	13	25	34	20.39	100^{8hr}
Barni, Gaurambha	**$PM_{2.5}$**	26.66	18.04	38.69	61.29	62.29	21.8	58.34	29.22	31.43	27.55	41.59	37.86	39.81	52.33	65^{24hr}
	PM_{10}	61.11	59.02	91.79	93.36	103.42	50.26	73.17	43.88	46.29	51.98	64.71	57.94	59.5	65.17	150^{24hr}
	SPM	98.74	82.02	128.48	159.8	154.35	83.2	134.6	92.38	98.15	93.44	111.39	102.3	107.06	50.75	200^{8hr} (ECR, 1997)
	SO_2	18.88	24.29	20.17	16.47	13.52	14.44	21.39	14.36	18.42	10.57	13.88	12.69	13.91	8.82	80^{24hr}
	NOx	11.58	10.62	14.47	21.18	19.371	19.48	38.46	21.92	40.28	16.4	20.31	15.78	14.18	34.68	80^{24hr}
	CO	32	0	0	0	0	0	0	0.1	1	0.8	0.1	0.7	0.6	0.22	$(5000)^{8hr}$
	O_3	12	8	0	6	2	19	28	6	10	14	33	16	19	22.45	100^{8hr}
Chunkuri-2,	**$PM_{2.5}$**	39.44	18.22	43.91	59.18	53.36	33.27	29.61	45.3	48.94	38.48	30.22	57.36	58.71	59.21	65^{24hr}

Locations of Monitoring	Pollutants	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	28th QM, April, 2021	29th QM, Aug, 2021	30th QM, Nov, 2021	31st QM, Jan, 2022	32nd QM, May, 2022	33rd QM, July, 2022	34th QM, Oct, 2022	35th QM, Jan, 2022	36th QM, May, 2023	37th QM, August, 2023	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
Weather		**Sunny**	**Rainy/Cloudy**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Rainy/Cloudy**	**Rainy/Cloudy**	**Sunny**	**Sunny**	**Rainy/Cloudy**	**Rainy/Cloudy**	
Bajua Dacope	**PM_{10}**	100.08	59.91	88.93	117.42	86.44	61.9	44.28	66.54	86.48	53.19	39.66	96.94	79.6	73.88	150^{24hr}
	SPM	146.72	146.72	139.04	188.27	128.36	104.29	77.88	134.71	165.58	103.72	77.36	161.53	147.84	57.88	200^{8hr} (ECR, 1997)
	SO_2	36.14	18.74	29.94	16.45	19.66	15.98	10.59	12.84	14.82	11.08	10.52	26.24	18.22	19.42	80^{24hr}
	NOx	20.04	10.19	18.32	26.14	24.21	18.66	17.21	16.73	26.42	21.94	18.03	31.89	19.01	38.37	80^{24hr}
	CO	18	10	0	0.1	0.1	0.8	1	1	1	0.2	0.1	0.9	0.6	0.442	$(5000)^{8hr}$
	O_3	22	8	0	23	28	11	9	8	13	29	14	56	25	22.38	100^{8hr}
Pankhali, Dacope	**$PM_{2.5}$**	33.26	16.63	33.32	66.31	42.62	32.45	42.59	47.51	42.57	42.85	48.3	50.11	58.35	45.44	65^{24hr}
	PM_{10}	127.52	55.78	74.83	102.73	73.29	74.89	64.71	81.84	71.22	69.02	74.05	74.37	92.53	54.87	150^{24hr}
	SPM	160.02	70.23	111.95	156.56	116.73	118.4	107.31	148.93	128.98	127.39	138.51	133.66	169.47	43.77	200^{8hr} (ECR, 1997)
	SO_2	30.89	16.73	21.39	16.16	13.1	14.61	12.8	21.4	19.71	12.71	15.42	16.42	24.74	12.22	80^{24hr}
	NOx	19.02	10.52	12.12	28.54	17.18	20.27	19.33	38.27	29.44	23.16	22.14	23.94	28.77	28.75	80^{24hr}
	CO	11	0	0	1	0	1	1.1	2.8	2	0.4	0.6	0.5	0.7	0.37	$(5000)^{8hr}$
	O_3	2	2	4	20	2	10	19	48	39	37	24	37	61	18.41	100^{8hr}
Mongla Port area	**$PM_{2.5}$**	38.92	41.33	40.75	74.19	65.37	22.54	51.83	26.39	28.19	43.8	58.46	53.71	51.81	49.15	65^{24hr}
	PM_{10}	119.61	126.13	114.61	118.67	129.71	64.44	72.4	61.63	51.66	62.53	93.43	69.26	72.55	74.7	150^{24hr}
	SPM	173.36	166.16	152.76	201.16	180.22	85.2	128.3	100.53	92	120.3	170.28	130.48	138.02	47.16	200^{8hr} (ECR, 1997)
	SO_2	31.33	22.04	20.06	12.26	18.91	10.28	17.44	12.54	20.33	14.55	21.41	12.51	14.74	14.9	80^{24hr}
	NOx	13.34	11.29	9.69	19.25	30.2	19.73	29.16	18.43	31.63	22.3	34	18.59	19.99	20.8	80^{24hr}
	CO	29	24	0	2	0.9	2	2.4	2	0.2	0.1	1.9	0.2	0.3	0.4	$(5000)^{8hr}$
	O_3	4	2	1	66	91	23	43	20	13	29	59	14	12	21.85	100^{8hr}
Harbaria, Sundarbans	**$PM_{2.5}$**	17.81	20.11	34.42	53.28	46.13	34.94	31.2	41.58	43.27	49.15	53.98	35.19	39.51	13.93	65^{24hr}
	PM_{10}	63.27	62.24	79.38	100.11	82.83	61.53	49.07	58.92	51.04	74.7	76.18	42.07	58.55	15.28	150^{24hr}
	SPM	87.51	87.71	122.94	146.2	133.1	108.74	83.16	118.83	110.28	141.48	142.09	85.63	109.89	13.43	200^{8hr} (ECR, 1997)
	SO_2	16.47	13.31	19.74	14.66	16.58	14.75	12.68	22	13.76	14.9	12.37	13.27	15.36	7.7	80^{24hr}
	NOx	9.9	8.13	10.16	21.44	0	23.28	22.27	27.2	39.23	20.82	20.41	20.18	24.22	35.17	80^{24hr}
	CO	30	8	0	0	3	1	1	1	1	0.4	0.3	0.3	0.4	0.614	$(5000)^{8hr}$
	O_3	12	22	3	6	46.13	9	11	41	24	31	41	11	13	17.73	100^{8hr}
Akram Point,	**$PM_{2.5}$**	23.04	13.16	22.74	48.2	41.33	39.16	23.6	29.65	58.43	30.22	35.35	54.94	47.74	2.63	65^{24hr}

Locations of Monitoring	Pollutants	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	28th QM, April, 2021	29th QM, Aug, 2021	30th QM, Nov, 2021	31st QM, Jan, 2022	32nd QM, May, 2022	33rd QM, July, 2022	34th QM, Oct, 2022	35th QM, Jan, 2022	36th QM, May, 2023	37th QM, August, 2023	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
Weather		**Sunny**	**Rainy/Cloudy**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Rainy/Cloudy**	**Rainy/Cloudy**	**Sunny**	**Sunny**	**Rainy/Cloudy**	**Rainy/Cloudy**	
Sundarbans	**PM_{10}**	82.91	58.82	56.74	90.12	84.16	76.18	51.88	53.69	77.69	60.21	50.14	97.62	71.27	3.07	150^{24hr}
	SPM	121.68	78.8	80.31	144.95	131.46	123.59	79.47	98.47	141.37	103.5	99.42	159.36	137.62	2.59	200^{8hr} (ECR, 1997)
	SO_2	24.21	15.06	12.74	15.05	17.44	16.55	15.89	15.53	21.81	12.59	11.06	25.7	17.2	1.08	80^{24hr}
	NOx	16.74	10.47	6.64	20.6	23.5	21.28	21.39	19.38	38.3	19.69	18.2	27.24	23.83	17.88	80^{24hr}
	CO	20	14	0	0.2	0	2	1	1.4	0.3	0.9	1	0.8	0.2	0.204	$(5000)^{8hr}$
	O_3	2	4	6	8	8	11	8	16	41	24	19	63	32	8.32	100^{8hr}
Hiron Point, Sundarbans	**$PM_{2.5}$**	17.39	NO	28.15	55.71	NO	25.3	38.51	36.88	39.62	NO	57.2	47.31	NO	2.28	65^{24hr}
	PM_{10}	72.45	NO	59.31	99.64	NO	59.7	49.27	58.45	48.81	NO	89.22	70.5	NO	2.61	150^{24hr}
	SPM	94.28	NO	91.06	155.39	NO	94.7	89.36	106.93	96.23	NO	164.2	124.46	NO	2.26	200^{8hr} (ECR, 1997)
	SO_2	13.33	NO	11.36	16.2	NO	13.92	14.33	12.76	15.38	NO	16.82	14.26	NO	1.27	80^{24hr}
	NOx	8.65	NO	9.74	23.53	NO	20.06	16.27	19.66	39.72	NO	27.87	21.67	NO	17.53	80^{24hr}
	CO	36	NO	0	0	NO	0	0	0.3	0.7	NO	0.5	0.1	NO	0.138	$(5000)^{8hr}$
	O_3	7	NO	1	11	NO	14	22	22	38	NO	28	35	NO	9.17	100^{8hr}
	$PM_{2.5}$	40.22	46.73	48.32	88.71	71.2	29.47	65.66	61.57	67.33	69.28	63.57	51.17	53.57	86.08	65^{24hr}

Locations of Monitoring	Pollutants	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	28th QM, April, 2021	29th QM, Aug, 2021	30th QM, Nov, 2021	31st QM, Jan, 2022	32nd QM, May, 2022	33rd QM, July, 2022	34th QM, Oct, 2022	35th QM, Jan, 2022	36th QM, May, 2023	37th QM, August, 2023	Bangladesh (DoE) Standard (Air Pollution Control rules, 2022; ECR, 1997 and subsequent amendments)
Weather		**Sunny**	**Rainy/Cloudy**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Sunny**	**Rainy/Cloudy**	**Rainy/Cloudy**	**Sunny**	**Sunny**	**Rainy/Cloudy**	**Rainy/Cloudy**	
Khulna City, near Khan Jahan Ali Bridge	**PM_{10}**	116.16	119.11	109.63	159.22	120.38	64.44	124.55	100.3	92.36	100.28	92.2	64.49	70.49	99.54	150^{24hr}
	SPM	157.28	167.18	157.35	240.18	193.61	101.85	195.17	198.24	178.26	189.38	169.49	124.91	134.71	81.37	200^{8hr} (ECR, 1997)
	SO_2	28.31	30.73	29.58	18.8	20.64	12.73	26.18	28.52	19.29	23.66	21.71	17.32	14.05	22.14	80^{24hr}
	NOx	24.14	24.24	20.44	34.2	28.35	20.45	38.58	41.59	37.91	39.12	36.56	23.09	21.89	34.49	80^{24hr}
	CO	32	18	0.7	2	3	4	4.9	1.4	0.2	2.1	1.6	0.3	0.4	0.57	$(5000)^{8hr}$
	O_3	10	4	0	80	63	21	59	53	36	66	64	12	15	22.91	100^{8hr}
Township area	**$PM_{2.5}$**	44.26	22.08	41.29	166.72	67.82	59.2	79.64	56.26	69.23	51.29	61.47	59.24	57.73	25.7	65^{24hr}
	PM_{10}	122.73	86.26	97.16	234.41	108.16	94.6	102.33	104.73	94.28	69.28	84.89	91.3	95.63	28.3	150^{24hr}
	SPM	171.29	111.73	142.36	347.39	170.37	158	193.43	178.63	181.85	134.27	158.26	155.86	160.25	24.23	200^{8hr} (ECR, 1997)
	SO_2	34.12	20.61	21.73	18.61	23.72	19.7	16.92	38.36	27.45	14.56	23.49	16.26	18.34	7.57	80^{24hr}
	NOx	21.72	11.17	13.36	33.48	34.49	27.3	48.41	44.77	39.56	20.23	39.35	31.49	32.53	30.51	80^{24hr}
	CO	18	2	0	3	1	1	1	3.3	4	1.3	1	0.8	0.7	0.162	$(5000)^{8hr}$
	O_3	4	2	0	212	108	92	68	93	59	38	49	38	36	18.58	100^{8hr}
Access road bridge	**$PM_{2.5}$**	26.26	20.16	38.72	94.23	64.73	52.2	55.31	57.29	31.28	28.43	42.84	40.29	42.34	28.36	65^{24hr}
	PM_{10}	91.39	78.69	93.48	188.64	119.73	96.1	69.4	69.89	59.15	53.42	71.49	74.81	78.77	33.23	150^{24hr}
	SPM	126.13	102.03	136.66	269.3	173.92	151	129.45	137.46	98.74	89.45	127.77	121.17	126.63	27.24	200^{8hr} (ECR, 1997)
	SO_2	16.16	18.82	18.11	20.23	19.16	13.3	20.76	16.93	19.3	11.39	13.27	11.09	15.88	4.64	80^{24hr}
	NOx	9.04	9.22	9.92	26.3	23.74	20.1	31.69	21.62	33.62	20.47	20.63	23.25	22.67	26.49	80^{24hr}
	CO	22	0	0	0.8	0.2	2	1	1	1	2	1.1	0.8	0.5	0.213	$(5000)^{8hr}$
	O_3	6	8	2	68	46	16	29	72	31	23	14	17	18	18.65	100^{8hr}

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

- 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	√
	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

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
	NOx	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Akram Point Sundarbans	PM	X	X	X	X	X	√	√	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hiron Point Sundarbans	PM	X	X	X	X	X	√	√	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	NOx	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	GHGs	X	X	X	X	X	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Khulna City, near Khan Jahan Ali Bridge	PM	√	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	√	√
	SOx	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	√	√	√	√	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	√
Township area	PM	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√	√	√
	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

Monitoring period	Sampling Locations ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
1st QM	7.2	7.2	7.2	7.9	7.1	7.1	7.4	7.4	7.3	7.4	7.4	7.3	7.9	7.2	7.2
2nd QM	7	7	6.9	7.1	6.9	6.9	7	6.9	6.8	6.9	6.8	6.8	6.9	6.9	7
3rd QM	8.1	8.2	8	8.1	8.1	8.2	8.1	8	8	8.1	8.1	7.4	8	7.9	7
4th QM	7.9	8	8.1	7.9	7.9	7.9	7.6	7.5	7.8	7.7	7.3	8.2	8.1	8.1	8.1
5th QM	7.6	7.7	7.8	7.5	7.6	7.7	7.5	7.2	7.3	7.5	7.6	7.5	7.7	7.7	7.7
6th QM	7.8	7.9	7.8	7.9	8	8	8.1	8	8.1	8.1	6.9	7.9	7.9	NS	NS
7th QM	7.6	7.58	7.64	7.6	7.58	7.62	7.78	7.6	7.64	7.3	7.56	7.1	7.8	7.63	7.39
8th QM	7.1	7.3	7.3	7.1	7.5	7.6	8.1	8	7.9	7.3	7.1	7.4	8.2	8	NS
9th QM	7.5	7.8	7.2	7.4	7.8	7.4	7.6	7.1	7.2	7.1	7.4	7.3	7.3	7.9	7.8
10th QM	7.27	7.3	7.93	7.56	7.6	7.9	7.94	8.04	8.2	8.1	7.8	7.3	7.63	7.67	NS
11th QM	6.9	7	7.2	7.3	7	6.9	7.2	7.5	7.3	6.8	7.1	6.9	7.4	7.1	7.6
12th QM	7.6	7.5	7.8	8.2	8.5	8.7	8.1	8.6	8.9	8.1	7.6	7.2	7.8	8.2	8.5
13th QM	7.2	7.3	7.3	7.2	7.8	7.4	6.9	6.8	7.1	7.2	7.4	6.9	6.9	7.2	NS
14th QM	7.1	6.9	6.9	6.9	7.2	7.2	7.2	7.1	7	7.1	7	6.8	7.1	7.1	6.8
15th QM	8.28	8.25	8.17	8.2	8.21	8.2	8.39	8.15	8.16	8.4	7.92	7.48	8.19	8.22	8.2
16th QM	8.1	8.1	8.1	8.1	8.1	8.1	8	8.1	8.1	8.1	7.6	7.3	8.1	8.2	NS
17th QM	8.4	8.4	8.4	8.3	8.3	8.2	8.4	8.5	8.5	8.6	7.3	8.3	8.4	8.2	NS
18th QM	7.9	6.04	8.09	7.65	8.2	7.87	8.11	7.44	7.07	7.94	7.63	7.02	7.19	8	7.18
19th QM	8.18	8.03	8.06	7.78	7.97	8.04	7.89	7.85	8.06	8.05	7.8	8.65	7.71	7.77	7.79
20th QM	9	9.9	8.7	8.9	8.4	8.5	9.3	8.7	8.4	9.3	8.2	8.1	8.2	7.9	NS
21st QM	6.8	6.8	7.1	7.5	7.2	6.7	7.4	6.5	7.3	7.2	7	7	7.2	7.1	NS
22nd QM	7.9	7.8	7.8	7.5	7.4	7.4	7.3	7.2	7.2	7.4	7.3	8	8	7.8	7.8
23rd QM	8.4	8.3	8.8	8.3	8.3	8	8.6	8.2	8.3	8	7.9	8.3	8.4	8.2	8.2
25th QM	6.9	7	7.1	7	7.2	7.2	7.4	7.6	7.8	7.1	6.9	7.1	7.4	7.7	NS
26th QM	6.9	6.66	6.59	6.6	6.77	6.88	7.13	6.82	6.8	6.85	6.83	7.06	6.1	6.6	6.7

Monitoring period	Sampling Locations ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
27th QM	8.5	7.8	8	7.7	7.7	7.8	7.8	8	7.8	7.4	7.5	7.8	8.2	7.7	7.6
28th QM	8.3	8.1	8	8.6	8	8.9	8.2	8.4	8.3	8	8.3	8.6	7.8	8.2	NS
29th QM	5.5	6.5	8.5	7.4	8.4	5.8	6.7	8.6	8.5	5.9	6.9	7.3	6.6	6	8
30th QM	7.8	7.5	6.5	6.8	7.6	7.6	8.2	8.2	7.9	7.8	8.5	8.1	7.3	6.9	6.7
31st QM	8	7.6	7.7	8.1	7.7	7.8	7.9	7.8	7.7	8	7.7	7.9	7.7	7.6	7.5
32nd QM	7.77	7.8	7.7	7.63	7.72	7.81	7.63	7.64	7.8	7.61	7.5	7.9	7.7	7.69	NS
33rd QM	8.02	8	7.94	7.58	7.95	7.98	7.99	7.99	8.03	8.5	7.74	8.1	8.07	7.83	NS
34th QM	7.67	7.59	7.6	7.55	7.44	7.42	7.58	7.5	7.4	7.79	7.66	8.4	8.2	7.71	7.28
35th QM	8.3	8.25	8.2	8.24	8.23	8.18	8.2	8.27	8.2	8.3	8.35	8.01	8.13	7.2	8.1
36th QM	7.86	8.02	8.07	8.1	8.05	7.95	8.08	8.04	8.1	7.84	8.2	7.51	7.8	7.79	NS
37th QM	7.21	7.84	7.68	7.98	7.81	7.3	7.84	8.1	8.3	7.9	7.8	7.4	7.4	7.8	7.9
Standard (ECR'2023)	**6.5– 8.5 (Coastal area)**												**6.5– 8.5 (Reserved area)**		

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Table B.2: Surface Water Temperature (^{0}C) in Passur River

Monitoring period	Sampling Location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
1st QM	31	31	31	31	30	30	31	31	31	30	30	29	30	29	29
2nd QM	33	33	33	33	32	32	32	31	31	31	32	30	30	29	30
3rd QM	31	31	30	31	31	31	30	29	29	28	27	32	27	30	29
4th QM	19	20	20	19	19	19	20	19	19	19	20	19	22	21	21
5th QM	30	30	30	31	30	30	31	30	31	30	30	30	30	30	30
6th QM	31.8	30.5	30.5	30.8	30.6	30.4	30.5	30.8	30.6	30.8	31.6	29.8	29	NS	NS
7th QM	31.2	31.8	30.9	31.3	31.6	31.1	30.3	30.5	30.8	31.8	31.2	30.7	30.8	30.2	30.4
8th QM	22	21	21	22	22	21	23	22	21	22	23	21	22	21	NS
9th QM	31.2	31.1	30.8	31.4	30.9	31	30.7	30.4	30.1	31.2	30.6	31.3	31.5	30.8	31.4
10th QM	29.6	29.1	29.4	30.1	30.5	30.5	30.7	29.8	29.8	30.4	30.7	30.7	30.9	30.4	NS
11th QM	30.1	30.8	30.4	30.1	31	31.1	30.4	30.2	31.1	31.1	31.2	30.38	29.9	30.4	31.3
12th QM	22.8	22.5	22.1	22.8	21.8	21.9	22.1	22	22.1	21.9	21.8	22.1	23.1	22.5	21.4

Monitoring period	Sampling Location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
13th QM	30	30	29.8	31.3	30	30	29.9	29.8	30.1	30.3	30.1	30.2	30.2	30.8	NS
14th QM	29.8	30.1	30.2	30.1	29.8	29.9	30	30.1	30.1	29.9	30	30	29.8	29.9	29.4
15th QM	19.7	19.8	20.2	20.3	20.3	20.3	20.6	20.2	20.3	19.1	21.1	20.8	21	21.2	21.2
16th QM	30	30	31	28	29	28	28	28	28	28	31	30	30	32	NS
17th QM	30	30	30	30	30	31	31	31	31	31	31	29	29	30	NS
18th QM	28	26.9	27.5	28.4	28	28.1	27.9	28	28	27.62	30.2	26.82	27.62	27.21	28.66
19th QM	22	22	21.8	22.6	22.6	22.4	22.2	22.3	22.5	22.06	21	21.89	21.81	22.42	23.78
20th QM	31	31	31	31	31	31	33	31	32	33	32	31	31	31	NS
21st QM	30	30	30	30	31	30	30	30	30	30	30	30	31	31	NS
22nd QM	27	27	27	28	28	28	27	27	27	27	27	28	30	29	31
23rd QM	25	25	24	24	24	24	25	25	25	25	23	22	24	24	23
25th QM	30	30	31	30	30	30	30	30	30	30	30	30	31	31	NS
26th QM	27.7	27.7	27.7	27.8	27.8	27.7	28.4	27.9	27.8	28.67	28	28.07	28.35	29.48	29.02
27th QM	20	20	20	20	20	20	21	20	21	22	21	21	21	22	22
28th QM	31	30	30	30	30	30	30	30	30	31	31	29	30	30	NS
29th QM	30.3	30.5	30.5	30.6	30.4	30.5	30.4	30.5	30.5	30.39	30.5	30.15	29.6	29.75	30.66
30th QM	26	26	26	28	27	30	27	27	27	27	29	27	27	28	28
31st QM	22	22	22	21	22	22	23	22	22	23	22	22	24	21	22
32nd QM	30	30.2	30.2	30.1	30.3	30.2	30.1	30.2	30.2	30.45	29.2	31.63	30.13	31.36	NS
33rd QM	31.2	30.9	30.8	30.9	31	31.1	31.2	31	31.1	31.77	32.5	31.05	31.76	32.34	NS
34th QM	27.8	28	27.9	28.2	28.1	28.1	28.4	28.1	28.3	29.27	29.2	26.3	27.59	28.25	28.59
35th QM	25.29	24.3	23.6	24.2	23.86	24.4	24.8	23.95	24.57	26.54	28.1	21.91	25.38	22.28	23.6
36th QM	31.86	31.9	31.28	31.59	31.95	33.02	32.8	32.18	31.94	34.53	32.98	29.86	31.25	31.35	NS
37th QM	31.7	31.1	30.8	30.9	30.4	30.9	30.7	31	30.8	30.8	31.4	31.4	30.5	31.1	30.3
Standard (ECR*2023)	**N/A**														

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location; N/A-Not available

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

Monitoring periods	Sampling Location ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
1st QM	11.5	11.5	11.5	12	12	12	9.5	9	10	10	9	10	12	19	23
2nd QM	2.5	0.3	0.2	2.2	0.3	0.5	4	0	2.5	0.5	4.5	9.5	10	15	19.5
3rd QM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
4th QM	4.5	4.1	4.5	4.7	5.1	5	5.2	5.2	5.1	5.2	4.5	5	6	16	23
5th QM	13	15	16	9	13	14	14	13	12	10	9	14	15	20	25
6th QM	0	0	0	0	0	0	0	0	0	0	0	0	0	NS	NS
7th QM	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6.2
8th QM	4.1	4.3	4.3	4.4	5.1	5	5.2	4.9	5.5	3.8	2.5	4.8	5.3	11.3	NS
9th QM	8	7.4	7	6	6.2	9	8	7	6.8	7.1	6.3	6	8.9	9.4	14
10th QM	0	0	0	0	0	0	0	0	0	0	0	0	0	4	NS
11th QM	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5.8
12th QM	3.7	3.8	3.6	4	3.9	4.2	4.2	4.1	4.1	3.9	3.8	6.7	8.9	16.3	21.4
13th QM	6.3	5.9	6.2	6.8	6.9	6.1	6.5	7.1	7	7	6.9	10.4	10.4	16	NS
14th QM	0	0	0	0	0	0	0	0	0	0	0	1.2	2.3	3.6	5.1
15th QM	2	2	2	2.6	2.6	2.7	2.8	2.8	2.8	2.6	2.52	10.8	2.8	13.1	16.45
16th QM	11.5	11.5	11.5	12	12	12	9.5	9	10	10	9	10	12	19	23
17th QM	0.2	0.2	0.4	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.6	2.2	2.8	NS
18th QM	0.9	0.1	0.8	0.9	0.8	0.8	1	0.2	0.3	0.9	0.02	1	1.8	9.1	13.9
19th QM	11.1	11.1	10.6	10.8	10.8	11	9.9	11.5	11.1	11.3	9.9	7.9	11.9	16.7	22.7
20th QM	16.6	16.2	16.5	16.6	16.9	16.9	12	16.7	16.9	16.5	8	14.9	15.6	22.9	NS
21st QM	0.5	0.2	0.3	0.2	0.2	1.2	0.3	0.2	0.3	0.3	1	0.4	0.3	0.9	NS
22nd QM	0.4	0.3	0.3	0.5	0.3	0.3	2.1	0.1	0.4	0.3	0.3	0.5	0.7	6.6	9.2
23rd QM	3.8	3.9	4	3.8	3.9	3.9	3.7	0.1	3.5	4	4	3.6	3.7	8.9	11
25th QM	0.2	0.3	0.2	0.1	0.2	0.1	0.2	0.2	0.3	0.3	0.5	0.4	1.5	4	NS
26th QM	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	2	0.2	0.2	1.6	2.6
27th QM	2.4	2.7	2.7	2.5	2.7	2.4	2.6	2.5	2.7	2.5	2.5	1.8	2.6	7.1	8.2

Monitoring periods	Sampling Location ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
28th QM	7.1	7.5	7.2	7.2	7.3	7.3	7	7.3	7.4	7	6.5	6.9	7	10.9	NS
29th QM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8	0.1	0.1	1	0.9
30th QM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.2	2.2	2.6
31st QM	0.8	0.7	0.7	0.7	0.8	0.8	1	0.9	0.9	0.9	0.2	0.9	2.1	6.4	8
32nd QM	2.6	2.5	2.3	2.6	2.3	2.1	2.6	2.7	2.4	2.7	2.5	4	6.3	8.3	NS
33rd QM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.6	0.3	0.6	3.2	NS
34th QM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	1.7	2.9
35th QM	3.2	3.7	3.7	3.5	3.9	4	3.8	4.2	4	3.5	3.3	2.9	3	8.4	9.5
36th QM	8.8	9.1	9.2	8.9	9	9	8.9	9	9.1	8.8	9.2	8.8	8.6	10.8	NS
37th QM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.19	0.11	1.14	0.3	0.9	1.5	2.8
Standard (ECR*2023)	**N/A**														

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location; N/A-Not available

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

Monitoring period	Sampling Locations ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
1st QM	5.9	4.9	5.2	5.7	5.9	5.8	6.6	6.5	6.5	6	6.7	5.3	5.4	7.9	7.5
2nd QM	6.1	6.8	6.7	6.8	6.9	6.6	7.3	7.1	7.2	6.5	6.8	6.2	5.9	6.4	6.5
3rd QM	5.6	7.7	7.7	7.6	7.2	8	5.6	5.6	5.8	8	8	7	7	7.7	7.8
4th QM	5.5	6.6	6.7	5.8	5.9	6.8	6.1	6.9	6.6	6	6.2	6.5	6.6	6.7	6.5
5th QM	6.2	6.4	6.2	6.2	6.6	6.4	6.3	6.5	6.4	6.2	6.5	6.3	5.8	6	5.8
6th QM	5.3	5	5	6.7	6.6	6	7.5	7.4	7.3	6	6.4	7	7.5	NS	NS
7th QM	6.8	6.4	7.1	6.8	7.2	7.6	6.4	6.1	6.3	7.1	7.1	6.6	7.1	7.3	7
8th QM	5.1	5.1	6.2	5.9	5.3	5.4	6	6.1	5.8	4.1	5.2	5.4	5.2	6.2	NS
9th QM	7.1	6.4	6.9	5.8	6.1	6.6	6.9	7.1	6.8	6.4	5.9	5.8	6.4	6.1	7.1
10th QM	6.2	5.7	5.6	6.1	6.3	5.8	6.3	6.4	5.6	5.2	5.4	5.4	5.4	6.2	6.8
11th QM	6	6.1	6	6.3	5.9	6.1	5.9	6	6	6.1	6.4	5.6	5.8	6.7	6.9
12th QM	6.1	5.9	6.1	6.2	5.9	5.9	6.3	6.4	6.4	6.7	6.7	5.9	6.1	6.5	6.8
13th QM	7.1	7.2	6.8	6.9	7.4	7.5	6.4	7.2	6.8	6.8	7.1	6.4	6.4	7.2	NS

Monitoring period	Sampling Locations ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
14th QM	6.3	6.4	6.5	6.3	6.3	6.5	6.5	7.1	6.5	6.3	6.2	6.4	6.2	6.8	7.3
15th QM	5.19	5.03	5.06	5.1	5.03	4.9	5	4.98	5.11	5.17	5.11	5.23	5.03	5.4	5.4
16th QM	6.575	6.225	6.275	6.15	6.5	6.575	6.55	6.825	6.625	6.35	6.7	5.95	5.8	6	NS
17th QM	6	6.2	6.1	5.5	6	6.5	6.8	6.2	6	6.7	6.3	5.8	6.9	6.8	NS
18th QM	6.4	6.2	6.3	6	6.2	6	6.1	6.3	6.2	5.8	6	6	8.21	6.9	7.2
19th QM	8.7	7.9	7.3	8.7	7.3	7.4	7.8	7.1	6.9	7.5	6	6.9	7.5	7.7	8
20th QM	5.9	6.5	6.3	6.1	6.5	6	6.1	6.5	6.1	6.3	6.2	6.5	6.9	7	NS
21st QM	6	6	6.1	6.5	6.3	6.4	6.2	6.2	6.3	6.4	6	6.2	6	6.6	NS
22nd QM	7.7	7.8	7.8	8.6	8	8.2	9.9	10	10.5	7.1	7.7	7.9	8.4	7.7	8.6
23rd QM	8.4	8.6	7.6	8.1	8.2	7	6.9	7.2	7.8	9.7	7.5	8.6	6.9	9.7	6.7
25th QM	6.1	6.1	6	6	6.4	6.2	6.6	6.5	6.3	6.4	6.1	6	6.1	6.5	NS
26th QM	6.4	7.64	6.3	8.2	8.89	7.8	9.7	9.76	9.76	9.7		8.14	7.65	6.61	8.2
27th QM	9.2	9.6	7.8	9	8.9	9.3	9.6	7	6.4	8.1	8	9.2	7.6	7.2	9
28th QM	6.5	6	6.8	8.4	8	8.5	5.4	6.3	5.9	7.5	7	5.9	5.5	6.8	NS
29th QM	5.8	6	6.3	6.6	6.2	6.8	7.2	6.2	6.7	6.8	5.5	6.2	6.6	6.1	6.2
30th QM	7.8	7.5	6.5	6.7	5.6	6.5	6.7	6.5	6.1	6.7	6.2	5.8	6.8	6.5	6.9
31st QM	6.5	6.7	6.5	7.1	5.5	6.7	6.4	6.6	6.5	6.5	6.5	6.9	5.9	6.2	6.2
32nd QM	7.3	7.8	7.5	7.5	6	5	6.2	7.2	6.7	6.1	7	6.8	7.8	7.1	NS
33rd QM	8.1	8.5	7.8	7.5	8.8	8.1	7.5	8	8.1	8.5	7.6	7.1	7.6	7.6	NS
34th QM	6.2	8.4	8.5	7.7	5.7	5.8	7.5	8.2	5.9	5.7	7.5	8.1	8.4	8.2	7.5
35th QM	6.1	6.2	5.9	5.8	5.8	6.2	6	6.1	6.7	5.9	5.8	7.2	6.5	7.6	6.6
36th QM	5.3	6	5.2	4.9	5.4	5.6	5	5.3	5.2	5.75	6.1	6.7	5.8	6.8	NS
37th QM	6.7	6.8	6.7	6.4	6.6	6.7	6.6	6.8	6.7	6.3	7.2	7.4	7.8	7.6	7.9
Standard (ECR*2023)	**≥ 5 mg/L (Coastal area)**												**≥ 5 mg/L (Reserved area)**		

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Table B.5: COD (mg/L) of Passur River System

Monitoring periods	Sampling Location ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
1st QM	288	284	328	376	400	364	364	400	408	276	284	408	372	536	540
2nd QM	24	20	56	28	60	496	108	40	120	32	96	172	216	520	416
3rd QM	6	30	14	18	14	18	10	22	10	10	26	14	14	54	122
4th QM	128	68	92	84	116	108	104	16	100	116	84	96	96	316	472
5th QM	87	58	132	102	110	88	96	18	106	88	94	92	102	302	470
6th QM	42	43	18	26	21	24	32	25	25	51	36	30	26	NS	NS
7th QM	32	36	28	36	36	40	42	28	48	40	42	46	36	84	96
8th QM	124	100	96	100	108	80	100	100	124	100	108	88	100	96	NS
9th QM	220	240	280	280	240	260	240	180	200	160	210	220	140	156	160
10th QM	8	8	8	8	12	8	12	8	12	8	30	12	16	4	NS
11th QM	12	8	8	12	16	12	8	8	12	8	8	16	12	68	56
12th QM	56	40	44	48	52	42	56	52	44	36	48	40	40	56	196
13th QM	52	48	56	40	36	48	42	36	52	44	40	64	216	240	NS
14th QM	24	8	40	32	40	16	48	8	4	16	32	40	32	16	4
15th QM	48	28	40	36	32	28	40	44	36	40	32	48	40	72	88
16th QM	276	240	230	232	254	252	212	218	230	180	252	260	280	296	NS
17th QM	20	24	12	30	16	12	10	24	16	40	20	10	16	110	NS
18th QM	56	44	48	60	36	42	48	32	28	36	42	20	58	44	76
19th QM	72	60	48	44	56	64	88	36	68	72	68	32	56	180	140
20th QM	188	180	176	192	180	172	200	160	180	160	172	178	184	160	NS
21st QM	36	24	32	20	28	24	28	20	32	24	20	24	32	220	NS
22nd QM	56	40	26	40	28	24	20	32	20	24	36	40	32	92	72
23rd QM	24	28	32	24	40	24	26	20	28	44	36	36	40	56	64
25th QM	32	36	28	24	36	40	48	36	42	32	48	72	80	108	NS
26th QM	16	12	8	28	16	20	8	12	20	12	28	56	76	60	40
27th QM	56	32	20	48	20	56	48	56	8	12	24	32	12	28	NS
28th QM	508	404	400	304	412	390	408	424	448	400	380	472	424	392	NS
29th QM	4	4	4	4	4	12	8	8	12	16	48	32	16	80	32
30th QM	44	52	40	20	40	4	4	24	4	48	4	12	4	192	180
31st QM	24	12	8	40	32	12	16	36	12	12	32	16	60	36	40

Monitoring periods	Sampling Location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
32nd QM	24	28	48	36	24	20	24	48	52	56	96	96	240	36	NS
33rd QM	4	12	4	8	36	20	4	36	48	4	12	0.03	4	84	NS
34th QM	4	8	4	12	4	4	8	8	4	8	12	8	16	8	8
35th QM	144	256	148	212	188	264	220	144	192	112	144	148	188	112	120
36th QM	436	236	248	288	412	296	416	412	496	348	480	248	236	436	NS
Standard (ECR*2023)	**5 mg/L (Coastal area)**												**8 mg/L (Reserved area)**		

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Table B.6: Oil and Grease (mg/L) Concentration of Passur River System

Monitoring periods	Sampling Location ID				
	SL-7	**SL-12**	**SL-13**	**SL-14**	**SL-15**
1st QM	<5	<5	<5	<5	<5
2nd QM	<5	<5	6.3	<5	<5
3rd QM	<5	<5	<5	<5	<5
4th QM	>15	>15	>20	>20	>20
5th QM	16.9	13	39.1	<5	<5
6th QM	9	7.63	10.1	NS	NS
7th QM	<5	9.87	<5	10.8	9.73
8th QM	39	21	14	ND	36
9th QM	61	30.3	26	31	82
10th QM	5	13.5	5.73	NS	5.87
11th QM	<5	<5	<5	10.1	<5
12th QM	9.2	15.6	<5	13.8	14.2
13th QM	*5.73*	<5	<5	7.71	ND
14th QM	<5	<5	<5	<5	<5
15th QM	16.6	<5	<5	<5	<5
16th QM	<5	<5	<5	<5	<5
17th QM	<1	<5	<1	NS	<1
18th QM	<2.0	<2.0	<2.0	<2.0	<2.0
19th QM	<2.0	<2.0	<2.0	<2.0	<2.0
20th QM	<2.0	<2.0	<2.0	<2.0	<2.0

Monitoring periods	Sampling Location ID				
	SL-7	SL-12	SL-13	SL-14	SL-15
21st QM	<2.0	<2.0	<2.0	<2.0	<2.0
22nd QM	<2.0	<2.0	<2.0	<2.0	<2.0
23rd QM	2.3	<2.0	<2.0	4.4	2.3
25th QM	<2.0	<2.0	<2.0	<2.0	<2.0
26th QM	<2.0	<2.0	<2.0	<2.0	<2.0
27th QM	2.93	<2.0	<2.0	<2.0	NS
28th QM	<2.0	<2.0	<2.0	<2.0	3.2
29th QM	<2.0	<2.0	<2.0	<2.0	<2.0
30th QM	<2.0	<2.0	<2.0	<2.0	<2.0
31st QM	<2.0	<2.0	<2.0	<2.0	<2.0
32nd QM	<2.0	<2.0	<2.0	<2.0	<2.0
33rd QM	<2.0	<2.0	<2.0	<2.0	NS
34th QM	<2.0	<2.0	<2.0	<2.0	<2.0
35th QM	<2.0	<2.0	<2.0	<2.0	<2.0
36th QM	<2.0	<2.0	<2.0	<2.0	<2.0
Standard (ECR*2023)	**0.14 mg/L (Coastal area)**		**0.01 mg/L (Reserved area)**		

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location; SL-Sampling location

Table B.7: TDS (mg/L) of Passur River System

Monitoring Periods	Sampling Location ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
1st QM	13060	12630	12900	13190	13330	13380	13180	13390	13240	12400	10970	12800	12280	21500	21500
2nd QM	251	246	383	445	353	402	655	587	916	455	2510	6410	9360	15960	14050
3rd QM	176	162	153	169	156	152	162	153	154	214	257	209	285	3400	5720
4th QM	4360	3950	4330	4750	4920	4870	5040	5050	5130	5050	4390	5130	4780	12350	17900
5th QM	14400	14700	14900	14600	14500	14200	14500	14600	14250	14000	13900	14050	13900	13600	25300
6th QM	937	941	127	175	132	156	336	158	160	2320	355	298	683	NS	NS
7th QM	158	169	152	172	162	160	192	164	164	183	176	227	205	4220	5830
8th QM	5570	5910	5490	5720	5850	5480	5650	5740	5650	5450	4420	4540	4940	13330	NS
9th QM	13400	13280	13560	12830	13100	13460	12820	12960	13590	13340	11700	11330	13580	20720	25500
10th QM	179	112	125	162	185	143	205	195	140	165	5170	893	1321	7330	NS

Monitoring Periods	Sampling Location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
11th QM	138	106	108	147	110	112	113	108	146	196	238	162	301	2550	4120
12th QM	3100	3140	3330	3630	3600	3520	3470	3790	3770	2920	3960	3370	3370	3580	12210
13th QM	13400	13480	13400	13560	13490	13330	13640	13680	13360	13490	13110	12340	13600	19370	NS
14th QM	496	122	123	172	125	125	160	126	127	1616	1200	204	245	3270	4450
15th QM	1913	1919	1915	2500	2520	2500	2840	2710	2720	2500	2970	2570	2690	11390	14190
16th QM	14500	14420	14650	14300	14450	14540	14400	14500	14610	14160	14450	14500	15350	20600	NS
17th QM	315	224	232	328	235	208	205	286	296	265	340	580	2190	7680	NS
18th QM	855	733	722	824	716	732	945	784	786	992	827	940	1715	8100	12500
19th QM	9940	9950	9730	9860	9980	9800	10190	10280	10080	10040	8860	8350	10950	17200	21110
20th QM	15800	15600	15500	15700	16000	16100	15640	16000	15800	15700	15100	15722	15400	14800	NS
21st QM	290	150	152	205	142	150	208	145	154	940	365	172	560	12500	NS
22nd QM	480	175	170	190	175	174	325	180	172	1405	875	350	474	3950	5750
23rd QM	6800	6950	7300	6760	6760	6900	6740	6450	6700	7250	5800	6240	6430	16300	20400
25th QM	134	114	116	221	125	132	195	128	114	229	2893	740	489	4188	NS
26th QM	122	96	94	102	179	105	181	98	92	206	164	148	2260	1472	490
27th QM	3770	4410	4390	4150	4170	4060	4100	4210	4450	4170	2320	3010	4060	11400	14600
28th QM	12500	12700	12300	12800	13100	13200	13100	13300	13200	12500	11800	12100	12400	18500	NS
29th QM	58	105	106	74	97	110	158	110	100	216	1270	180	240	1700	1610
30th QM	160	150	147	158	150	153	155	153	156	160	780	203	275	3850	6300
31st QM	1380	1300	1210	1230	1510	1380	1850	1680	1650	1540	1350	1580	3850	11600	15500
32nd QM	4870	4800	4350	5250	4920	4060	5150	5070	4750	5100	8900	7820	12200	16400	NS
33rd QM	190	125	122	140	115	135	150	127	125	134	2850	460	1020	6200	
34th QM	155	150	136	158	135	133	235	136	132	210	140	210	315	2890	5300
35th QM	5700	6900	6850	6300	7400	7500	6800	7700	7600	5500	5600	5300	6100	15300	18100
36th QM	16900	17500	18000	17400	17800	17900	17600	17500	17800	17600	15200	16700	16800	21000	NS
Standard (ECR*2023)	**N/A**														

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

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

Monitoring ID	Sampling Location ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
1st QM	2900	2500	2650	2550	2600	2625	2550	2800	2500	2500	2400	3150	2625	4500	4850
2nd QM	250	180	170	175	275	350	325	350	475	450	725	1400	2150	3625	3050
3rd QM	216	218	335	390	340	355	330	345	325	350	330	377	345	980	1440
4th QM	930	870	870	940	990	970	1045	1125	975	980	970	1000	970	2380	2690
5th QM	3000	3050	3250	3450	3250	3200	3600	3670	3540	3260	3190	3210	3080	3420	3640
6th QM	245	110	105	118	103	105	153	105	165	470	130	135	200	NS	NS
7th QM	250	330	360	365	355	350	345	390	445	183	340	410	430	1090	1460
8th QM	1270	1380	1240	1220	1300	1260	1370	1340	1270	950	1075	1090	1100	2850	NS
9th QM	3130	3090	3140	3010	3070	3100	3060	3130	3110	3180	3080	3060	3050	4520	5050
10th QM	240	205	205	220	232	218	235	242	224	220	875	405	415	1750	NS
11th QM	255	250	190	265	237	242	205	217	238	250	240	245	282	670	810
12th QM	1090	980	1030	1020	915	1070	935	1100	1110	1040	1170	1070	1070	1130	2870
13th QM	3640	3420	3300	3400	3440	3380	3540	3480	3600	1960	2300	2450	3560	4300	NS
14th QM	200	150	155	160	145	140	150	155	175	165	320	220	200	640	905
15th QM	430	510	498	570	590	480	505	530	512	505	478	1070	610	1475	1740
16th QM	3100	1040	1030	1060	1040	1085	1080	1110	1100	1300	1120	1410	1330	1440	NS
17th QM	210	205	185	200	210	215	205	212	205	210	220	245	530	2030	NS
18th QM	335	310	313	285	255	275	295	265	325	295	315	325	2550	2750	4200
19th QM	2050	3900	4100	4600	4200	4400	4400	4300	4600	4000	4100	4000	4500	5900	6900
20th QM	3000	5000	5000	5200	5000	4800	4400	5100	4900	5200	5000	4782	4500	4500	NS
21st QM	2100	1950	1900	1850	2500	2550	1700	1850	2000	2000	2200	1800	1400	4300	NS
22nd QM	215	125	190	175	178	155	175	150	115	350	285	200	185	830	1225
23rd QM	1540	1485	1530	1580	1560	1490	1530	1560	1485	1460	1440	1510	1390	3470	3850
25th QM	205	200	187	217	215	202	195	210	207	310	742	250	280	1000	NS
26th QM	272	195	225	210	235	200	240	235	243	198	217	265	225	210	230
27th QM	2800	2700	2750	3000	3100	2500	2550	3200	2800	1400	1200	2850	2870	5050	5600
28th QM	4500	4200	4300	4100	4500	4000	4400	4100	4400	4200	4100	4200	4400	4300	NS
29th QM	140	200	180	200	175	175	140	130	100	145	400	150	160	480	470
30th QM	145	125	130	175	140	145	160	170	155	165	265	190	170	1000	1450
31st QM	370	385	310	375	325	340	375	420	430	380	435	500	680	6500	5300

Monitoring ID	Sampling Location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
32nd QM	2500	2400	2250	2500	2350	2100	2550	2400	2460	2450	3100	2300	4000	5000	NS
33rd QM	140	110	115	120	110	120	125	120	130	140	1000	215	930	2500	NS
34th QM	190	140	150	130	125	115	152	140	130	155	140	115	110	2000	2500
35th QM	2600	2800	2800	2900	3100	3200	3100	3300	3500	2500	2500	2600	2800	4500	5000
36th QM	4700	4800	4700	4500	4650	4750	4600	4850	4800	4550	4400	4600	4650	5250	NS
Standard (ECR*2023)	**N/A**														

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

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

Monitoring Periods	Sampling Location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
1st QM	598	45	53	54	60	55	24	27	67	7	9	50	65	115	91
2nd QM	126	92	112	99	100	105	116	112	37	65	24	310	90	99	72
3rd QM	234	193	174	227	232	186	185	536	459	798	389	203	869	28	267
4th QM	180	210	230	450	250	200	300	530	450	280	206	280	400	103	200
5th QM	160	167	170	160	165	155	150	147	155	148	160	165	160	150	180
6th QM	26	25	127	30	27	40	32	40	44	36	28	24	42	NS	NS
7th QM	76	80	65	92	85	97	104	90	82	96	92	60	74	110	144
8th QM	14	12	14	17	18	22	20	7	18	11	10	15	22	16	NS
9th QM	8	7	10	10	8	7	12	10	11	7	6	13	18	23	15
10th QM	61	48	56	62	45	49	51	43	39	42	11	47	31	16	NS
11th QM	20	18	16	20	24	19	20	18	16	24	30	27	18	41	33
12th QM	46	52	48	42	54	46	61	58	63	55	66	61	**61**	34	49
13th QM	51	42	48	52	43	38	32	44	40	37	49	38	33	28	NS
14th QM	18	15	22	16	20	17	15	16	14	26	30	**25**	27	22	16
15th QM	14	15	14	13	13	14	15	17	12	14	15	13	17	14	13
16th QM	18	17	22	20	19	21	17	19	18	23	32	14	15	18	NS
17th QM	17	16	15	18	16	15	16	14	20	13	12	17	13	14	NS
18th QM	14	11	15	11	13	12	14	13	15	11	42	27	22	15	6
19th QM	15	12	14	12	13	15	16	13	14	14	8	15	12	11	9

Monitoring Periods	Sampling Location ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
20th QM	12	14	13	11	12	15	12	11	13	14	12	13	11	10	NS
21st QM	14	11	13	12	13	14	13	12	13	15	12	13	12	7	NS
22nd QM	8	7	6	8	7	6	7	6	5	9	7	15	11	7	5
23rd QM	11	8	7	8	9	6	7	8	6	13	12	14	11	10	10
25th QM	14	6	11	12	9	12	14	13	8	11	5	9	17	18	NS
26th QM	7	11	8	7	6	9	15	8	6	8	7	8	5	8	6
27th QM	11	6	7	7	6	8	7	6	6	7	8	6	8	11	6
28th QM	15	23	20	13	12	16	14	15	13	17	12	3	14	11	NS
29th QM	12	14	9	12	11	8	12	9	15	13	3	7	9	16	13
30th QM	13	12	10	14	9	13	17	4	15	11	8	13	15	12	13
31st QM	15	14	17	12	13	11	14	12	15	13	13	14	15	16	13
32nd QM	7	10	11	12	9	11	18	13	12	19	16	15	13	17	NS
33rd QM	27	23	24	31	27	26	29	26	24	30	15	64	21	32	NS
34th QM	16	15	19	18	14	16	21	18	14	15	18	25	20	23	21
35th QM	11	14	12	11	8	13	12	7	11	8	7	8	6	7	9
36th QM	25	20	16	18	12	13	10	7	6	8	6	7	6	11	NS
Standard (ECR'2023)	**50 mg/L (Coastal area)**												**25 mg/L (Reserved area)**		

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed.

Table B.10: Nitrate (NO_3^{2-}) (mg/L) concentration of Passur River System

Monitoring Periods	Sampling Location ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
1st QM	0.9	0.7	0.1	1.3	1.4	1.1	0.75	1.1	1.2	0.3	0.5	0.6	1.4	2.7	0.8
2nd QM	2.89	2.4	3.2	0.76	2.69	2.98	2.13	2.43	2.05	2.18	0.88	1.52	1.75	3.32	2.84
3rd QM	0.32	1.57	1.84	1.64	1.42	1.33	1.85	2.09	2.21	2.26	1.98	1.64	1.67	0.59	0.4
4th QM	3	1.5	4.3	3.1	2.2	8.5	2.7	1.8	1.9	6	4	4.5	2.7	1.5	2
5th QM	33	13	39	48	69	8	87	48	128	62	48	29	18	25	28
6th QM	9.1	7.5	6.2	6.6	6.1	6.6	14.9	4	4.9	7	3.1	7.8	4.4	NS	NS
7th QM	4	7.1	5	5.7	3.3	4.7	4.4	6.2	4.4	4.9	2.9	3.1	4.4	3.2	11.5
8th QM	6.3	4.3	3.9	3.1	5.2	4.1	4.9	3.7	4.4	5.6	3.9	3.7	5.1	4.9	NS

Monitoring Periods	Sampling Location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
9th QM	3	2.9	2.5	2	3.1	3.6	2.6	2.9	2.6	2.7	3.1	3	3.4	2.9	3.5
10th QM	3.9	6.2	4.3	5.1	2.7	3.9	3.6	5.1	4.9	5.2	5.3	5.2	5.1	5.4	NS
11th QM	0.25	0.39	0.42	0.76	0.52	0.31	0.2	0.41	0.63	0.4	0.32	0.27	0.39	0.25	0.38
12th QM	3.62	2.89	1.87	2.25	2.46	3.01	3.64	1.93	2.17	2.46	3.1	2.78	2.78	3.08	2.28
13th QM	4.35	5.05	4.55	6.11	3.4	3.16	3.14	3.34	2	3.61	1.6	2.49	2.46	3.69	NS
14th QM	5.8	6.8	4.5	7.1	3.1	5	4.1	3.4	3.1	2.3	3.2	3.5	4.2	2.2	2.6
15th QM	3	4.2	3.6	3	4.7	7.6	8.8	8.5	2.8	1.6	3.4	4.5	4.6	1.8	6.1
16th QM	6.8	4.9	5.1	2.8	5.2	5.5	2.6	4.5	5.3	5.9	3.9	4.7	5.2	5.5	NS
17th QM	0.8	1.7	2.1	2.8	1.8	3.2	4	3.7	3.8	4.4	3.1	2.4	2.7	4.2	NS
18th QM	2.8	0.1	0.11	1.7	0.9	0.1	0.1	3.4	0.7	2.3	0.12	1.6	0.1	0.1	0.9
19th QM	3.5	2.6	1.9	2.1	2.2	3.5	4.2	3	3.1	2.1	1.3	3.7	4.7	1.8	2.6
20th QM	0.3	0.3	3.7	3	1.2	4.8	0.5	3.4	4.1	5	2.9	2.7	4.4	2.7	NS
21st QM	0.1	1.1	1.2	1.5	1.5	2.1	1.5	1.7	0.5	3.1	2.5	1.8	1.7	1.3	NS
22nd QM	3.5	2.7	3.4	3	1.7	2.1	2	1.3	2.2	2.9	1.6	2	2.1	1.6	2.5
23rd QM	1.3	1.7	3.2	4.5	2.7	5.1	7.4	3.9	4.1	4.7	4.9	3.3	3.2	2.6	4.1
25th QM	3	3.3	9.5	2.9	1.9	1.8	1	1.5	1.3	3.9	2.1	1.5	5.7	4	NS
26th QM	3.2	1.3	4.7	2.5	2.6	1	0.5	2.1	3	1.5	1.3	2.6	2.6	2.6	2.6
27th QM	4.3	2.2	1.2	0.7	3.1	2.7	1.8	3	1.9	3	4.9	0.5	0.5	2.9	3.9
28th QM	3.3	2.1	1.3	2.1	3	1.5	1.7	2	2.3	4.2	1	1.7	2.6	2.8	NS
29th QM	2.1	2.2	1.3	1.4	1.6	1.4	1.9	2.1	2.5	3.1	2.1	3.8	3.9	4.1	3.2
30th QM	3.5	3.8	6.7	12.6	0.3	7.4	0.7	9.2	1.7	0.5	0.1	0.4	1	0	0.5
31st QM	2.06	1.43	2	15.9	1.5	6.8	1.1	ND	1.5	16.2	5.7	9.4	4.06	24.7	1.8
32nd QM	8.41	13.52	12.75	10.8	8.71	9.39	11.15	8.5	11	14.42	6.41	8.05	15.35	10.85	NS
33rd QM	3.85	6.47	10.43	8.83	13.06	12.26	8.2	8.18	11.82	11.52	13.14	15.7	15.96	11.29	NS
34th QM	0.03	0.09	0.23	3.79	2.06	3.6	5.18	5.01	4.71	5.74	1.62	5.97	5.72	3.49	5.76
35th QM	1.13	1.45	2.06	1.3	1.7	1.7	1.8	1.3	2.4	2.2	2.2	1.3	2.2	2.7	2.1
36th QM	2.27	1.94	0.68	2.44	1.1	4.19	2	4.44	5.32	3.57	1.2	13.96	1.53	0.52	NS
Standard (ECR'2023)	**0.3 mg/L (Coastal area)**												**0.8 mg/L (Reserved area)**		

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Table B.11: Sulphate (SO_4^{2-}) (mg/L) concentration of Passur River System

Monitoring periods	Sampling Location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
1st QM	1840	1320	1280	1360	1040	1320	1640	1520	1280	1120	1320	1360	1560	2600	2080
2nd QM	20	23	36	45	32	20	60	40	80	20	210	620	860	1400	1160
3rd QM	26	28	34	33	30	27	40	35	64	63	63	44	69	1390	2360
4th QM	580	450	480	550	520	540	630	560	620	570	460	630	590	850	1500
5th QM	1360	1260	1240	1240	1120	820	880	1180	900	1220	840	980	900	1540	1920
6th QM	67	11	9	26	6	8	9	19	12	72	27	39	51	NS	NS
7th QM	7	8	11	10	8	9	12	8	6	11	9	13	7	84	97
8th QM	570	590	560	550	580	565	640	560	550	96	480	482	500	760	NS
9th QM	1080	1040	1020	1060	980	1100	1060	1020	1080	1040	1020	1100	1080	1650	2100
10th QM	18	10	13	15	17	14	15	18	12	11	480	42	60	620	NS
11th QM	5	3	4	4	6	5	6	5	8	14	14	14	19	190	320
12th QM	230	210	200	230	280	230	230	231	250	160	200	220	220	230	1090
13th QM	422	460	1340	1380	1280	1400	880	1440	1340	1220	1340	1220	1300	1420	NS
14th QM	29	3	5	2	1	2	2	1	3	120	76	**5**	13	30	2
15th QM	630	370	410	310	310	490	700	340	340	270	350	280	220	760	510
16th QM	1400	1320	1440	1260	1200	1400	1300	1380	1240	1200	1250	1260	1300	1460	NS
17th QM	24	18	20	22	21	16	10	24	22	21	18	28	35	620	NS
18th QM	51	49	46	52	38	42	56	52	39	65	46	30	20	250	780
19th QM	760	756	764	748	760	762	768	760	770	758	760	765	756	764	769
20th QM	1460	1380	1420	1410	1440	1400	1500	1450	1460	1500	1490	1446	1500	1500	NS
21st QM	23	19	21	16	17	19	15	16	14	18	12	14	16	980	NS
22nd QM	37	6	6	5	4	8	25	9	6	71	55	33	38	370	540
23rd QM	490	510	560	530	640	490	520	470	510	490	565	580	470	410	445
25th QM	4	3	5	8	10	13	16	8	16	16	21	12	34	60	NS
26th QM	3	6	11	5	3	8	6	4	12	31	26	21	540	430	30
27th QM	270	420	460	410	420	430	450	440	450	420	190	260	410	580	1240
28th QM	1	5	2	1	3	2	3	1	2	3	15	13	5	5	NS
29th QM	21	20	24	18	15	18	19	13	14	17	39	39	41	410	598
30th QM	99.4	90.3	92.6	89.3	108.4	98	118.7	118	118.7	115	91.1	106.8	243.8	183.3	230.8
31st QM	185.5	188.6	197.8	198.1	186.2	180.8	191.3	189.4	185	199.7	218	212.37	227.53	245.62	985

Monitoring periods	Sampling Location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
32nd QM	36.32	33.65	46.92	41.55	22.28	29.53	37.16	45.68	52.04	36.65	158.9	111.28	200.6	517.86	NS
33rd QM	28.35	19.51	21.31	23.56	21.32	22.27	30.07	14.26	21.18	35.24	33.71	92.53	79.75	172.39	NS
34th QM	200.77	206.51	200.31	202.27	208.03	211.48	198.41	202.02	211.53	199.39	193.21	198.8	185.87	232.06	236.27
35th QM	240	244	243	244	241	246.5	245	246.1	238.7	247.5	243	247	246	248	246
36th QM	20.7	13.22	33.64	20.52	24.94	17.49	24.13	36.43	12	39.89	38.22	54.14	59.7	194.84	NS
Standard (ECR'2023)	**N/A**														

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Table B.12: Phosphate (PO_4^{3-}) (mg/L) concentration of Passur River System

Monitoring periods	Sampling location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
1st QM	0.52	0.5	1.1	2.1	2.2	2	0.57	1.2	1.5	0.55	1.1	1.3	1.1	1.3	7.51
2nd QM	2.23	1.99	2.55	0.45	2.13	2.42	1.25	1.51	1.1	2.1	0.53	0.35	0.56	0.29	0.29
3rd QM	0.67	1.12	0.95	0.92	1.11	0.99	1.18	1.25	1	1.27	1.04	0.86	1.22	0.8	1.09
4th QM	0.32	0.61	0.7	0.43	0.41	0.55	0.76	0.85	0.53	0.59	0.64	0.42	0.61	0.42	0.44
5th QM	0.86	0.53	0.72	0.49	0.68	0.61	0.65	0.53	0.6	0.7	0.55	0.71	0.59	0.61	0.47
6th QM	10	0.23	0.67	0.27	0.59	0.13	0.1	0.18	0.1	0.5	0.29	0.59	0.89	NS	NS
7th QM	1.27	1.97	1.94	2.53	1.3	1.32	0.99	1.02	1.39	1.27	1.28	0.95	0.35	0.43	0.45
8th QM	0.269	0.269	0.179	0.357	0.536	0.269	0.536	0.625	0.536	0.351	0.269	0.179	0.269	0.357	NS
9th QM	0.22	0.36	0.27	0.31	0.3	0.43	0.63	0.21	0.33	0.19	0.13	0.31	0.42	0.26	0.36
10th QM	1.14	1.76	1.77	2.31	0.98	1.01	0.87	0.96	1.123	1.06	1	0.78	0.53	0.47	NS
11th QM	3.39	4.11	4.58	2.76	3.2	2.48	4.16	2.76	2.71	2.836	5.23	4.01	1.16	9.08	5.9
12th QM	0.67	0.31	0.09	0.07	0.12	0.16	0.09	0.04	0.07	0.07	0.2	0.09	0.09	0.1	0.23
13th QM	1.31	1.72	2.73	2.77	0.66	0.62	0.65	0.37	0.45	0.61	0.47	0.18	0.21	0.19	NS
14th QM	0.49	2.5	2.8	3.3	3.9	3.9	4.6	0.41	0.63	0.51	15.3	1.3	3.15	0.36	0.55
15th QM	0.21	0.16	0.3	0.19	0.17	0.47	1.31	0.39	0.62	0.38	0.71	0.63	0.81	0.97	1.45
16th QM	0.38	0.25	0.29	0.38	0.34	0.27	0.29	0.29	0.42	0.24	0.28	0.37	0.26	0.2	NS

Monitoring periods	Sampling location ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
17th QM	1.03	0.83	0.76	0.88	1.07	0.67	1.16	0.86	1.03	0.83	1.2	0.86	0.5	0.67	NS
18th QM	0.25	0.3	0.22	0.24	0.4	0.53	0.32	0.43	0.57	0.27	0.22	0.33	0.25	0.5	0.61
19th QM	0.25	0.3	0.17	0.2	0.35	0.27	0.2	0.2	0.37	0.4	0.28	0.29	0.3	0.19	0.18
20th QM	0.25	0.32	0.4	0.3	0.27	0.25	0.41	0.35	0.27	0.28	0.3	0.31	0.52	0.63	NS
21st QM	10.1	0.6	0.5	0.6	0.6	0.9	11.1	0.8	0.8	0.5	0.8	0.6	0.6	0.5	NS
22nd QM	0.3	0.3	0.4	0.2	0.3	0.4	0.5	0.7	0.5	0.6	0.4	0.6	0.7	0.3	0.3
23rd QM	0.2	0.2	0.3	0.3	0.2	0.3	0.4	0.4	0.4	0.5	0.3	0.4	0.2	0.1	0.2
25th QM	0.25	0.27	0.3	0.35	0.29	0.36	0.4	0.43	0.52	0.25	0.56	0.53	0.4	0.37	NS
26th QM	0.5	0.5	0.5	0.7	0.5	0.8	0.7	0.4	1.3	1.2	0.7	0.8	0.3	0.4	0.4
27th QM	5.3	3.5	3.2	2.9	3	5.4	3	2.5	3.2	13.1	4.1	9.6	2.6	7.1	1.1
28th QM	4.9	2	1.9	2.3	5.7	4	1.2	2.4	6.3	8	0.76	0.79	0.6	3	NS
29th QM	4.2	0.6	0.54	4.5	2.1	3.4	5.4	3.7	2.7	3.4	0.2	0.27	1.9	0.87	0.5
30th QM	1.5	0.9	1.3	0	0	0	0.3	0.4	0.1	0.2	0.4	0.2	0.7	0.4	0.2
31st QM	0.19	0.33	0.13	0.46	0.1	0.4	0.04	0.03	0.14	0.59	0.35	0.3	0.48	0.45	1.03
32nd QM	0.048	0.025	0.069	0.051	0.02	0.021	0.02	0.061	0.008	0.006	0.003	0.0572	0.228	0.125	NS
33rd QM	1.02	0.67	1.2	1.74	0.49	0.4	0.44	0.3	0.5	0.71	0.68	2.53	1.7	1.04	NS
34th QM	2.14	1.2	0	0.08	0.04	0.07	0.07	0.13	0.11	0.08	0.08	0.61	0.6	0.02	0.03
35th QM	1.01	0.56	0.62	0.45	0.08	0.08	0.06	0.06	0.03	0.1	0.09	0.14	0.5	0.07	0.52
36th QM	0.97	1.42	1.25	2.53	0.01	0.09	0.002	0.0235	0.001	0.044	0.037	0.543	0.004	0.07	NS
Standard (ECR'2023)	**0.05 mg/L (Coastal area)**												**0.08 mg/L (Reserved area)**		

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Table B.13: Arsenic (As) (mg/L) concentration of Passur River System

Monitoring periods	Sampling location ID														
	Sl-1	Sl-2	Sl-3	Sl-4	Sl-5	Sl-6	Sl-7	Sl-8	Sl-9	Sl-10	Sl-11	Sl-12	Sl-13	Sl-14	Sl-15
1st QM	0.002	0.002	0.001	0.002	0.002	0.002	<0.001	<0.002	0.002	<0.001	0.002	0.002	0.004	0.004	0.003
2nd QM	0.003	0.003	0.003	0.004	0.004	0.003	0.003	0.004	0.003	0.003	0.002	0.004	0.003	0.002	0.002
3rd QM	0.004	0.004	0.004	0.004	0.004	0.003	0.006	0.004	0.006	0.006	0.003	0.003	0.004	0.002	0.003
4th QM	0.003	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.004	0.003	0.002
5th QM	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.002	0.002
6th QM	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	NS	NS
7th QM	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
8th QM	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.001	0.001	0.002	0.001	0.002	0.002	0.002	NS
9th QM	0.001	0.003	0.003	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.005	0.006	0.004
10th QM	0.002	0.003	0.005	0.004	0.002	0.002	0.003	0.003	0.004	0.005	0.002	0.004	0.002	0.001	NS
11th QM	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.003	0.002
12th QM	0.002	0.001	0.001	0.002	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.002	0.002	0.001	0.002
13th QM	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.002	0.001	0.002	NS
14th QM	0.002	0.001	0.002	0.002	0.002	0.003	0.003	0.002	0.002	0.003	0.001	0.002	0.003	0.002	0.002
15th QM	0.002	0.002	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001
16th QM	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.001	0.001	0.002	0.001	0.002	0.001	0.002	NS
17th QM	0.004	0.005	0.004	0.005	0.003	0.002	0.005	0.003	0.004	0.004	0.003	0.003	0.003	0.002	NS
18th QM	0.003	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.002	0.001	0.001
19th QM	0.002	0.001	0.003	0.001	0.001	0.002	0.003	0.001	0.001	0.002	0.005	0.007	0.001	0.002	0.001
20th QM	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.003	0.003	0.003	0.002	0.002	NS
21st QM	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.003	0.004	0.002	0.001	0.001	NS
22nd QM	0.002	0.003	0.002	0.003	0.003	0.002	0.003	0.002	0.002	0.003	0.004	0.004	0.002	0.002	0.002
23rd QM	0.002	0.003	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.002	0.002
25th QM	0.003	0.003	0.003	0.002	0.002	0.002	0.005	0.003	0.003	0.004	0.002	0.002	0.002	0.003	NS
26th QM	0.003	0.003	0.003	0.003	0.004	0.003	0.004	0.003	0.003	0.004	0.004	0.002	0.002	0.002	0.009
27th QM	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.002	0.002	0.003	0.002	0.003	0.002	0.002	0.002

Monitoring periods	Sampling location ID														
	Sl-1	Sl-2	Sl-3	Sl-4	Sl-5	Sl-6	Sl-7	Sl-8	Sl-9	Sl-10	Sl-11	Sl-12	Sl-13	Sl-14	Sl-15
28th QM	0.003	0.004	0.003	0.002	0.002	0.004	0.003	0.003	0.003	0.003	0.004	0.002	0.002	0.002	NS
29th QM	0.003	0.002	0.003	0.003	0.002	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003
30th QM	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.003	0.003	0.002
31st QM	0.003	0.003	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.003	0.003	0.003	0.002	0.002	0.002
32nd QM	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.004	0.003	0.003	0.003	0.003	NS
33rd QM	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.003	0.002	0.003	0.002	0.002	0.003	NS
34th QM	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
35th QM	0.003	0.003	0.004	0.003	0.003	0.003	0.004	0.003	0.003	0.004	0.001	0.002	0.002	0.002	0.002
36th QM	0.003	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.001	0.001	0.002	0.002	NS
Standard (ECR'2023)	**0.001 mg/L (Coastal area)**												**0.003 mg/L (Reserved area)**		

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

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

Monitoring Periods	Sampling Locations ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
1st QM	0.053	0.055	0.055	0.057	0.06	0.058	0.053	0.054	0.056	0.053	0.048	0.05	0.043	0.194	0.224
2nd QM	0.004	0.002	0.005	0.002	0.002	0.002	0.002	0.003	0.005	0.004	0.004	0.032	0.044	0.071	0.05
3rd QM	0.002	0.003	0.002	0.003	0.002	0.002	0.003	0.004	0.004	0.004	<0.002	<0.002	0.004	0.032	0.07
4th QM	0.104	0.104	0.111	0.154	0.139	0.138	0.16	0.153	0.139	0.143	0.133	0.141	0.137	0.309	0.309
5th QM	0.098	0.102	0.138	0.142	0.135	0.156	0.142	0.148	0.163	0.135	0.14	0.14	0.13	0.297	0.291
6th QM	0.0059	0.0038	0.0058	0.011	0.002	0.0021	0.0076	0.002	0.002	0.002	0.002	0.002	0.002	NS	NS
7th QM	0.007	0.006	0.008	0.01	0.009	0.007	0.01	0.011	0.009	0.07	0.008	0.009	0.012	0.084	0.073
8th QM	0.168	0.092	0.176	0.115	0.148	0.112	0.134	0.099	0.093	0.023	0.067	0.078	0.135	0.302	NS
9th QM	0.203	0.302	0.347	0.336	0.317	0.298	0.396	0.323	0.331	0.35	0.275	0.258	0.228	0.359	0.607
10th QM	0.01	0.009	0.017	0.014	0.006	0.01	0.007	0.006	0.012	0.008	0.015	0.098	0.02	0.142	NS
11th QM	0.009	0.007	0.01	0.007	0.006	0.005	0.006	0.007	0.007	0.008	0.007	0.011	0.01	0.126	0.151
12th QM	0.024	0.034	0.03	0.036	0.046	0.041	0.048	0.044	0.056	0.038	0.056	0.05	0.05	0.033	0.129

Monitoring Periods	Sampling Locations ID														
	SL-1	**SL-2**	**SL-3**	**SL-4**	**SL-5**	**SL-6**	**SL-7**	**SL-8**	**SL-9**	**SL-10**	**SL-11**	**SL-12**	**SL-13**	**SL-14**	**SL-15**
13th QM	0.002	0.001	0.003	0.001	0.003	0.002	0.003	0.009	0.003	<LOQ	0.001	0.0001	0.001	0.009	NS
14th QM	0.003	0.003	0.003	0.002	0.002	0.001	0.001	0.002	0.002	0.003	0.011	0.011	0.005	0.004	0.019
15th QM	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.003	0.169	0.175
16th QM	0.002	0.001	0.004	0.001	0.003	0.001	0.007	0.003	0.005	0.002	0.003	0.002	0.003	0.001	NS
17th QM	0.002	0.001	0.02	0.018	0.008	0.041	0.012	0.015	0.03	0.01	0.016	0.015	0.017	0..062	NS
18th QM	0.003	0.007	0.017	0.013	0.01	0.012	0.011	0.014	0.019	0.008	0.017	0.009	0.009	0.018	0.014
19th QM	0.004	0.005	0.007	0.005	0.003	0.007	0.003	0.004	0.006	0.004	0.005	0.007	0.015	0.013	0.017
20th QM	0.003	0.002	0.004	0.003	0.003	0.002	0.002	0.003	0.002	0.002	0.003	0.003	0.002	0.002	NS
21st QM	0.001	0.003	0.002	0.009	0.003	0.009	0.12	0.006	0.004	0.003	0.004	0.002	0.006	0.001	NS
22nd QM	0.001	0.002	0.001	0.001	0.001	0.003	0.001	0.002	0.001	0.002	0.003	0.002	0.014	0.019	0.008
23rd QM	0.008	0.007	0.009	0.008	0.006	0.004	0.006	0.008	0.007	0.008	0.006	0.005	0.007	0.043	0.056
25th QM	0.006	0.004	0.007	0.005	0.007	0.008	0.019	0.009	0.01	0.013	0.005	0.003	0.009	0.011	NS
26th QM	0.002	0.005	0.006	0.008	0.006	0.005	0.018	0.008	0.004	0.003	0.006	0.007	0.004	0.02	0.013
27th QM	0.016	0.017	0.018	0.015	0.017	0.019	0.019	0.017	0.022	0.019	0.007	0.015	0.002	0.001	0.001
28th QM	0.029	0.029	0.036	0.016	0.014	0.012	0.0140.	0.003	0.014	0.013	0.015	0.014	0.014	0.018	NS
29th QM	0.017	0.019	0.019	0.012	0.012	0.016	0.022	0.015	0.016	0.022	0.002	0.023	0.011	0.005	0.5
30th QM	0.009	0.019	0.002	0.003	0.002	0.002	0.003	0.004	0.005	0.004	0.005	0.008	0.019	0.004	0.005
31st QM	0.013	0.01	0.011	0.009	0.007	0.011	0.014	0.006	0.007	0.008	0.01	0.013	0.01	0.011	0.009
32nd QM	0.009	0.009	0.01	0.008	0.003	0.008	0.004	0.007	0.009	0.01	0.012	0.017	0.01	0.009	NS
33rd QM	0.006	0.005	0.006	0.007	0.009	0.007	0.007	0.006	0.008	0.003	0.002	0.006	0.001	0.001	NS
34th QM	0.004	0.003	0.004	0.006	0.002	0.003	0.005	0.005	0.004	0.007	0.006	0.024	0.01	0.012	0.003
35th QM	0.006	0.007	0.007	0.006	0.007	0.005	0.007	0.008	0.006	0.004	0.006	0.005	0.006	0.008	0.007
36th QM	0.008	0.009	0.007	0.01	0.012	0.007	0.006	0.01	0.009	0.003	0.004	0.007	0.004	0.005	NS
Standard (ECR'2023)	**0.05 mg/L (Coastal area)**												**0.05 mg/L (Reserved area)**		

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Table B.15: Hg (mg/L) Concentration of Passur River System

Monitoring Periods	Sampling Location ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
1st QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
2nd QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	NS
3rd QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
4th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
5th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
6th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
7th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	NS
8th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	NS
9th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
10th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	NS
11th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
12th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
13th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
14th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
15th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
16th QM	0.004	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	NS
17th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	NS
18th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
19th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
20th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	NS
21st QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
22nd QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
23rd QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
25th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	NS
26th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
27th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
28th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	NS
29th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015

Monitoring Periods	Sampling Location ID														
	SL-1	SL-2	SL-3	SL-4	SL-5	SL-6	SL-7	SL-8	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14	SL-15
30th QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
31st QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
32nd QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
33rd QM	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
34th QM	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
35th QM	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
36th QM	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NS
Standards (ECR'2023)															

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Parameters for Ground Water Quality Monitoring

Table B.16: pH and Temperature (^{0}C) of Ground Water

pH					Temperature (^{0}C)				
Monitoring periods	Sampling location ID				Monitoring periods	Sampling location ID			
	SL-1	SL-2	SL-3	SL-4		SL-1	SL-2	SL-3	SL-4
1st QM	7.6	7.6	7.6	6.3	**1st QM**	27.3	29.6	29.2	27.5
2nd QM	7.7	7.8	7.7	6.5	**2nd QM**	28.5	29.9	28.9	28.7
3rd QM	7.9	8	8	NF	**3rd QM**	26	28	28	NF
4th QM	8	8.2	8.1	NF	**4th QM**	24.5	22.5	25.1	NF
5th QM	TC	7.8	7.9	NF	**5th QM**	TC	28.6	28.8	NF
6th QM	8.1	8.3	8.3	NF	**6th QM**	31	28	30	NF
7th QM	7.49	7.93	7.7	NF	**7th QM**	30	27.8	28.7	NF
8th QM	7.6	8.1	7.9	NF	**8th QM**	24	23	25	NF
9th QM	7.8	8.3	8.2	NF	**9th QM**	29.8	29.6	30.1	NF
10th QM	7.8	8.1	7.9	NF	**10th QM**	28.6	29.1	29.4	NF
11th QM	8.4	7.9	7.9	NF	**11th QM**	29.1	30.4	29.8	NF
12th QM	8.1	7.5	7.6	NF	**12th QM**	25.1	24.3	24	NF

pH					Temperature (^{0}C)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
13th QM	7.4	7.8	7.4	NF	**13th QM**	28.7	27.7	28.4	NF
14th QM	8.2	8.1	7.8	NF	**14th QM**	27.2	26.5	26.4	NF
15th QM	6.9	7.4	7.2	NF	**15th QM**	22.9	23.8	23.6	NF
16th QM	NF	6.9	7.2	NF	**16th QM**	NF	30.3	30.1	NF
17th QM	NF	7.9	7.6	NF	**17th QM**	NF	29.3	29.7	NF
18th QM	NF	7.3	7.6	NF	**18th QM**	NF	30	29	NF
19th QM	7.1	6.9	6.5	NF	**19th QM**	23.8	23.7	23.2	NF
20th QM	8.3	8.4	8.9	NF	**20th QM**	29	30	30	NF
21st QM	8.2	7.9	8.1	NF	**21st QM**	31.4	30	31.2	NF
22nd QM	7.2	7.6	7.4	NF	**22nd QM**	27	27	26	NF
23rd QM	7.8	7.3	7.5	NF	**23rd QM**	24	23	23	NF
25th QM	**8.1**	**8**	**8**	NF	**25th QM**	31	30	30	NF
26th QM	7.4	8	8	NF	**26th QM**	27	28	27	NF
27th QM	**7.2**	**7.5**	**7.5**	NF	**27th QM**	22	25	25	NF
28th QM	8	8.3	8.2	NF	**28th QM**	23	23	24	NF
29th QM	5.6	6.2	7.4	NF	**29th QM**	31.3	30.45	30.72	NF
30th QM	8	8.6	9.1	NF	**30th QM**	28.89	27.7	28.04	NF
31st QM	7.7	8.1	8.1	NF	**31st QM**	23	24	25	NF
32nd QM	7.7	7.4	8.2	NF	**32nd QM**	29	31.48	29.37	NF
33rd QM	7.26	7.8	7.7	NF	**33rd QM**	32	30	29	NF
34th QM	7.1	8.1	8	NF	**34th QM**	26	26.69	26	NF
35th QM	8.4	9.0	8.1	NF	**35th QM**	31	27.3	26.9	NF
36th QM	8.1	8.7	8.3	NF	**36th QM**	29	30	30.13	NF
37th QM	7.4	7.6	7.1	NF	**37th QM**	29	30	30.1	NF
Standard (ECR'2023)	**6.5-8.5**				**Standard (ECR'2023)**	**(20^{0}C-30^{0}C) mg/L**			

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NF-Not Functional.

Table B.17: Salinity (ppt.) and DO (mg/L) in Groundwater

Salinity (ppt.)					DO (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
1st QM	0	0	0	0	**1st QM**	4.4	6	6.4	4.4
2nd QM	0	0	0	0	**2nd QM**	5.2	6.2	6.5	6
3rd QM	0	0	0	NF	**3rd QM**	6.5	7.7	6.1	NF
4th QM	1	0	0	NF	**4th QM**	6.7	6.3	6.5	NF
5th QM	TC	0	0	NF	**5th QM**	TC	6	6.6	NF
6th QM	0	0	0	NF	**6th QM**	6	5.9	6	NF
7th QM	0	0	0	NF	**7th QM**	5.4	6.1	5.6	NF
8th QM	0	0	0	NF	**8th QM**	4.9	5.2	4.8	NF
9th QM	0	0	0	NF	**9th QM**	6.1	5.8	5.6	NF
10th QM	0	0	0	NF	**10th QM**	5.8	6.1	5.7	NF
11th QM	0	0	0	NF	**11th QM**	6.3	5.8	6.1	NF
12th QM	0	0	0	NF	**12th QM**	4.5	4.8	4.6	NF
13th QM	0	0	0	NF	**13th QM**	5.1	5.3	5.7	NF
14th QM	0	0	0	NF	**14th QM**	6.2	5.8	6.2	NF
15th QM	0	0.3	0.4	NF	**15th QM**	5.2	4.47	4.26	NF
16th QM	NF	0.3	0.2	NF	**16th QM**	NF	6	5.4	NF
17th QM	NF	0.1	0.1	NF	**17th QM**	NF	6	5.9	NF
18th QM	NF	0.1	0.1	NF	**18th QM**	NF	5.9	6.1	NF
19th QM	0.1	0.1	0.1	NF	**19th QM**	6	6.1	6.2	NF
20th QM	0.1	0.5	0.7	NF	**20th QM**	6	6.5	6.2	NF
21st QM	0.1	0.1	0.1	NF	**21st QM**	6.1	6	6	NF
22nd QM	0	0	0	NF	**22nd QM**	6	6.2	6	NF
23rd QM	0.1	0.1	0.1	NF	**23rd QM**	6	6.1	6	NF

Salinity (ppt.)					DO (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
25th QM	0.1	0.1	0.1	NF	**25th QM**	6	6.1	6.1	NF
26th QM	0.18	0.1	0.1	NF	**26th QM**	6	6.2	6	NF
27th QM	0.1	0.2	0.4	NF	**27th QM**	6.4	6.7	4.9	NF
28th QM	0.1	0.3	0.3	NF	**28th QM**	6.4	6.3	6.3	NF
29th QM	0.1	0.2	0.4	NF	**29th QM**	6	6	5	NF
30th QM	0	0	0	NF	**30th QM**	6.5	7.7	6.1	NF
31st QM	0.1	0.2	0.4	NF	**31st QM**	6.2	4.7	3.5	NF
32nd QM	0.3	0.2	0.4	NF	**32nd QM**	4	2.99	3.8	NF
33rd QM	0.4	0.2	0.1	NF	**33rd QM**	2.6	5.9	6	NF
34th QM	0.2	0.2	0.4	NF	**34th QM**	3.2	5	3.8	NF
35th QM	0.6	0.2	0.4	NF	**35th QM**	5.99	5.8	3.8	NF
36th QM	0.6	0.2	0.4	NF	**36th QM**	3.1	2	2.2	NF
37th QM	0.2	0.1	0.4	NF	**37th QM**	4.1	4	3.8	NF
Standard (ECR'2023)	**N/A**				**Standard (ECR'2023)**	**N/A**			

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NF-Not Functional.

Table B.18: TDS (mg/L) and TSS (mg/L) in Groundwater

TDS (mg/L)					TSS (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
1st QM	1113	4090	643	1055	**1st QM**	-	-	-	-
2nd QM	999	371	635	970	**2nd QM**	6	6	8	48
3rd QM	-	-	-	-	**3rd QM**	19	2	6	NF
4th QM	1021	378	600	NF	**4th QM**	40	28	32	NF
5th QM	NO	390	600	NF	**5th QM**	NF**	4	6	NF
6th QM	881	574	328	NF	**6th QM**	23	16	14	NF
7th QM	377	1007	611	NF	**7th QM**	4	5	4	NF
8th QM	447	491	284	NF	**8th QM**	31	46	41	NF
9th QM	1025	384	645	NF	**9th QM**	3	4	3	NF
10th QM	1000	408	607	NF	**10th QM**	5	4	4	NF
11th QM	617	382	636	NF	**11th QM**	7	4	5	NF
12th QM	623	401	998	NF	**12th QM**	32	28	25	NF
13th QM	395	617	558	NF	**13th QM**	4	10	9	NF
14th QM	602	996	390	NF	**14th QM**	8	10	9	NF
15th QM	405	602	994	NF	**15th QM**	12	6	7	NF
16th QM	NF	615	370	NF	**16th QM**	NF	12	5	NF
17th QM	NF	390	608	NF	**17th QM**	NF	2	3	NF
18th QM	NF	365	610	NF	**18th QM**	NF	6	8	NF
19th QM	1315	376	927	NF	**19th QM**	3	3	4	NF
20th QM	915	380	610	NF	**20th QM**	3	2	4	NF
21st QM	25	602	360	NF	**21st QM**	2	1	4	NF
22nd QM	900	385	603	NF	**22nd QM**	4	3	4	Nf
23rd QM	3080	660	370	NF	**23rd QM**	2	3	2	NF

TDS (mg/L)					TSS (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
25th QM	1196	701	316	NF	**25th QM**	1	3	1	NF
26th QM	139	335	202	NF	**26th QM**	3	5	2	NF
27th QM	200	350	610	NF	**27th QM**	1	2	5	NF
28th QM	810	450	570	NF	**28th QM**	1	1	1	NF
29th QM	890	360	610	NF	**29th QM**	1	1	2	NF
30th QM	350	615	860	NF	**30th QM**	1	4	3	NF
31st QM	0.86	350	620	NF	**31st QM**	1	1	1	NF
32nd QM	1150	360	620	NF	**32nd QM**	2	1	2	NS
33rd QM	350	620	900	NF	**33rd QM**	1	2	1	NF
34th QM	885	620	510	NF	**34th QM**	1	1	3	NF
35th QM	370	900	630	NF	**35th QM**	1	1	1	NF
36th QM	890	350	1300	NF	**36th QM**	1	1	3	NF
Standard (ECR'2023)	**1000 mg/L**				**Standard (ECR'2023)**	**10 mg/L**			

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NF-Not Functional.

Table B.19: TH (mg/L) and COD (mg/L) concentrations in Groundwater

TH (mg/L)					COD (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
1st QM	425	220	190	780	**1st QM**	32	28	48	32
2nd QM	250	175	140	450	**2nd QM**	32	28	32	36
3rd QM	300	180	180	NF	**3rd QM**	34	18	34	NF
4th QM	235	110	125	NF	**4th QM**	20	16	20	NF
5th QM	NO	138	216	NF	**5th QM**	NO	14	18	NF
6th QM	225	125	115	NF	**6th QM**	12	10	14	NF

TH (mg/L)					COD (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
7th QM	325	450	480	NF	**7th QM**	4	8	4	NF
8th QM	295	195	225	NF	**8th QM**	4	4	4	NF
9th QM	305	263	163	NF	**9th QM**	4	4	4	NF
10th QM	320	248	28	NF	**10th QM**	4	4	2	NF
11th QM	175	295	183	NF	**11th QM**	4	4	4	NF
12th QM	550	510	620	NF	**12th QM**	4	4	4	NF
13th QM	720	420	654	NF	**13th QM**	4	4	4	NF
14th QM	145	240	215	NF	**14th QM**	8	8	16	NF
15th QM	NF	265	305	NF	**15th QM**	NF	4	4	NF
16th QM	NF	195	215	NF	**16th QM**	NF	4	4	NF
17th QM	NF	235	170	NF	**17th QM**	NF	4	4	NF
18th QM	NF	178	138	NF	**18th QM**	NF	4	4	NF
19th QM	355	215	270	NF	**19th QM**	4	3	4	NF
20th QM	235	182	167	NF	**20th QM**	352	4	4	NF
21st QM	97	167	212	NF	**21st QM**	4	4	4	NF
22nd QM	145	245	137	NF	**22nd QM**	4	4	4	NF
23rd QM	137	118	145	NF	**23rd QM**	4	4	4	NF
25th QM	625	210	237	NF	**25th QM**	4	4	4	NF
26th QM	232	185	207	NF	**26th QM**	4	4	4	NF
27th QM	160	145	130	NF	**27th QM**	4	4	4	NF
28th QM	1400	1600	1200	NF	**28th QM**	16	32	8	NF
29th QM	160	195	140	NF	**29th QM**	32	28	36	NF
30th QM	70	243	155	NF	**30th QM**	4	20	28	NF
31st QM	180	200	210	NF	**31st QM**	12	8	28	NF
32nd QM	320	165	275	NF	**32nd QM**	32	28	32	NF

TH (mg/L)					COD (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
33rd QM	225	415	515	NF	**33rd QM**	4	4	4	NF
34th QM	265	130	110	NF	**34th QM**	4	4	4	NF
35th QM	215	445	348	NF	**35th QM**	16	12	8	NF
36th QM	237	190	1200	NF	**36th QM**	32	28	36	NF
Standard (ECR'2023)	**N/A**				**Standard (ECR'2023)**	**N/A**			

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NF-Not Functional.

Table B.20: NO_3^- (mg/L) and SO_4^{2-} (mg/L) concentrations in Groundwater

NO_3^- (mg/L)					SO_4^{2-} (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
1st QM	0.2	0.6	0.8	0.4	**1st QM**	-	-	-	NF
2nd QM	0.48	0.68	0.4	0.56	**2nd QM**	3	2	10	3
3rd QM	<0.10	0.31	0.8	NF	**3rd QM**	-	-	-	NF
4th QM	28	26	13	NF	**4th QM**	-	-	-	-
5th QM	-	-	-	NF	**5th QM**	-	-	-	-
6th QM	7.6	2.2	4.7	NF	**6th QM**	-	-	-	-
7th QM	4.3	4.2	3.8	NF	**7th QM**	1	2	2	-
8th QM	2.1	1.9	2.8	NF	**8th QM**	5	6	2	NF
9th QM	1.7	2.3	1.9	NF	**9th QM**	1	2	8	NF
10th QM	3.8	3.3	3.7	NF	**10th QM**	1	1	1	NF
11th QM	6.1	7.51	10.16	NF	**11th QM**	1	1	1	NF
12th QM	4.65	7.02	4.65	NF	**12th QM**	1	1		NF
13th QM	9.32	14.7	10.2	NF	**13th QM**	5	1	3	NF
14th QM	3.3	2.5	4.6	NF	**14th QM**	1	1	2	NF

NO_3^- (mg/L)					SO_4^{2-} (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
15th QM	5.9	7.2	1.7	NF	**15th QM**	8	2	6	NF
16th QM	NF	5.3	5.7	NF	**16th QM**	NF	2	4	NF
17th QM	NF	8.6	7.8	NF	**17th QM**	NF	4	6	NF
18th QM	NF	0.9	1.4	NF	**18th QM**	NF	1	1	NF
19th QM	1.7	4.4	2.1	NF	**19th QM**	1	2	1	NF
20th QM	4.4	2.7	8.3	NF	**20th QM**	4	1	4	NF
21st QM	1.4	2.7	1.7	NF	**21st QM**	1	2	1	NF
22nd QM	1.8	3.1	1.6	NF	**22nd QM**	2	2	1	NF
23rd QM	1.9	1.4	2.7	NF	**23rd QM**	2	3	2	NF
25th QM	1.7	7.5	1.7	NF	**25th QM**	4	3	4	NF
26th QM	0.5	3.8	3.1	NF	**26th QM**	9	3	3	NF
27th QM	2.4	2.2	4.9	NF	**27th QM**	1	1	7	NF
28th QM	1	1	2	NF	**28th QM**	1	1	1	NF
29th QM	1.5	2.1	2.1	NF	**29th QM**	1	4	3	NF
30th QM	3.7	4.1	2.6	NF	**30th QM**	2.2	6.3	2.6	NF
31st QM	12.09	4.02	8.83	NF	**31st QM**	14.94	4.22	9.51	NF
32nd QM	4.331	12.304	1.9372	NF	**32nd QM**	2.1054	6.83	1.76	NF
33rd QM	4.88	0.801	4.33	NF	**33rd QM**	1.41	1.36	3.31	NF
34th QM	15.51	1.22	4.82	NF	**34th QM**	0.2	1.9	1.0	NF
35th QM	1.34	1.34	1.34	NF	**35th QM**	5.25	5.57	11	NF
36th QM	2.003	0.7807	6.31	NF	**36th QM**	14.7	0.89	3.94	NF
Standard (ECR'2023)	**45 mg/L**				**Standard (ECR'2023)**	**250 mg/L**			

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NF-Not Functional.

Table B.21: PO_4^{3-} (mg/L) and as (mg/L) concentrations in Groundwater

PO_4^{3-} (mg/L)					As (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
1st QM	NF	-	-	NF	**1st QM**	0.013	0.006	0.036	0.376
2nd QM	2.2	2.5	6.2	1.2	**2nd QM**	0.02	0.009	0.033	0.407
3rd QM	-	-	-	NF	**3rd QM**	0.012	0.006	0.02	NF
4th QM	0.74	0.44	0.48	NF	**4th QM**	0.014	0.008	0.017	NF
5th QM	NO	1.98	4.54	NF	**5th QM**	NO	0.01	0.034	NF
6th QM	1.4	1.6	4.1	NF	**6th QM**	0.015	0.014	0.024	NF
7th QM	0.31	0.27	0.48	NF	**7th QM**	0.002	0.012	0.011	NF
8th QM	0.267	0.179	0.179	NF	**8th QM**	0.008	0.002	0.002	NF
9th QM	1.08	1.53	3.26	NF	**9th QM**	0.018	0.007	0.047	NF
10th QM	0.17	0.29	0.31	NF	**10th QM**	0.012	0.018	0.005	NF
11th QM	0.167	0.67	0.6	NF	**11th QM**	0.033	0.011	0.016	NF
12th QM	1.18	1.21	1.18	NF	**12th QM**	0.028	0.005	0.028	NF
13th QM	2.18	1.8	2.1	NF	**13th QM**	0.012	0.022	0.01	NF
14th QM	1.68	3.5	4.7	NF	**14th QM**	0.014	0.004	0.027	NF
15th QM	0.13	0.17	0.18	NF	**15th QM**	0.002	0.012	0.002	NF
16th QM	NF	4..5	0.27	NF	**16th QM**	0.001	0.022	0.001	NF
17th QM	NF	2.9	4.8	NF	**17th QM**	NF	0.012	0.004	NF
18th QM	NF	0.15	0.26	NF	**18th QM**	NF	0.007	0.05	NF
19th QM	2.1	1.3	3.6	NF	**19th QM**	0.014	0.003	0.004	NF
20th QM	2.3	2.5	3.2	NF	**20th QM**	0.012	0.012	0.012	NF
21st QM	0.3	4	2	NF	**21st QM**	0.014	0.006	0.022	NF
22nd QM	1	0.5	1.5	NF	**22nd QM**	0.001	0.027	0.001	NF
23rd QM	1.1	0.4	0.9	NF	**23rd QM**	0.018	0.006	0.033	NF

PO_4^{3-} (mg/L)					As (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**	**Sampling location ID**			
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
25th QM	0.3	1.5	1.7	NF	**25th QM**	0.02	0.068	0.003	NF
26th QM	0.7	6.3	2.3	NF	**26th QM**	0.022	0.045	0.004	NF
27th QM	2	1.8	2.3	NF	**27th QM**	0.003	0.053	0.006	NF
28th QM	1.4	0.98	4	NF	**28th QM**	0.002	0.004	0.049	NF
29th QM	1.7	1.2	5	NF	**29th QM**	0.002	0.003	0.008	NF
30th QM	0.9	1.4	0.6	NF	**30th QM**	0.012	0.003	0.061	NF
31st QM	1	0.6	1.4	NF	**31st QM**	0.003	0.063	0.014	NF
32nd QM	0.8	1.4	0.3	NF	**32nd QM**	0.016	0.003	0.048	NF
33rd QM	1.2	0.5	1.36	NF	**33rd QM**	0.008	0.003	0.064	NF
34th QM	0.7548	0.5	1.5	NF	**34th QM**	0.02	0.00	0.05	NF
35th QM	0.757	0.5	1.3	NF	**35th QM**	0.019	0.003	0.056	NF
36th QM	0.0	0.4	1.3	NF	**36th QM**	0.005	0.002	0.042	NF
Standard (ECR'2023)					**Standard (ECR'2023)**	**0.05 mg/L**			

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NF-Not Functional.

Table B.22: Pb (mg/L) and Hg (mg/L) concentrations in Groundwater

PB (mg/L)					Hg (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**		**Sampling location ID**		
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
1st QM	0.002	<0.002	<0.002	0.002	**1st QM**	<0.00015	<0.00015	<0.00015	<0.00015
2nd QM	<0.002	<0.002	0.004	0.008	**2nd QM**	<0.00015	<0.00015	<0.00015	<0.00015
3rd QM	0.004	<0.002	<0.002	NF	**3rd QM**	<0.0005	<0.0005	<0.0005	NF
4th QM	0.023	0.016	0.013	NF	**4th QM**	<0.0005	<0.0005	<0.0005	NF
5th QM	NO	0.013	0.017	D	**5th QM**	<0.0005	<0.00015	<0.00015	NF
6th QM	0.002	0.0027	0.002	D	**6th QM**	0.00015	0.00015	0.00015	NF

PB (mg/L)					Hg (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**		**Sampling location ID**		
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
7th QM	0.006	0.021	0.005	NF	**7th QM**	<0.00015	<0.00015	<0.00015	NF
8th QM	0.026	0.011	0.012	NF	**8th QM**	<0.00015	<0.00015	<0.00015	NF
9th QM	0.019	0.007	0.008	NF	**9th QM**	<0.00015	<0.00015	<0.00015	NF
10th QM	0.002	0.002	0.002	NF	**10th QM**	<0.00015	<0.00015	<0.00015	NF
11th QM	0.001	0.001	0.001	NF	**11th QM**	<0.00015	<0.00015	<0.00015	NF
12th QM	0.01	0.009	0.016	NF	**12th QM**	<0.00015	<0.00015	<0.00015	NF
13th QM	0.001	0.001	0.001	NF	**13th QM**	0.001	0.001	0.001	NF
14th QM	0.003	0.007	0.002	NF	**14th QM**	<0.0001	<0.0001	<0.0001	NF
15th QM	0.001	0.002	0.001	NF	**15th QM**	<0.001	<0.001	<0.001	NF
16th QM	0.001	0.001	0.001	NF	**16th QM**	<0.001	<0.001		NF
17th QM	0.001	0.001	0.001	NF	**17th QM**	<0.001	<0.001	<0.001	NF
18th QM	NF	0.001	0.001	NF	**18th QM**	<0.001	<0.001	<0.001	NF
19th QM	NF	0.004	0.056	NF	**19th QM**	<0.001	<0.001	<0.001	NF
20th QM	0.008	0.003	0.004	NF	**20th QM**	<0.001	<0.001	<0.001	NF
21st QM	0.004	0.004	0.006	NF	**21st QM**	0.001	0.003	0.001	NF
22nd QM	0.018	0.002	0.001	NF	**22nd QM**	<0.001	<0.001	<0.001	NF
23rd QM	0.002	0.008	0.001	NF	**23rd QM**	<0.001	<0.001	<0.001	NF
25th QM	0.001	0.001	0.002	NF	**25th QM**	<0.001	<0.001	<0.001	NF
26th QM	0.001	0.001	0.001	NF	**26th QM**	<0.001	<0.001	NF	NF
27th QM	0.004	0.006	0.002	NF	**27th QM**	<0.001	<0.001	<0.001	NF
28th QM	0.048	0.016	0.056	NF	**28th QM**	<0.001	<0.001	<0.001	NF
29th QM	0.003	0.008	0.002	NF	**29th QM**	<0.001	<0.001	<0.001	NF
30th QM	0.009	0.002	0.001	NF	**30th QM**	<0.001	<0.001	<0.001	NF
31st QM	0.001	0.001	0.001	NF	**31st QM**	<0.001	<0.001	<0.001	NF
32nd QM	0.003	0.004	0.003	NF	**32nd QM**	<0.001	<0.001	<0.001	NF

PB (mg/L)					Hg (mg/L)				
Monitoring periods	**Sampling location ID**				**Monitoring periods**		**Sampling location ID**		
	SL-1	**SL-2**	**SL-3**	**SL-4**		**SL-1**	**SL-2**	**SL-3**	**SL-4**
33rd QM	0.8	1.4	0.3	NF	**33rd QM**	0.008	0.003	0.064	NF
34th QM	0.002	0.003	0.001	NF	**34th QM**	<0.001	<0.001	<0.001	NF
35th QM	0.002	0.002	0.003	NF	**35th QM**	<0.001	<0.001	<0.001	NF
36th QM	0.001	0.002	0.001	NF	**36th QM**	<0.001	<0.001	<0.001	NF
Standard (ECR'2023)	**0.01 mg/L**				**Standard (ECR'2023)**	**0.001 mg/L**			

Source: CEGIS Field Survey; 2014 up to 2023; Note: QM= Quarterly Monitoring, NF-Not Functional.

Table B.23: PAH (mg/L) Concentrations of Monitored Locations

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

PAH		Acenapthylene	Anthracene	Benzlol (A) Anthracene	Benzlol (A) Pyrene	Benzlol (B) Fluoranthene	Benzol (G, H, I) Perilene	Benzol (K) Fluoranthene	Chrysene	Dibenzol (A, H) Anthracene	Fluorene	Phenanthrene	Pyrene
August, 2021	Project Jetty	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Majhar point	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hiron point	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
January, 2022	Project Jetty	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Majhar point	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hiron point	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
July, 2022	Project Jetty	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Majhar point	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hiron point	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
January, 2023	Project Jetty	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Majhar point	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hiron point	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Source: CEGIS Field Survey; 2014 up to 2023; Note: ND-Not dected.

Table B.24: TOC (mg/L) and TC (mg/L) concentrations of monitored locations

Monitoring sites	July, 2018		January, 2019		July, 2019		February, 2020		July, 2020		January, 2021		August, 2021		January, 2022		July, 2022		January, 2023	
	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon	Total Carbon	Total Organic Carbon
Project jetty site	26.4	19.5	20.7	14.3	17.2	13.6	37.5	26.4	152	9.17	1302	<5	250	<5	218	21.2	65	10.5	1403	5
Majhar point or Harbaria area	21.9	25.1	24.8	18.8	21.7	18.1	21.7	18.1	200	9.48	1568	<5	200	20.2	686	19.7	239	12.7	1058	5
Hiron point	NM	NM	6.8	5.7	NM	NM	8.1	6.7	NM	NM	9241	<5	NM	NM	2901	15.2	NM	NM	3759	5

Source: CEGIS Field Survey; 2014 up to 2023

(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

*Source: CEGIS Field Survey; 2014 up to 2023; 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

*Source: CEGIS Field Survey; 2014 up to 2023; 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

*Source: CEGIS Field Survey; 2014 up to 2023; 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; 2014 up to 2023; NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

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

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

*Source: CEGIS Field Survey; 2014 up to 2023; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

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

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

*Source: CEGIS Field Survey; 2014 up to 2023; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

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

Sl No	Location	QM 26 (Noise Level in dB (A)) Oct, 2020				QM 27 (Noise Level in dB (A)) Jan, 2021				QM 28 (Noise Level in dB (A)) Apr, 2021				QM 29 (Noise Level in dB (A) Jul, 2021				Std*
		Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	A. noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	65.91	51.62	56.93	58.15	58.33	NM	62.68	60.50	61.35	61.74	61.22	61.44	50.96	51.08	51.57	51.21	70
2	NW Corner of the Project area	47.82	50.15	47.45	48.48	45.00	52.75	56.51	51.42	50.65	48.34	NM	49.50	49.60	51.64	49.09	50.11	55
3	Chunkuri-2, Bajua	43.58	47.68	46.45	45.91	48.75	45.45	46.96	47.05	50.22	52.90	50.81	51.31	49.93	51.65	49.52	50.36	55
4	SW corner of the Project area	49.50	48.83	49.22	49.18	NM	50.88	53.84	52.36	55.41	54.85	55.45	55.24	49.82	54.82	51.07	51.90	55
5	Project site near Shapmari area	50.23	41.71	41.43	44.45	49.19	47.07	51.00	49.09	52.23	51.24	52.67	52.05	53.45	54.35	53.71	53.84	55
6	Barni, Gaurambha	67.71	51.76	55.51	58.33	51.69	51.99	55.60	53.09	54.16	51.69	51.15	52.34	52.73	NM	49.28	51.00	60
7	Khan Jahan Ali Bridge, Khulna	81.72	81.45	82.25	81.81	61.95	NM	61.93	61.94	56.08	54.09	53.79	54.65	52.78	51.29	53.05	52.38	70
8	Mongla Port area	74.72	75.67	80.37	76.92	55.16	56.85	57.53	56.52	54.01	52.41	54.48	53.63	55.26	55.54	55.68	54.49	75
9	Harbaria, Sundarbans	59.01	NM	50.06	54.54	46.98	41.82	NM	44.40	48.54	47.54	NM	48.04	NM	NM	NM	NM	50
10	Akram Point, Sundarbans	NM	42.23	NM	42.23	40.34	35.35	NM	37.85	45.95	40.89	NM	43.42	46.31	42.94	NM	44.62	50
11	Hiron Point, Sundarbans	52.40	49.01	NM	50.70	42.50	35.23	NM	38.85	NM	NM	NM	NM	49.70	51.2	NM	50.94	50

*Source: CEGIS Field Survey; 2014 up to 2023; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

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

Sl No	Location	QM 30 (Noise Level in dB (A)) Oct, 2021				QM 31 (Noise Level in dB (A)) Jan, 2022				QM 32(Noise Level in dB (A)) May, 2022				QM 33(Noise Level in dB (A)) Jul, 2022				
		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	Std*
1	Chalna, Dacope	68.9	52.08	58.3	64.57	56	59.05	64.08	59.71	56	61.25	59.97	59.08	52.71	52.62	53.30	52.88	70
2	NW Corner of the Project area	47.99	51.61	48.17	49.59	49	48.90	48.56	48.82	48.63	48.64	48.64	48.60	46.55	44.82	45.44	45.60	55
3	Chunkuri-2, Bajua	45.31	48.07	46.8	46.87	49.85	47.48	49.70	49.01	48.32	48.72	49.70	48.91	48.00	45.61	47.75	47.12	55
4	SW corner of the Project area	49.66	49.49	48.95	49.37	63.74	49.95	50.25	54.65	50.31	50.05	51.24	50.53	54.00	48.07	46.06	49.38	55
5	Project site near Shapmari area	50.94	42.29	41.88	47.17	50.05	50.57	49.45	50.03	49.70	49.34	50.24	49.76	44.50	45.75	43.49	44.58	55
6	Barni, Gaurambha	68.37	51.5	56.61	63.96	47.60	49.57	49.51	48.89	47.60	45.05	49.04	47.23	50.06	45.93	46.40	47.46	60
7	Khan Jahan Ali Bridge, Khulna	77.75	80.58	81.43	80.18	61.04	63.52	62.44	62.33	56.46	56.93	62.42	58.60	55.75	NM	NM	55.75	70
8	Mongla Port area	73.94	75.15	79.45	76.86	NM	53.89	58.02	55.95	55.95	56.99	59.19	57.38	55.41	55.09	54.75	55.08	75
9	Harbaria, Sundarbans	59.51	50.62	NM	57.02	49.85	44.77	NM	47.31	52.31	46.44	NM	49.37	42.95	38.59	NM	40.77	50
10	Akram Point, Sundarbans	44.22	42.12	NM	43.29	38.66	36.15	NM	37.41	46.22	39.94	NM	43.08	41.97	NM	41.01	41.49	50
11	Hiron Point, Sundarbans	53.99	49.41	NM	52.27	39.5	33.08	NM	36.29	NM	NM	NM	NM	NM	NM	NM	NM	50

*Source: CEGIS Field Survey; 2014 up to 2023; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

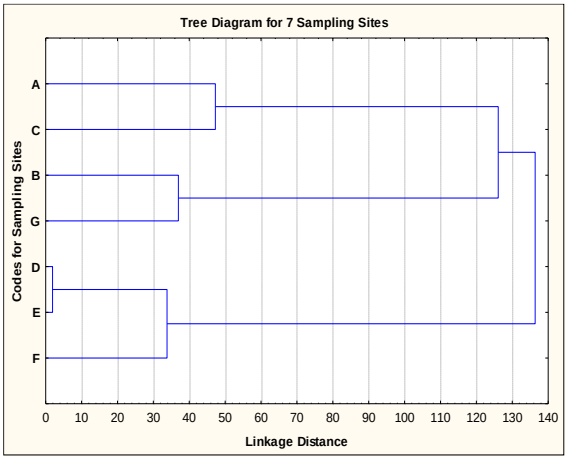
Table C.9: Ambient noise monitoring status at the monitored locations

Sl. No	Location	QM 34(Noise Level in dB (A)) Oct, 2022				QM 35 (Noise Level in dB (A)) Jan, 2023				QM 36 (Noise Level in dB (A)) Apr, 2023				QM 37 (Noise Level in dB (A)) Apr, 2023				Standard
		Morning (9:00)	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	78.1	72.2	76.2	75.5	69.5	67	62.7	66.4	62	55.2	57	58	57.69	55.83	57.87	57.13	**70**
2	NW Corner of the Project area	57	57.7	52.3	55.67	53.4	48.3	43.2	48.3	45.1	44.5	46	45.2	50.47	48.07	48.62	49.06	**55**
3	Chunkuri-2, Bajua	63.5	55.4	54.6	57.83	51.8	55.4	53.3	53.5	51.5	52.4	50.8	51.6	54.93	47.43	46.28	49.54	**55**
4	SW corner of the Project area	56.2	53.7	52.7	54.2	49.8	53.8	NM	51.8	58.7	49.7	50.9	54.2	50.55	55.53	53.87	53.32	**55**
5	Project site near Shapmari area	57.4	50.9	NM	54.15	56.3	53.8	46.4	52.2	46.7	46.4	51.2	48.1	47.07	45.4	47.54	46.67	**55**
6	Barni, Gaurambha	62.5	60.5	62.6	61.87	59.9	57	58.5	58.5	59.1	46.8	52.9	52.9	57.97	49.15	52.66	53.26	**60**
7	Khan Jahan Ali Bridge, Khulna	65.1	63.2	NM	64.15	70.2	68.9	75.9	71.7	65.9	62.1	NM	64	60.35	55.4	54.9	56.88	**70**
8	Mongla Port area	61.5	67.9	65.6	65	65.2	68.1	56.4	63.2	63.3	58.3	61.9	61.2	55.97	56.58	53.36	55.31	**75**
9	Harbaria, Sundarbans	49.6	50.4	NM	50	48.1	41.8	NM	44.9	48.7	51.4	NM	50	49.15	48.64	NM	48.89	**50**
10	Akram Point, Sundarbans	42.5	41.7	NM	42.1	42.9	37.6	NM	40.2	46.5	43.7	NM	45.1	40.49	55.69	NM	48.09	**50**
11	Hiron Point, Sundarbans	47.8	NM	NM	47.8	41.3	41.3	NM	41.3	NM	NM	NM	NM	55.8	52.51	NM	54.15	**50**

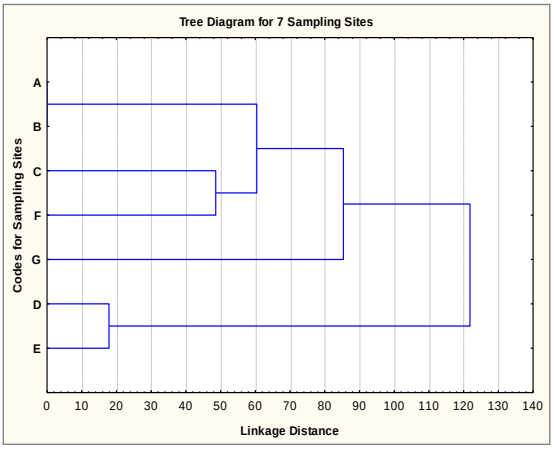
*Source: CEGIS Field Survey; 2014 up to 2023; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

(D) Fisheries Resources Monitoring Data

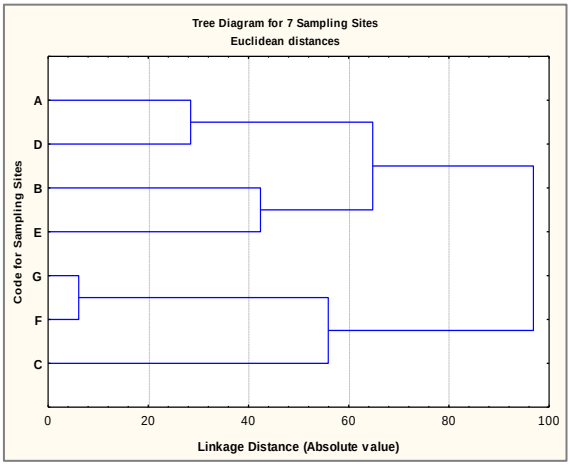
D1: Classification of Functional Habitat



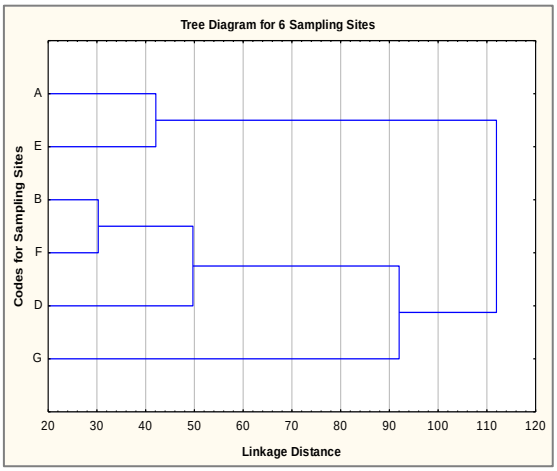
1st Monitoring, April, 2014



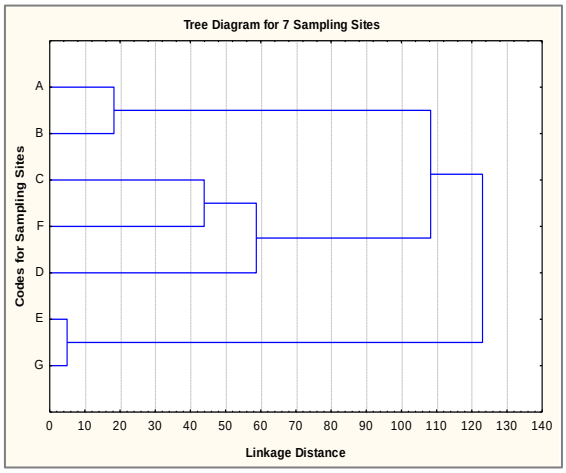
2nd Monitoring, July 2014



3rd Monitoring, October, 2014



4th Monitoring, January 2015



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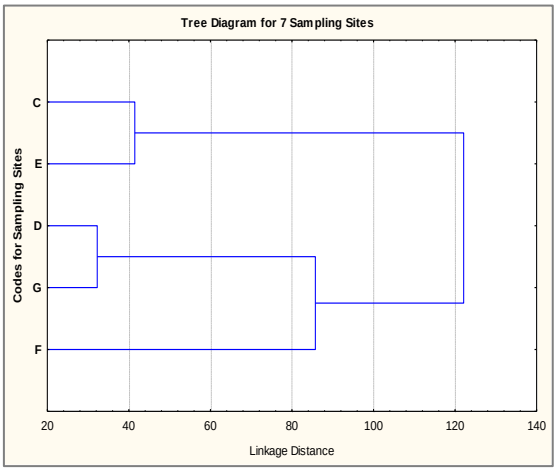

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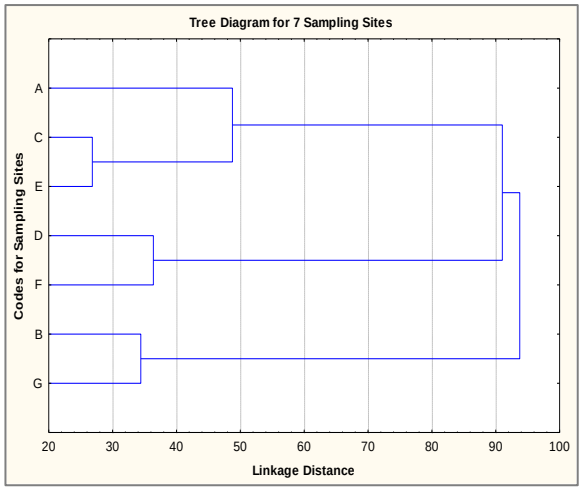

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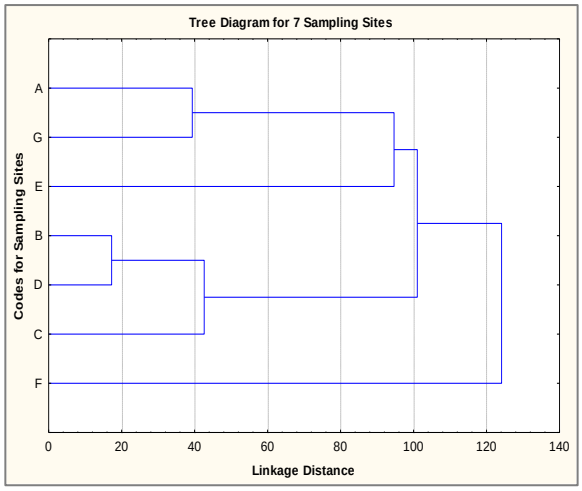
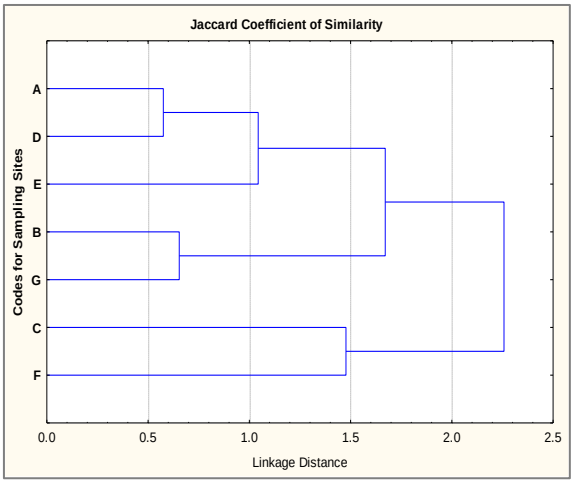
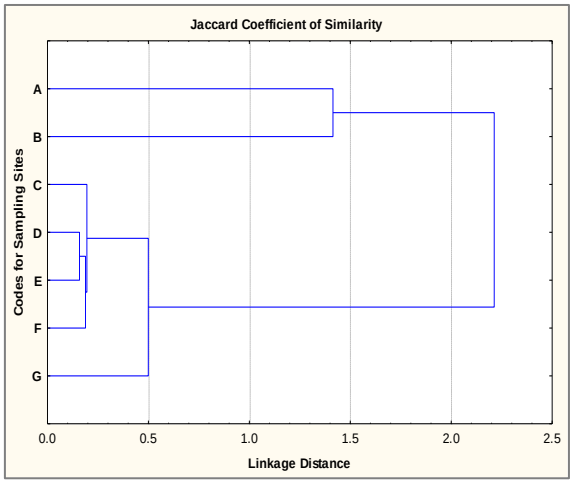
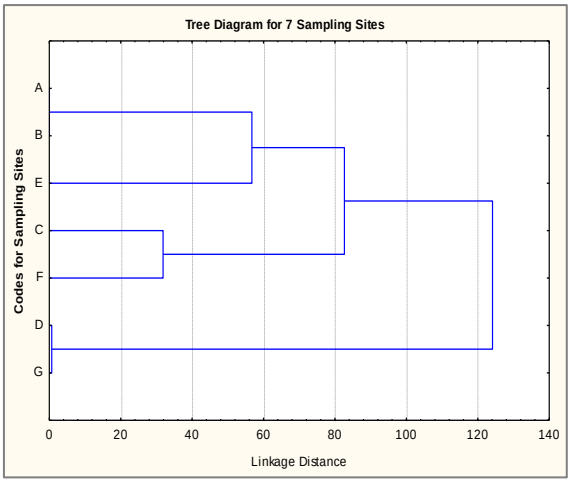


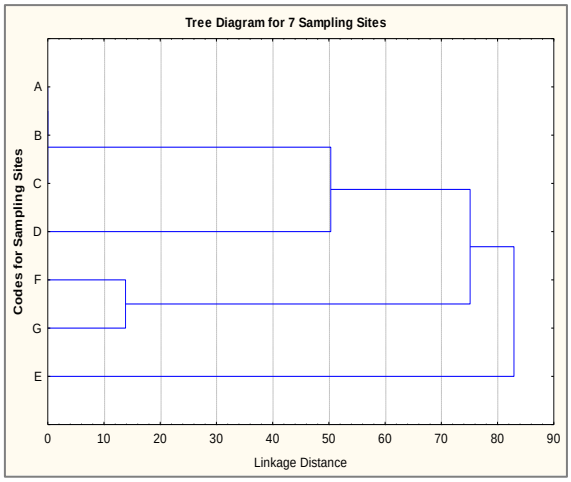
8th Monitoring, January, 2016



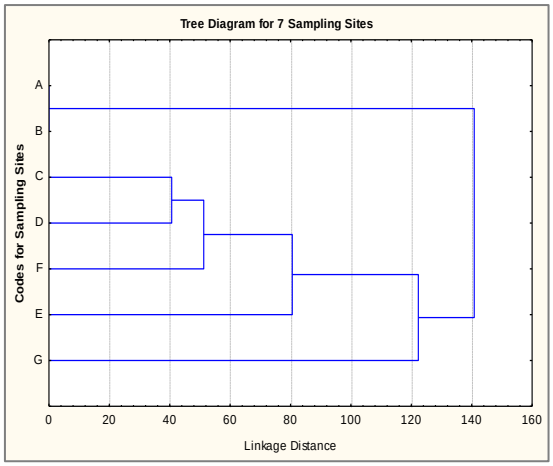




9th Monitoring, April, 2016



10th Monitoring, July, 2016



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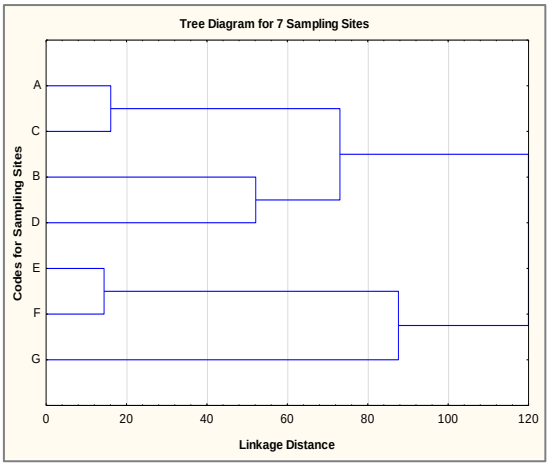
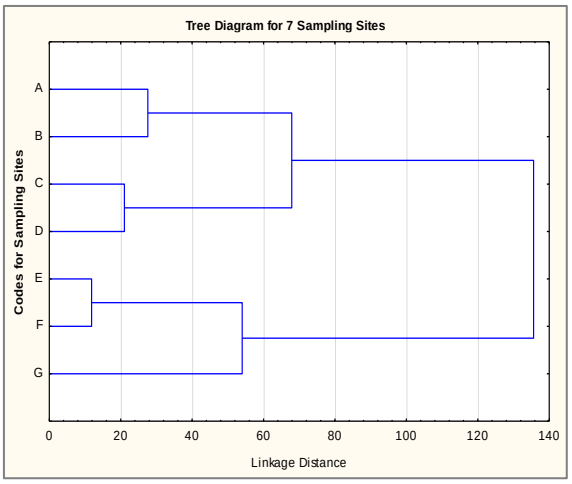
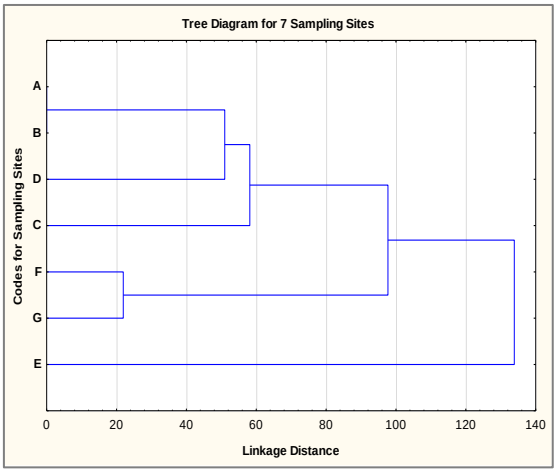


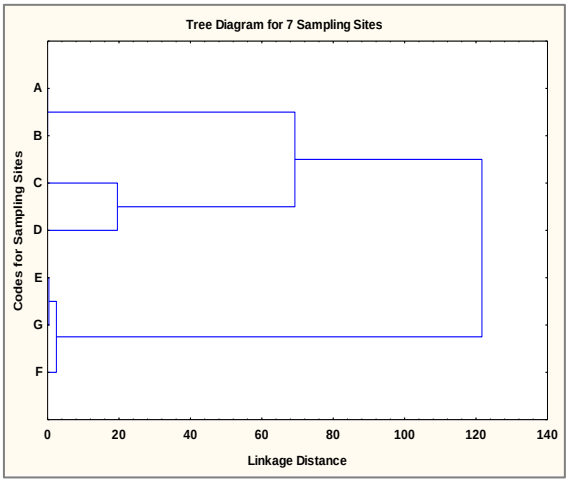
12th Monitoring, January, 2017



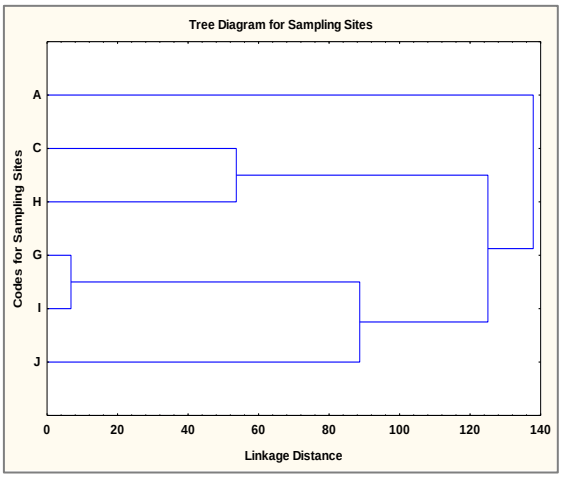
13th Monitoring, April, 2017



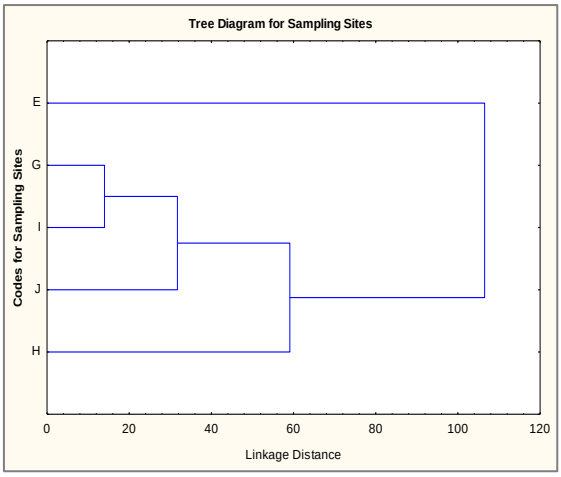
14th Monitoring, October, 2017



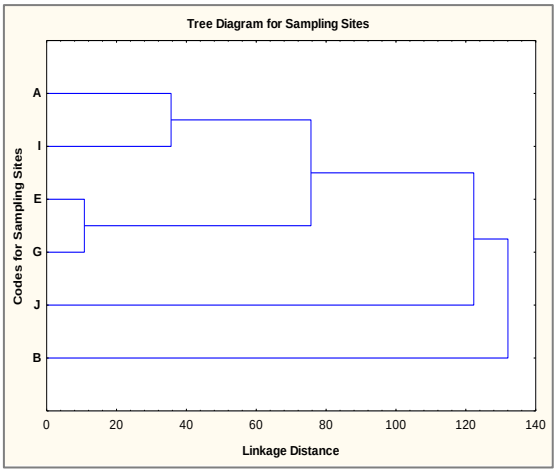
15th Monitoring, January, 2018



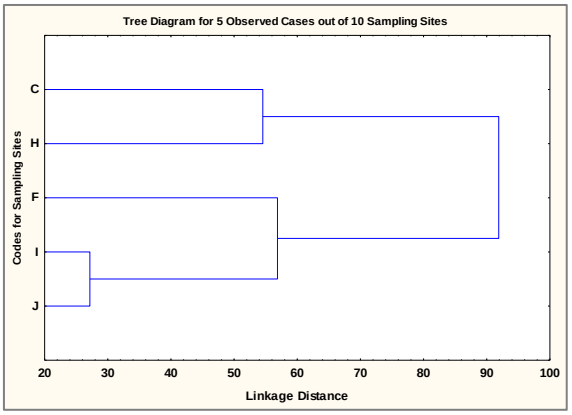
16th Monitoring, April, 2018



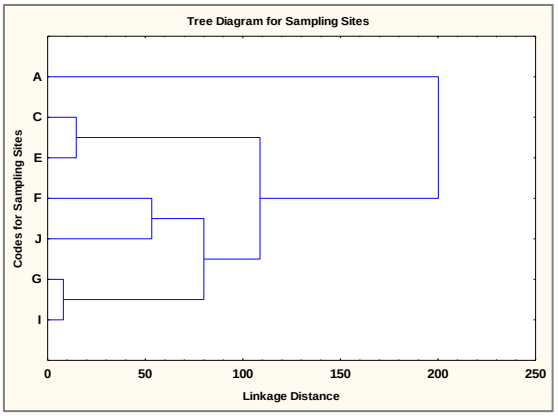
17th Monitoring, July, 2018



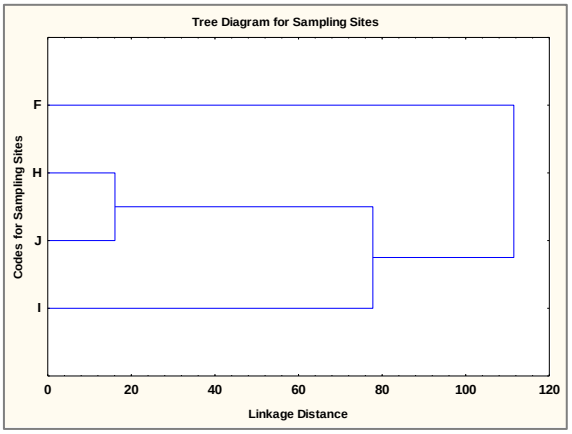
18th Monitoring, November, 2018



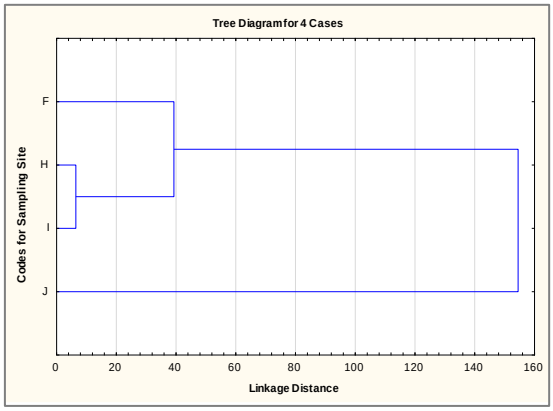
19th Monitoring, February, 2019



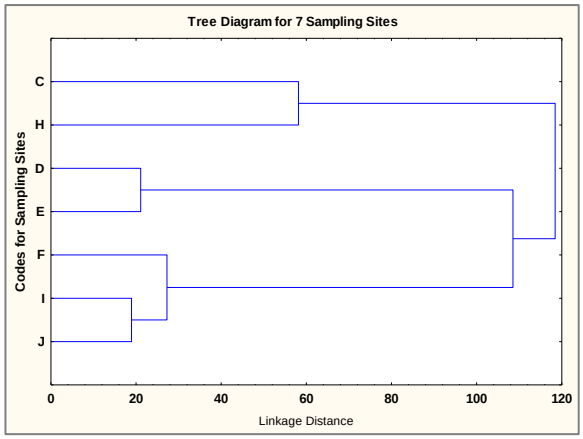
20th Monitoring, April, 2019



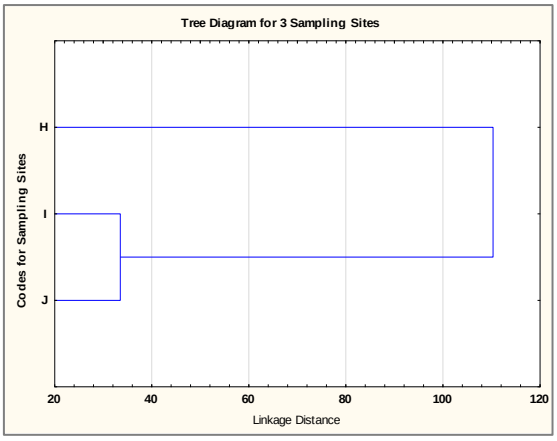
21st Monitoring, July 2019



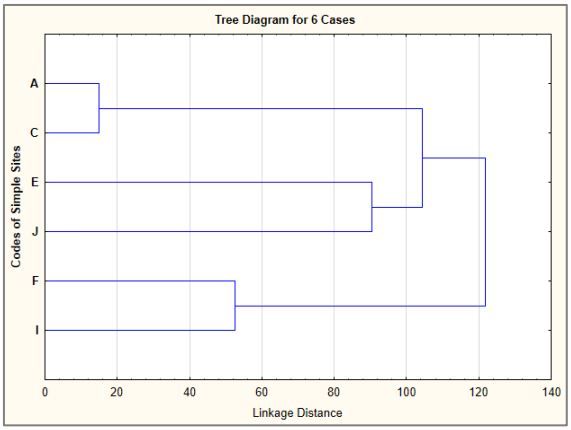
22nd Monitoring, November, 2019



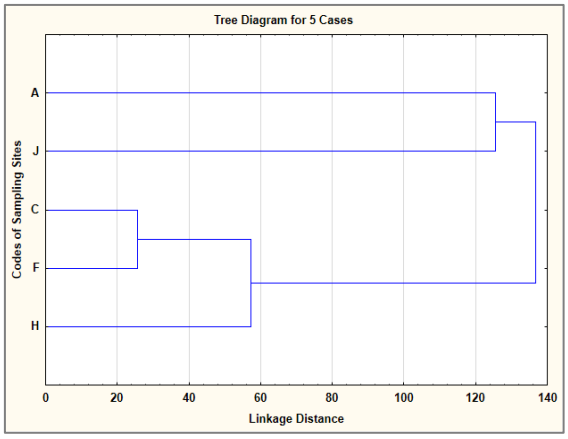
23rd Monitoring, February 2020



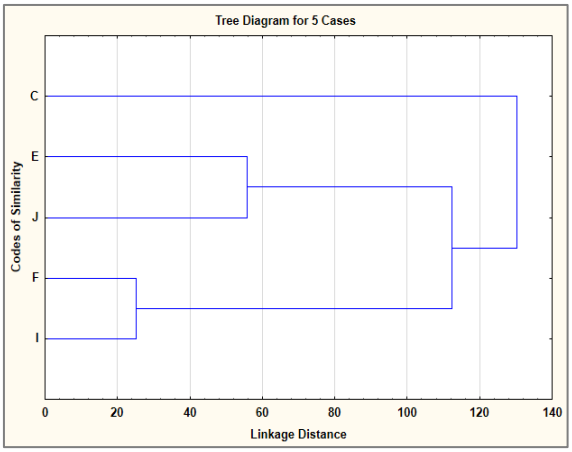
25th Monitoring, July 2020



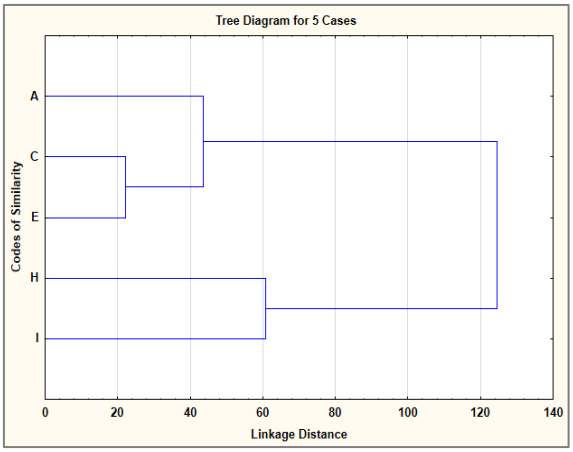
26th Monitoring, November 2020



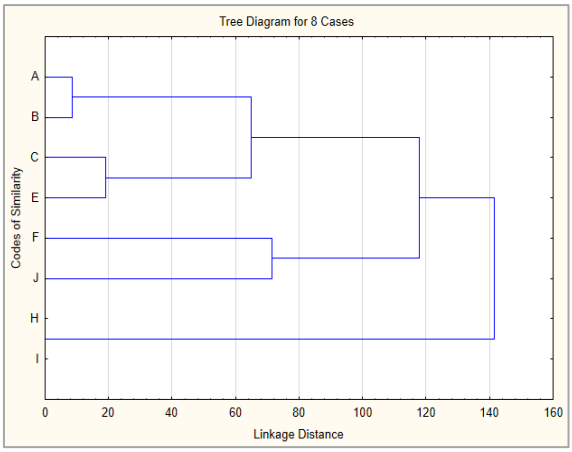
27th Monitoring, January 2021



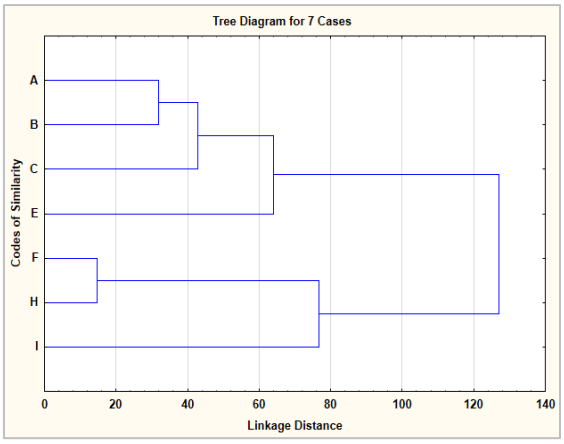
28th monitoring, April 2021



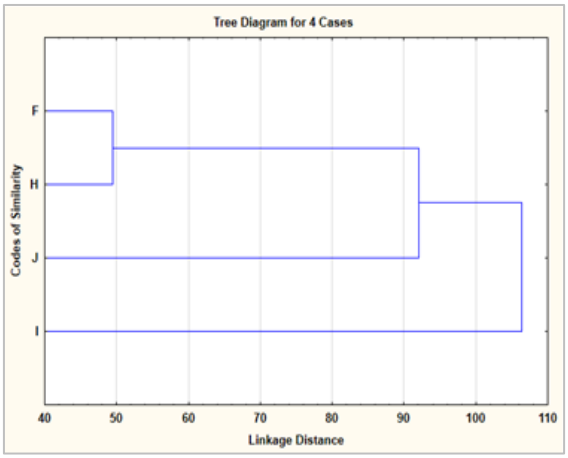
29th Monitoring, August 2021



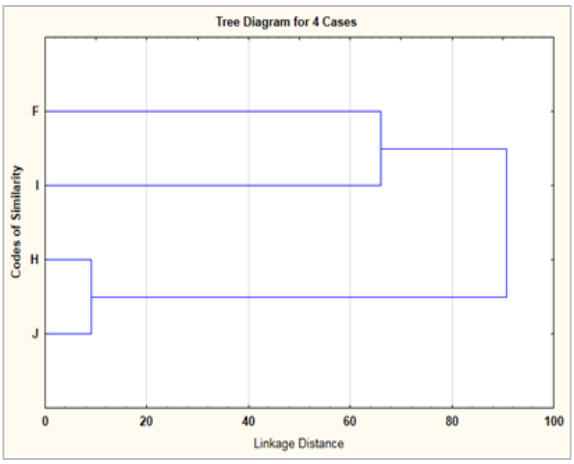
30th Monitoring, November 2021



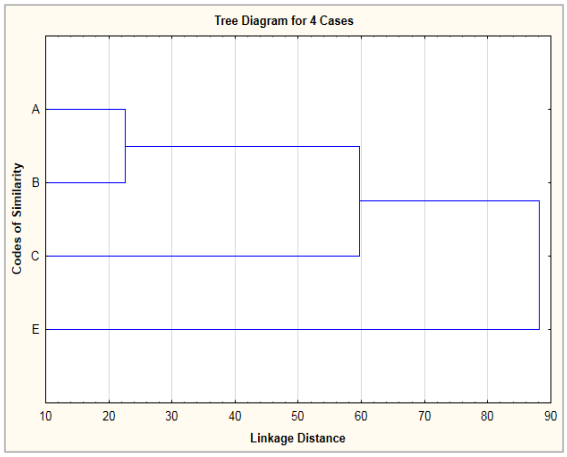
31st Monitoring, February, 2022



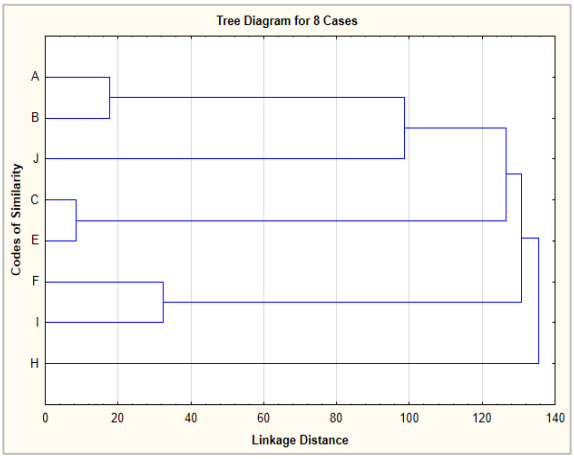
32nd Monitoring, May 2022



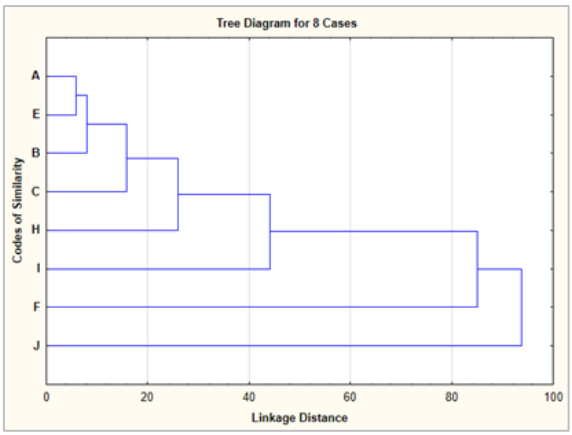
33rd Monitoring, July 2022



34th Monitoring, Oct 2022

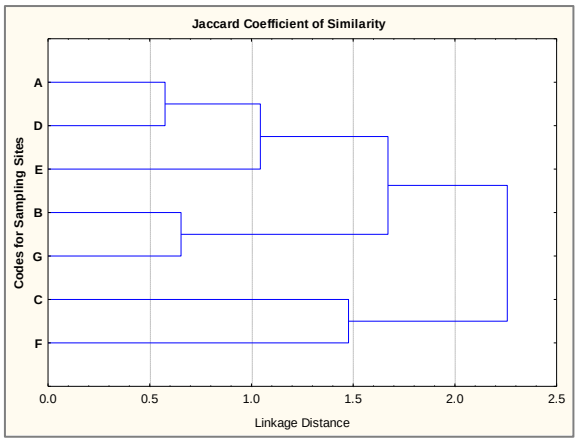


35th Monitoring Jan 2023

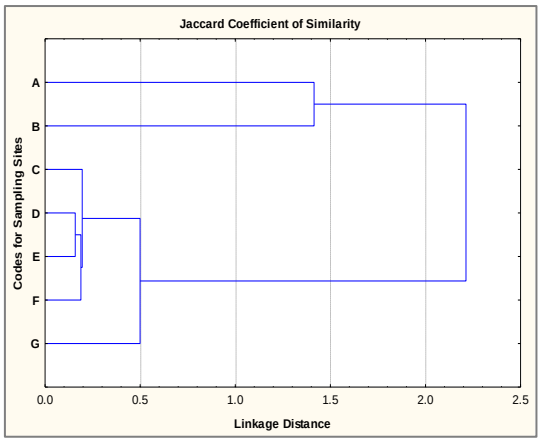


36th Monitoring, May 2023

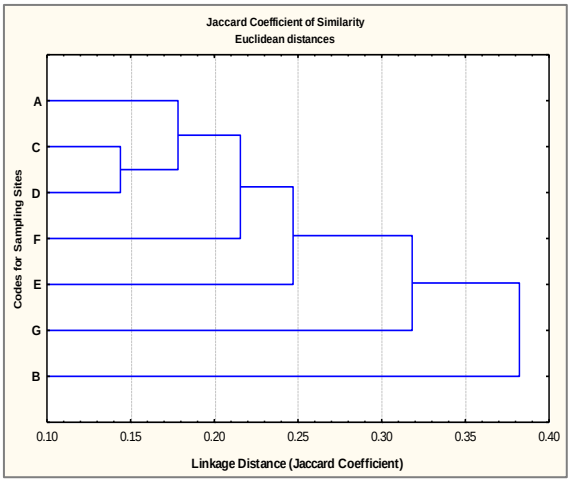
D2: Jaccard Co-efficient of Similarity of Habitats respecting fish species occurrence



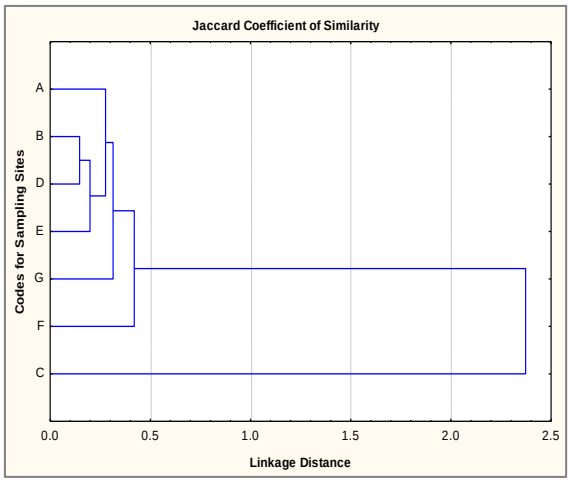
1st Monitoring, April, 2014



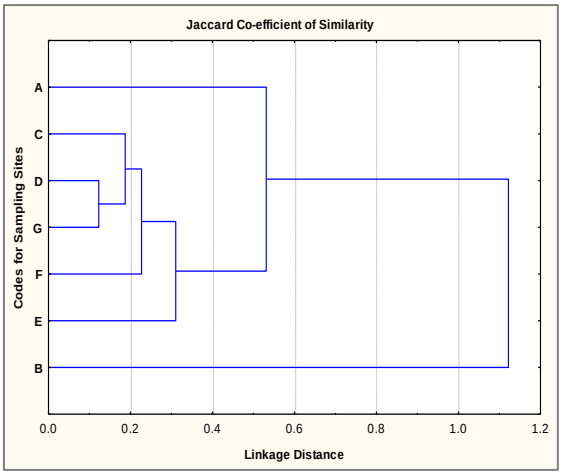
2nd Monitoring, July 2014



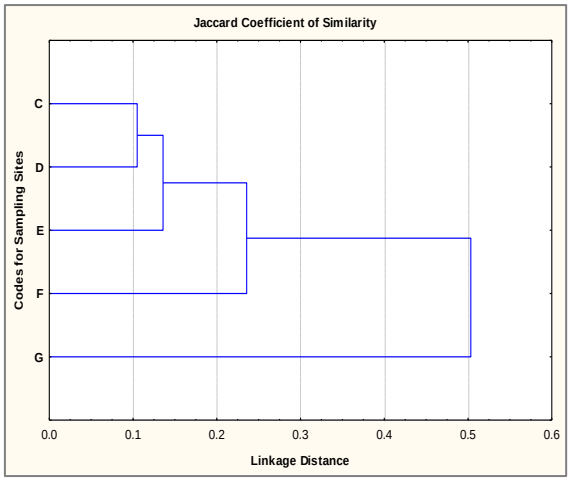
3rd Monitoring, October, 2014



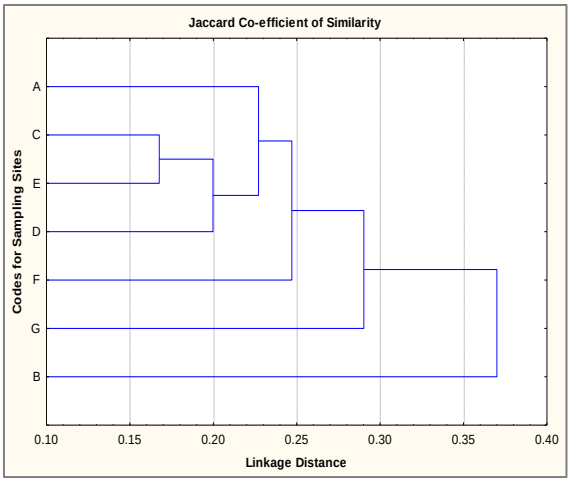
4th Monitoring, January 2015



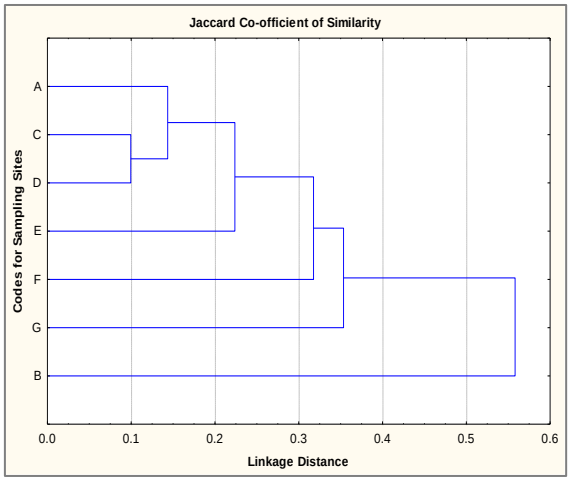
5th Monitoring, April, 2015



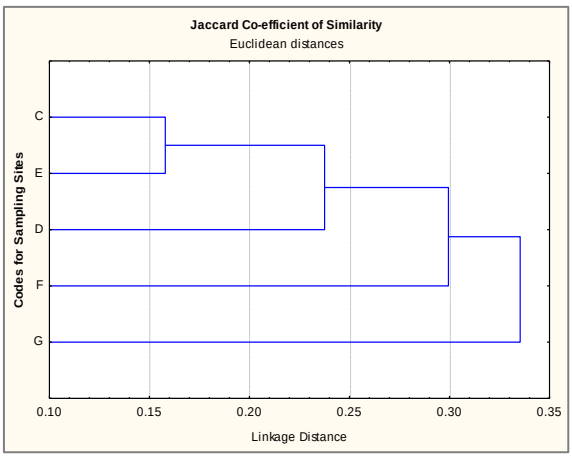
6th Monitoring, August, 2015



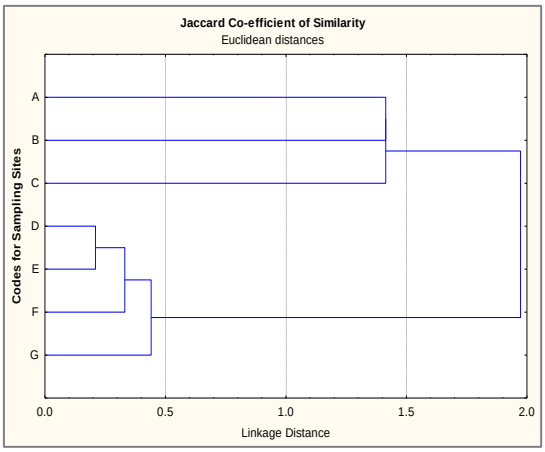
7th Monitoring, October, 2015



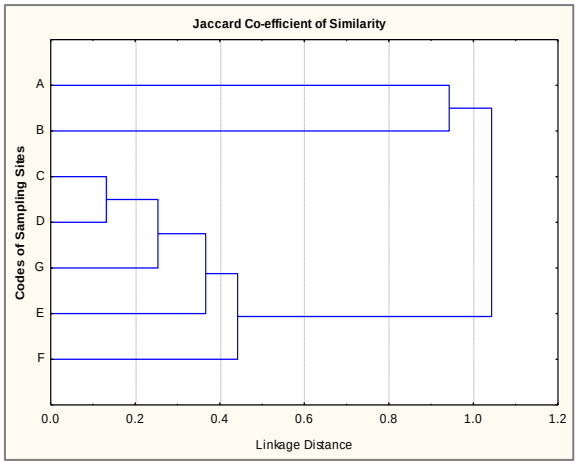
8th Monitoring, January, 2016



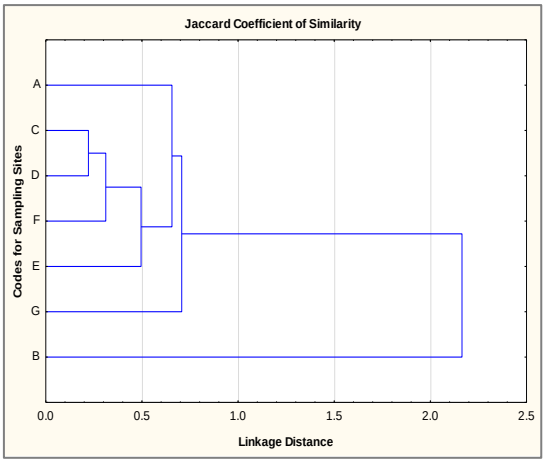
9th Monitoring, April, 2016



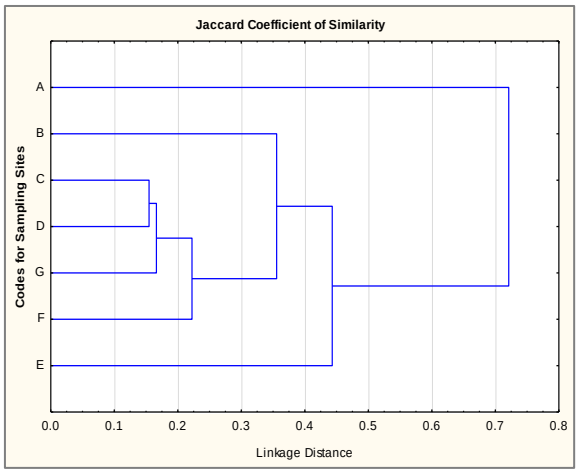
10th Monitoring, July, 2016



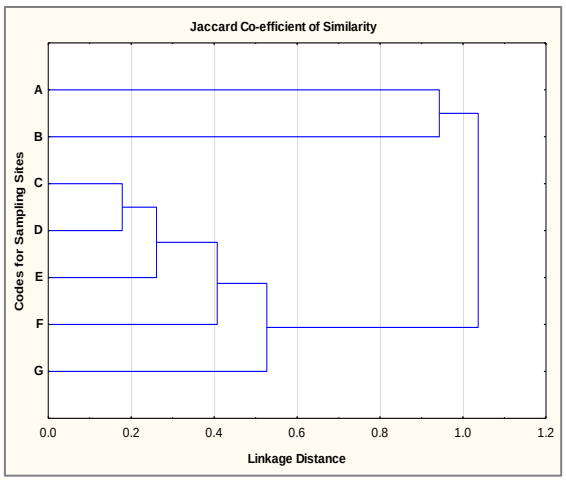
11th Monitoring, October, 2016



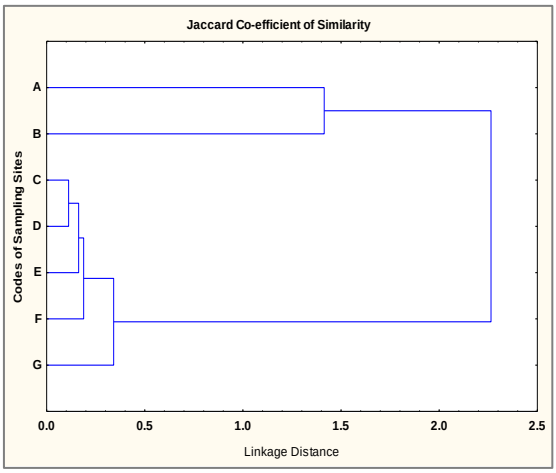
12th Monitoring, January, 2017



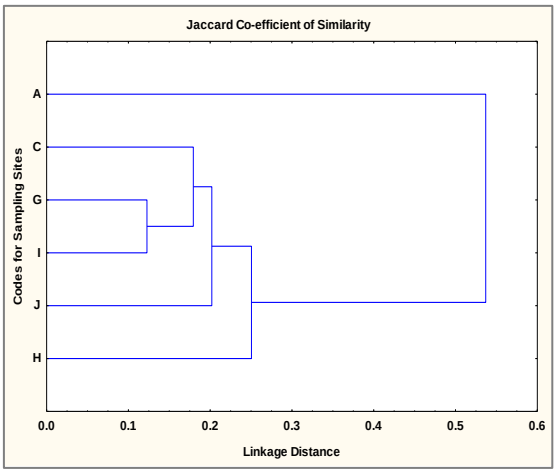
13th Monitoring, April, 2017



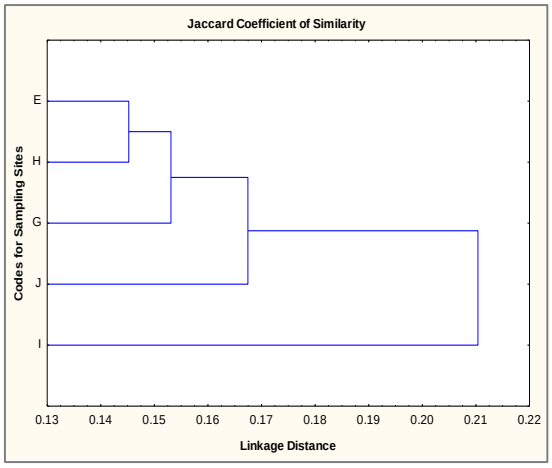
14th Monitoring, October, 2017



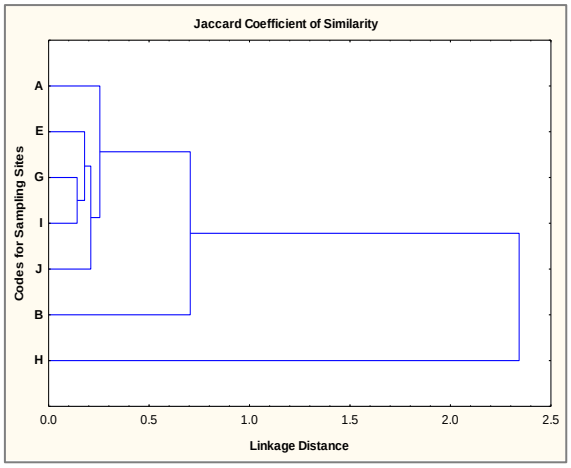
15th Monitoring, January, 2018



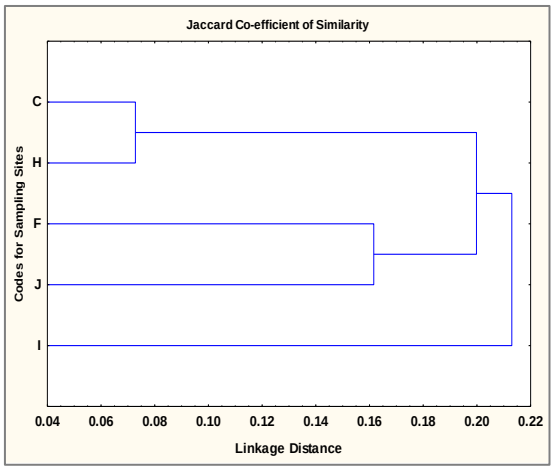
16th Monitoring, April, 2018



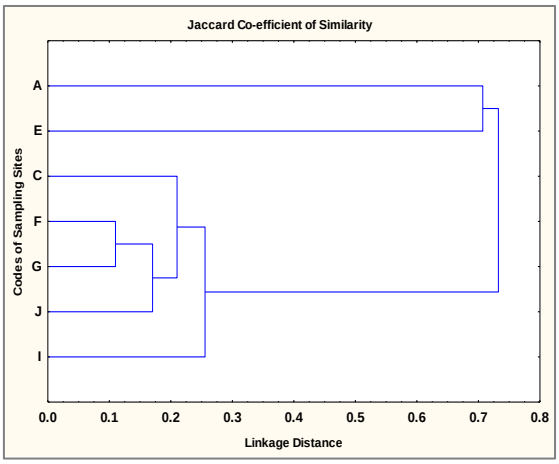
17th Monitoring, July, 2018



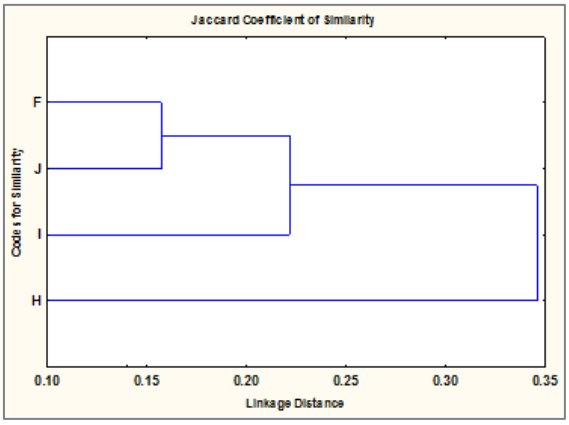
18th Monitoring, November, 2018



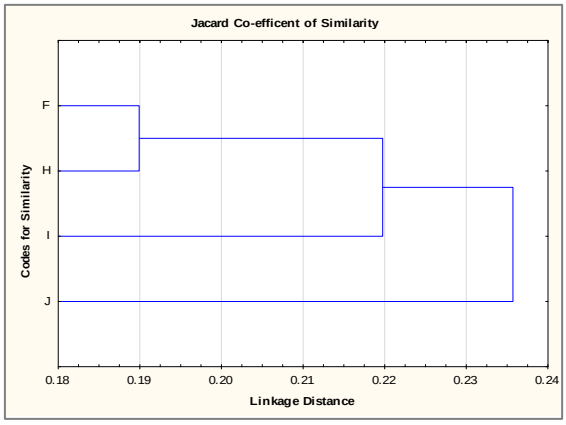
19th Monitoring, February, 2019



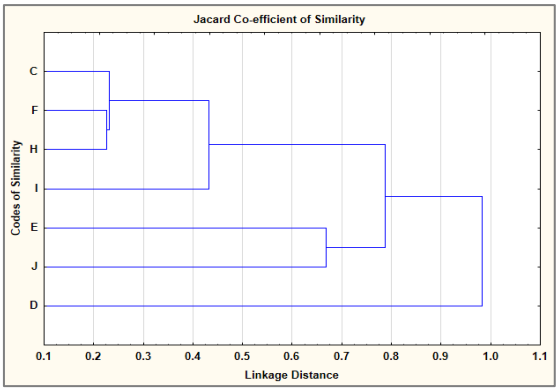
20th Monitoring, April, 2019



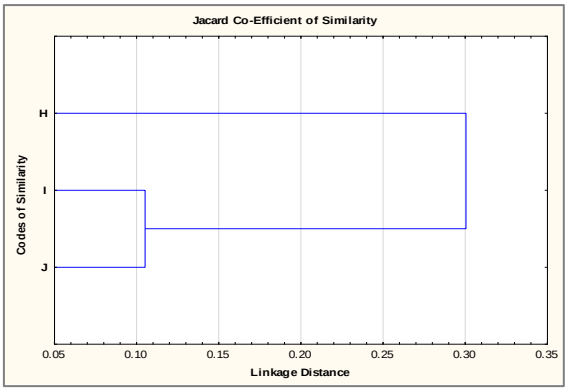
21st Monitoring, July 2019



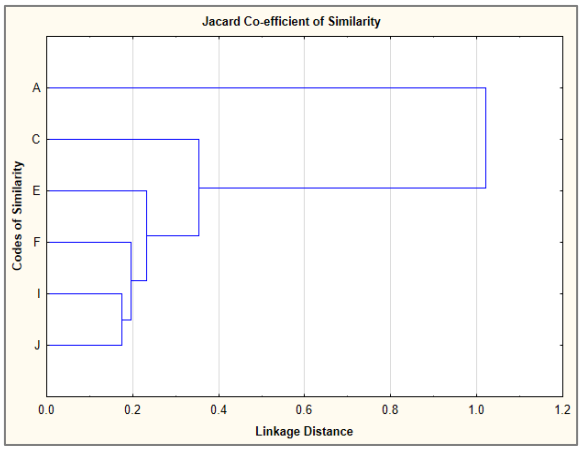
22nd Monitoring, November 2019



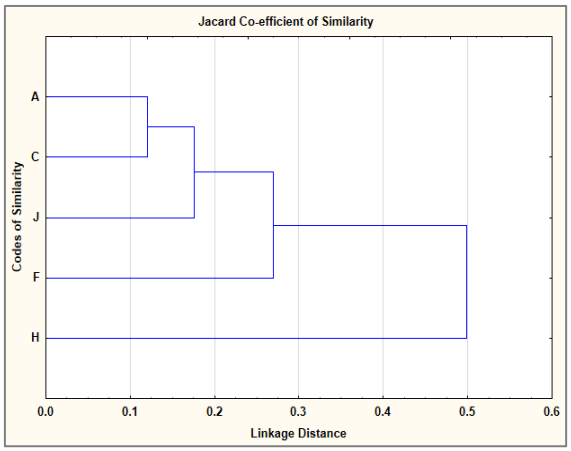
23rd Monitoring, February 2020



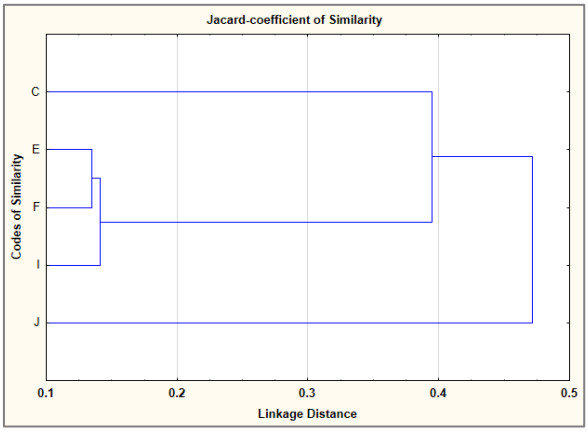
25th Monitoring, July 2020



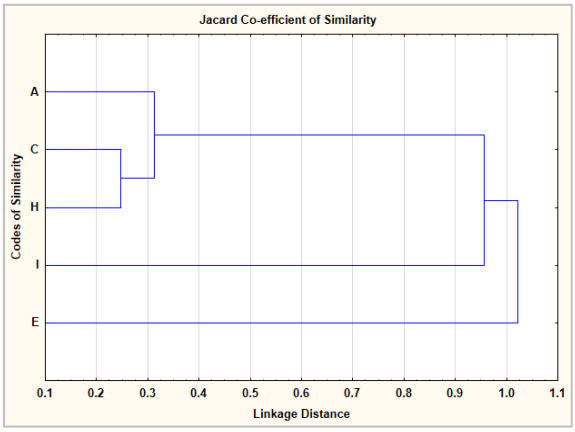
26th Monitoring, November, 2020



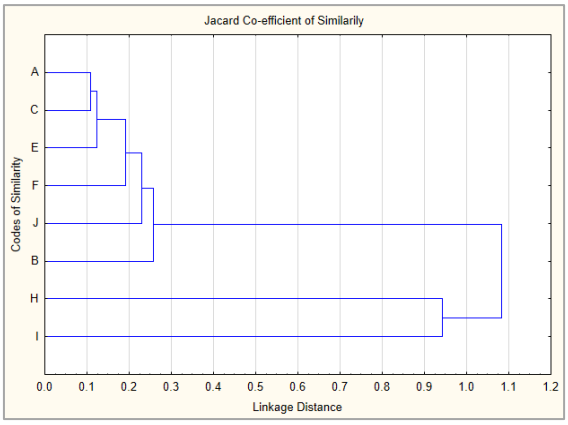
27th Monitoring, January, 2021



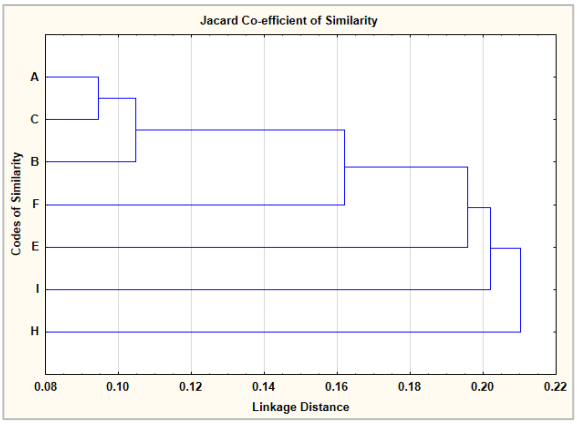
28th monitoring, April, 2021



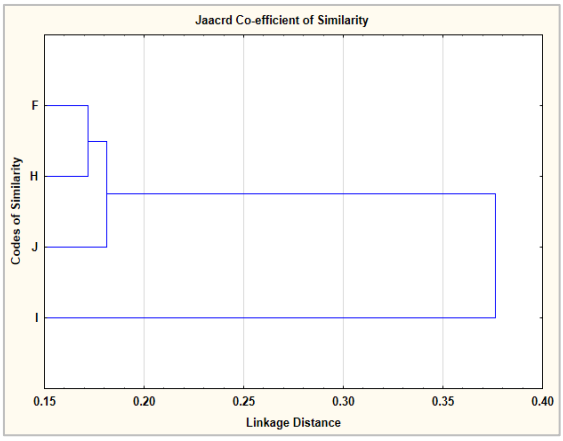
29th monitoring, August, 2021



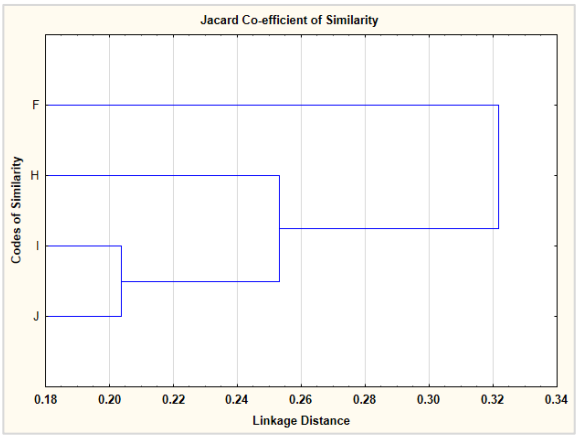
30th Monitoring, November 2021



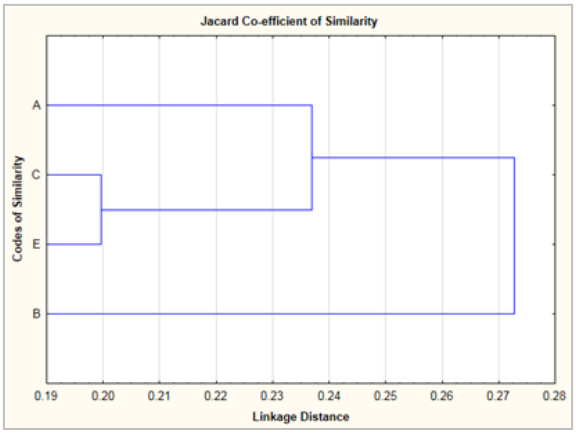
31st Monitoring, February, 2022



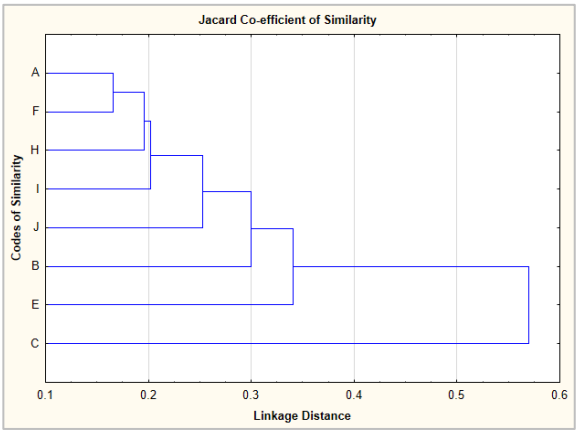
32nd Monitoring, May 2022



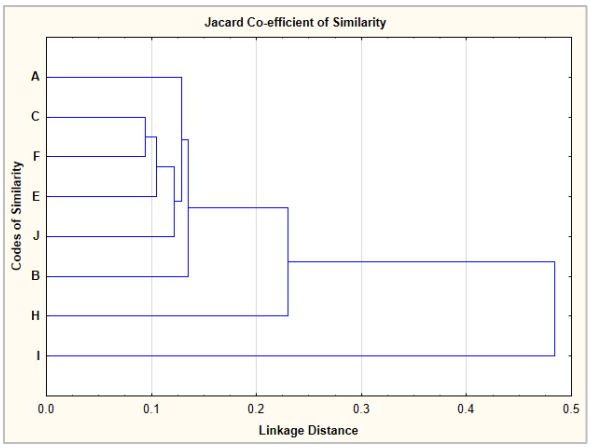
33rd Monitoring, July 2022



34th Monitoring, Oct 2022

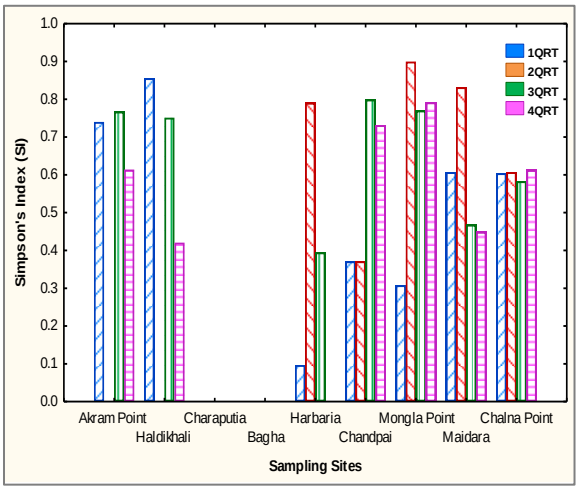


35th Monitoring, Feb 2023

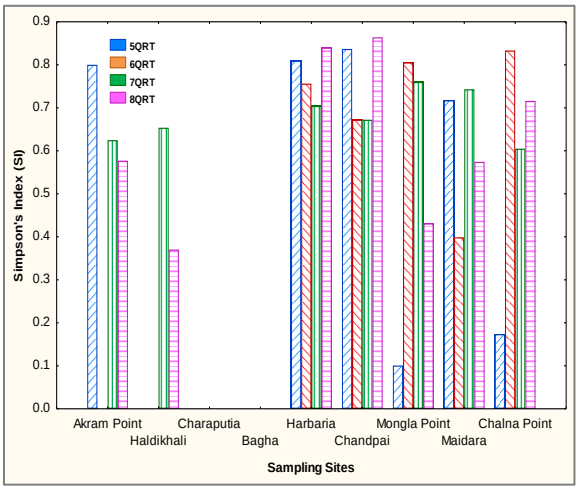


36th Monitoring, May 2023

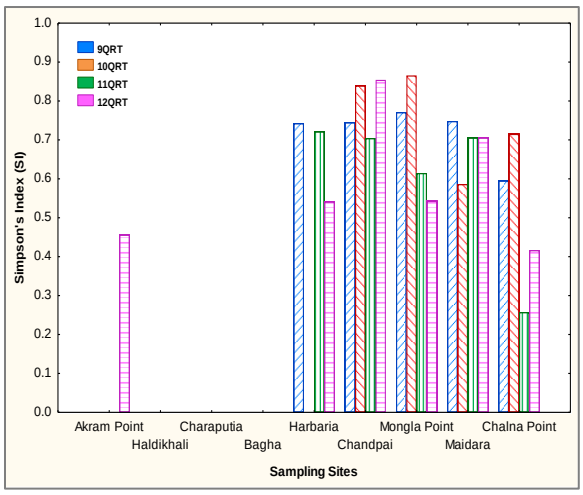
D.3: Site-wise fish species richness (FSR) in the Passur River System



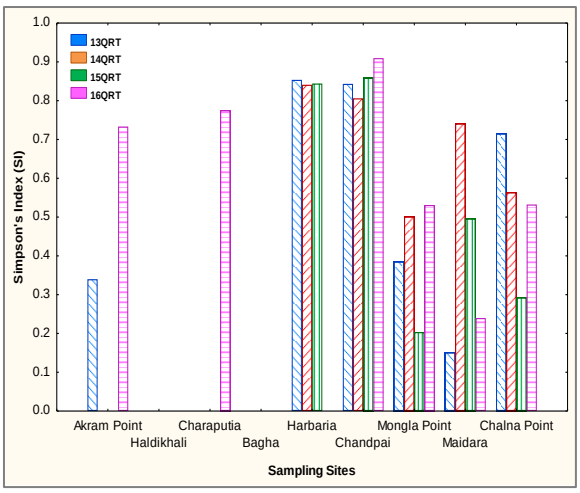
2014-2015



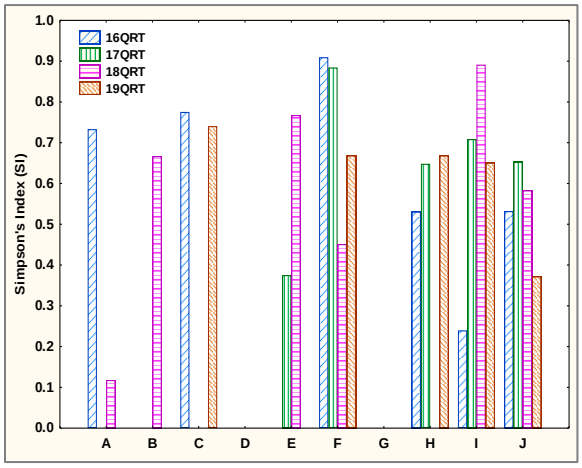
2015-2016



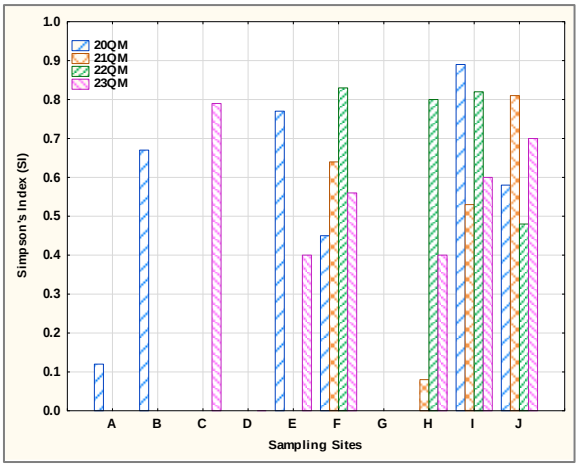
2016-2017



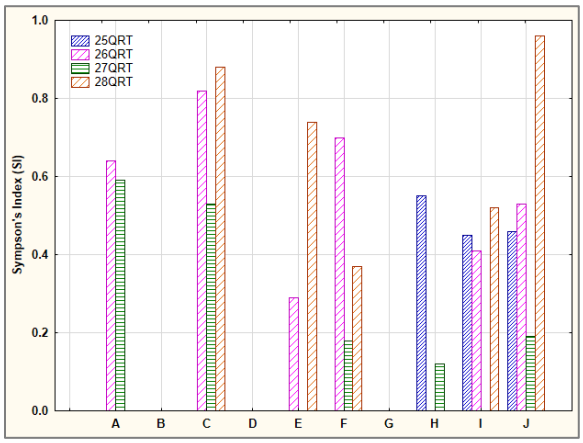
2017-18



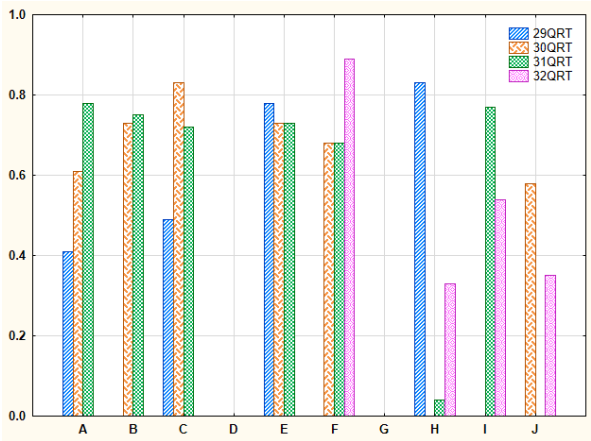
2018-19



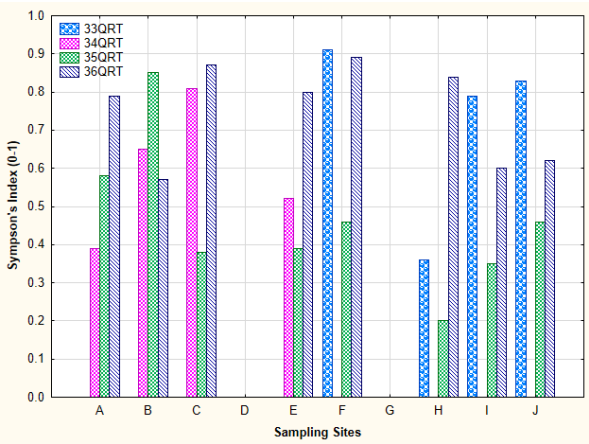
2019-20



2020-21

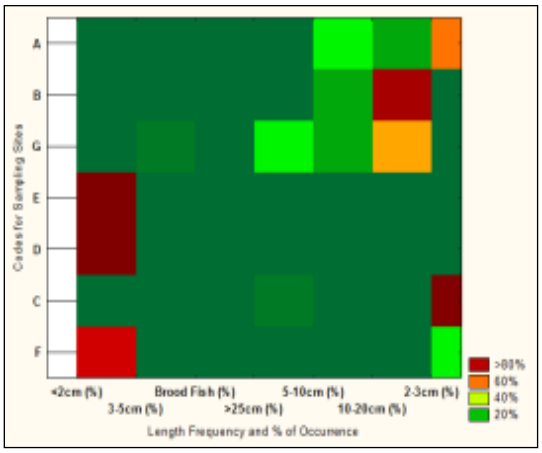


2021-2022

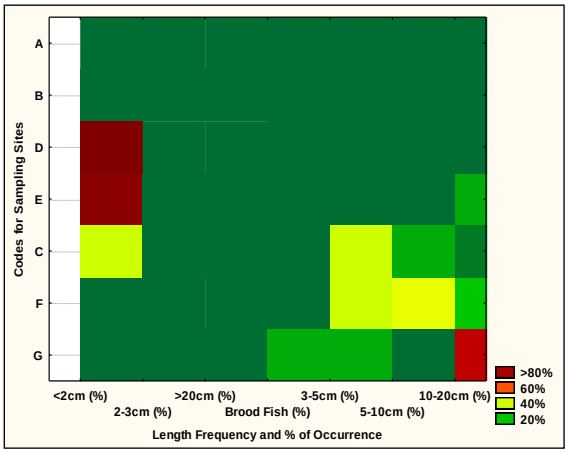


2022-23

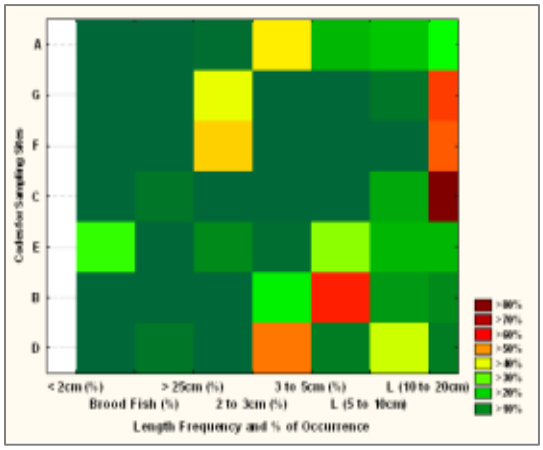
D4: Fish Community Structure



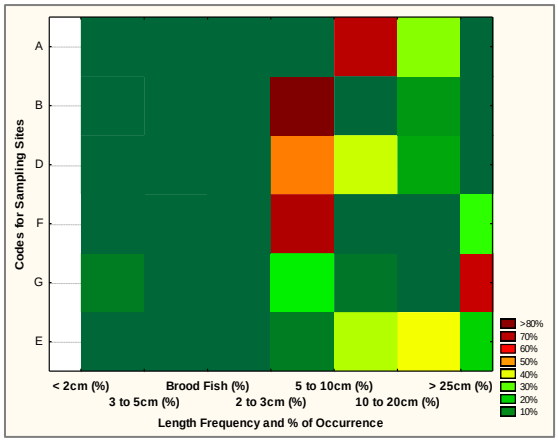
1st Monitoring, April, 2014



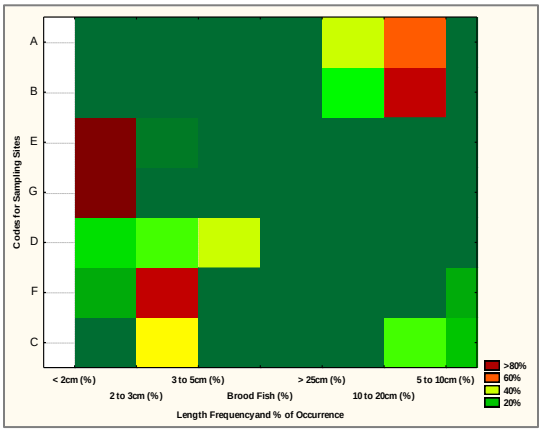
2nd Monitoring, July 2014



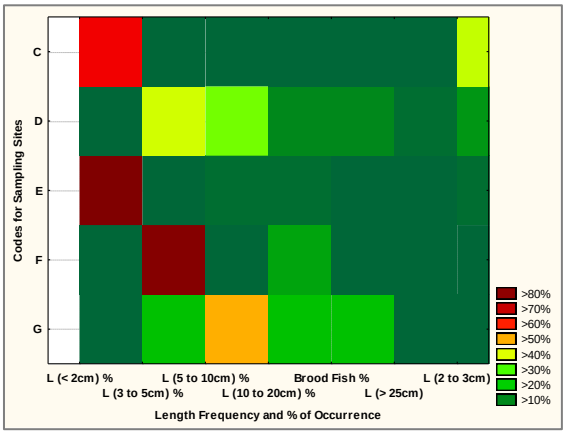
3rd Monitoring, October, 2014



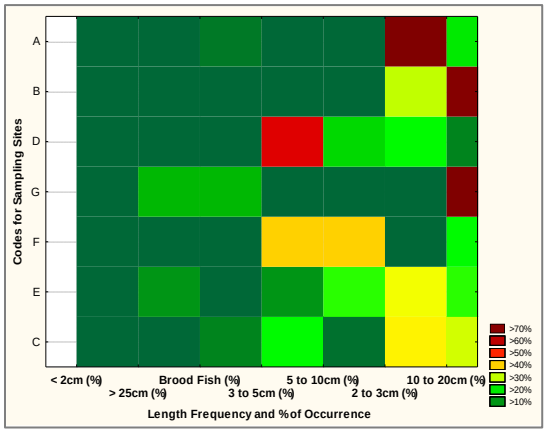
4th Monitoring, January 2015



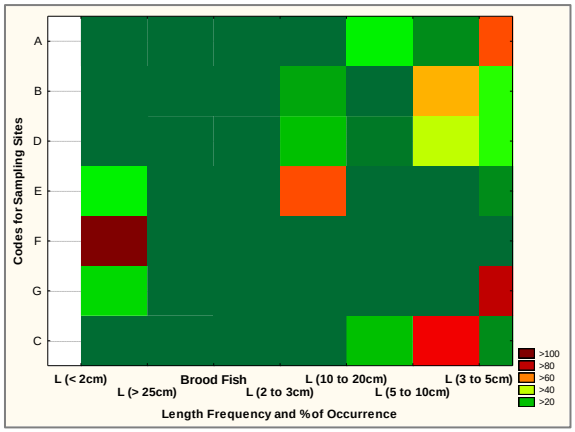
5th Monitoring, April, 2015



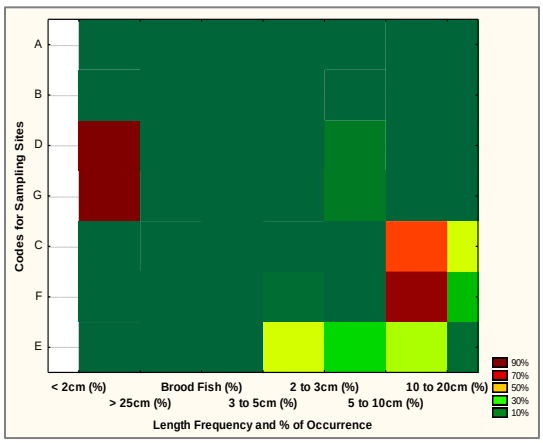
6th Monitoring, August, 2015



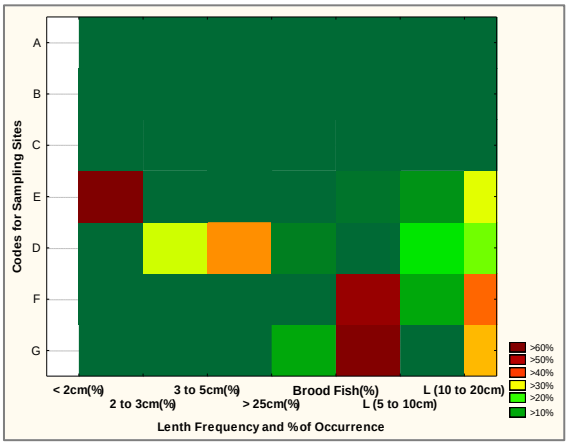
7th Monitoring, October, 2015



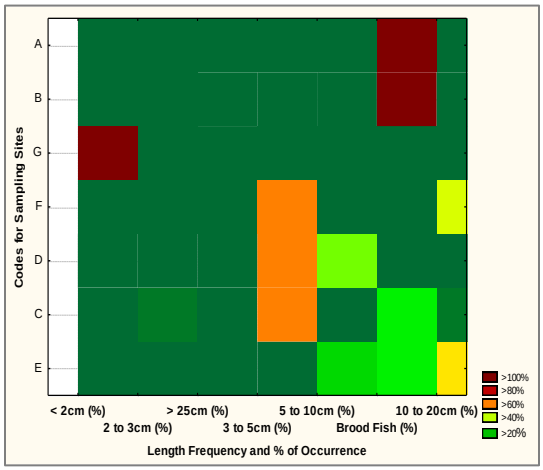
8th Monitoring, January, 2016



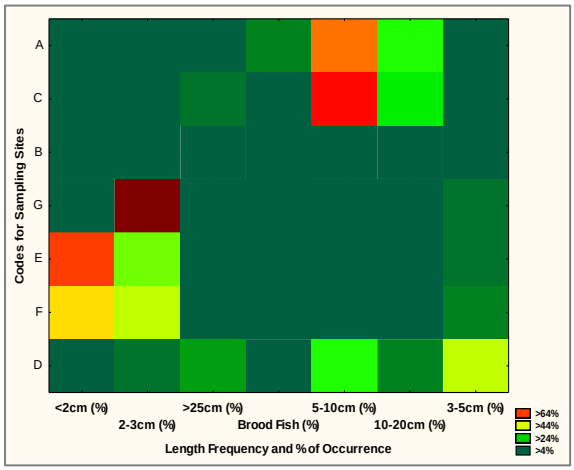
9th Monitoring, April, 2016



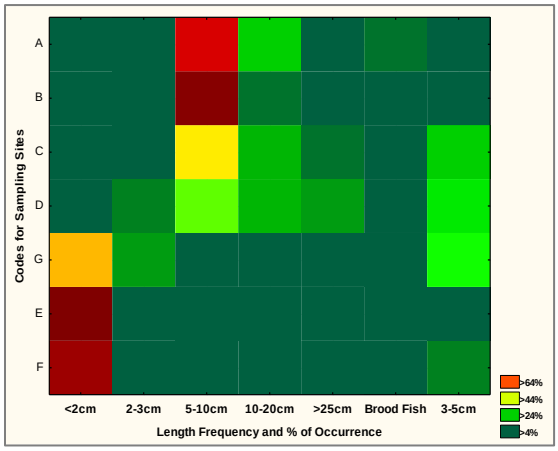
10th Monitoring, July, 2016



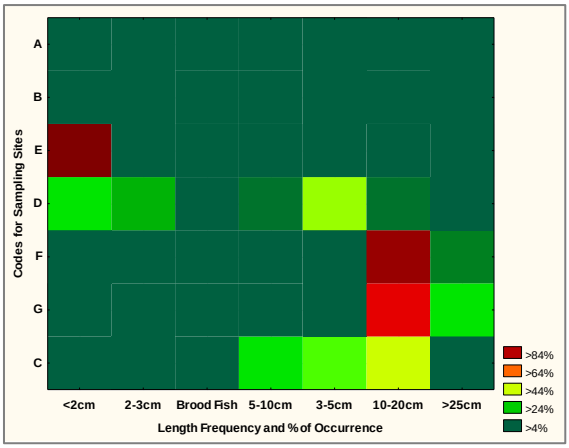
11th Monitoring, October, 2016



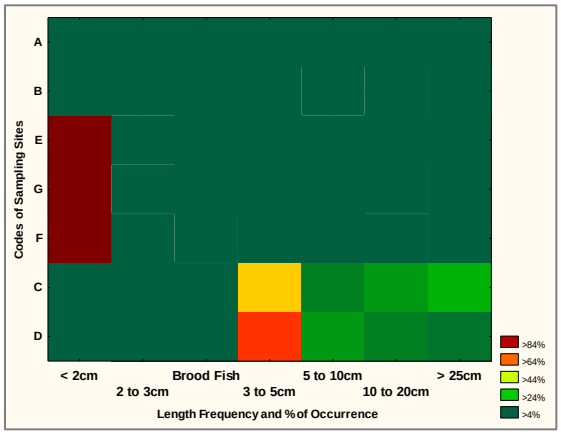
12th Monitoring, January, 2017



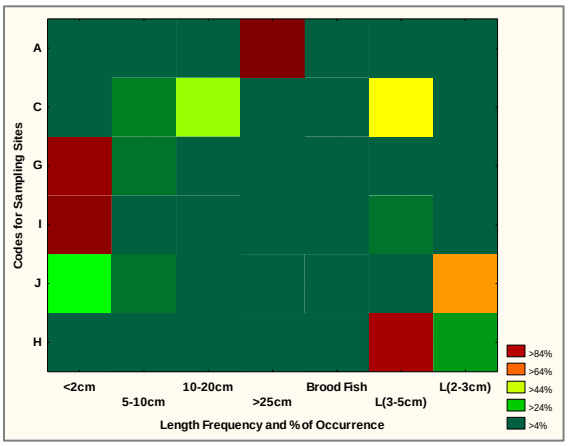
13th Monitoring, April, 2017



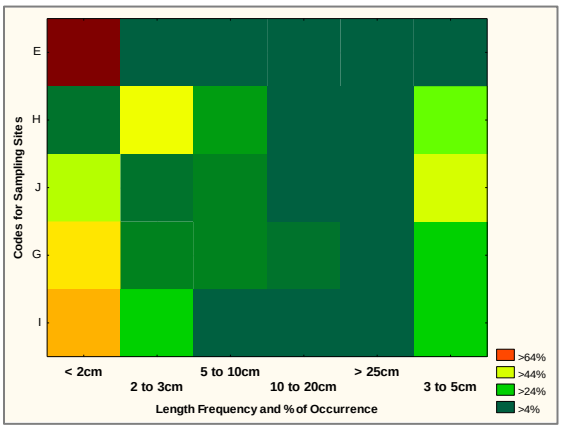
14th Monitoring, October, 2017



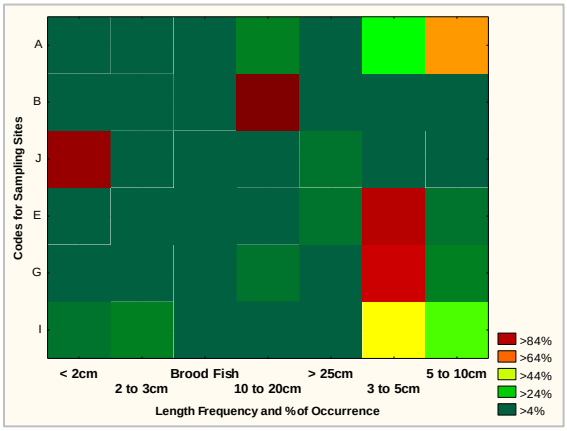
15th Monitoring, January, 2018



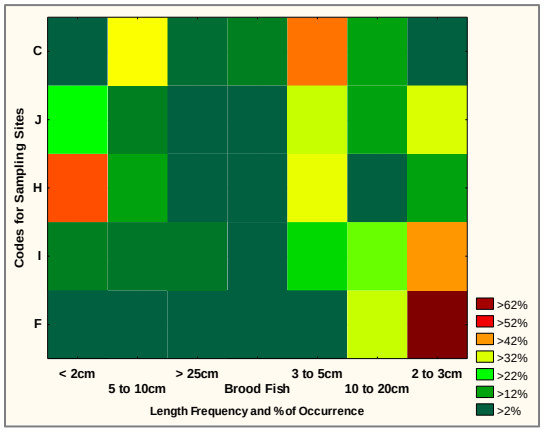
16th Monitoring, April, 2018



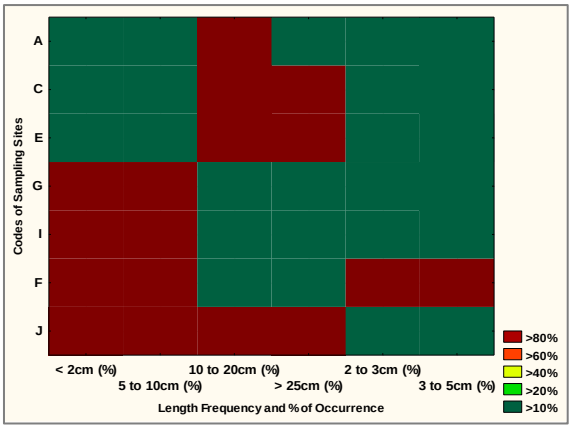
17th Monitoring, July, 2018



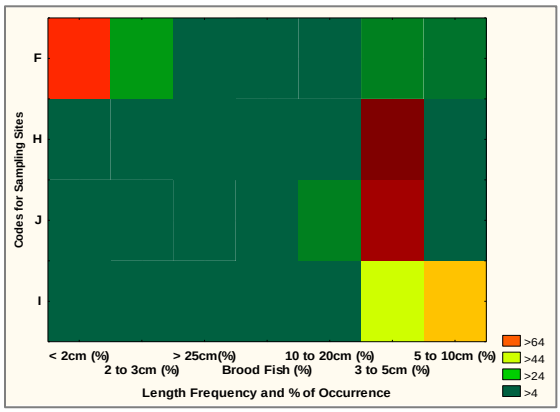
18th Monitoring, November, 2018



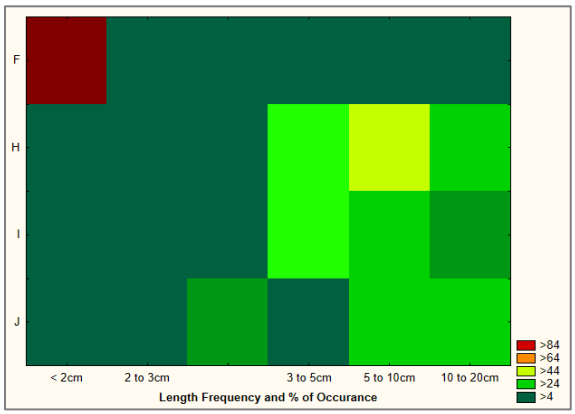
19th Monitoring, February, 2019



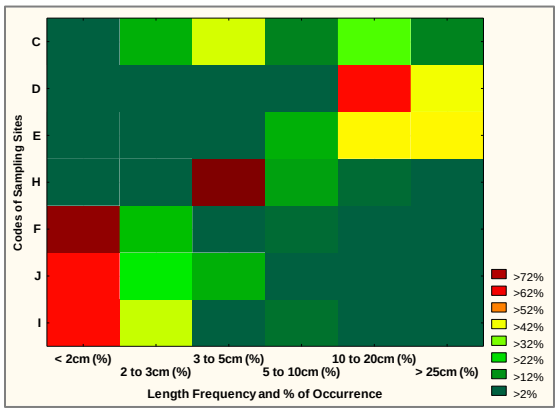
20th Monitoring, April, 2019



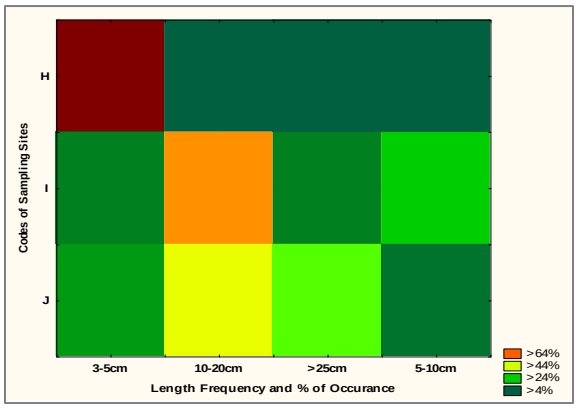
21st Monitoring, July 2019



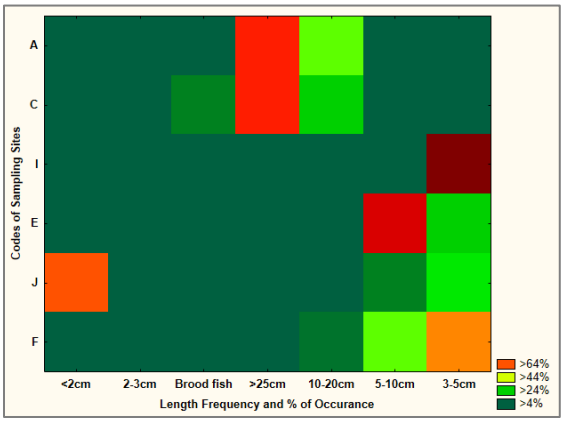
22nd Monitoring, November 2019



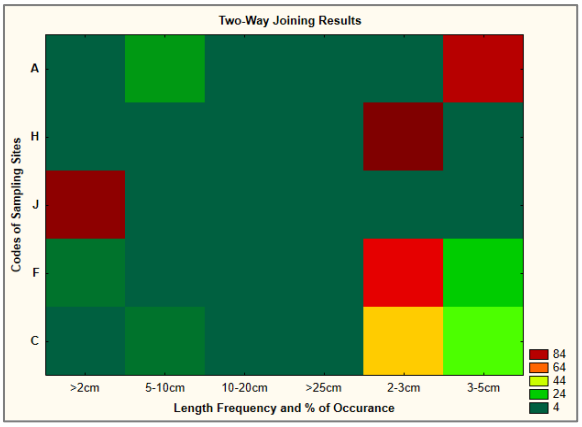
23rd Monitoring, February 2020



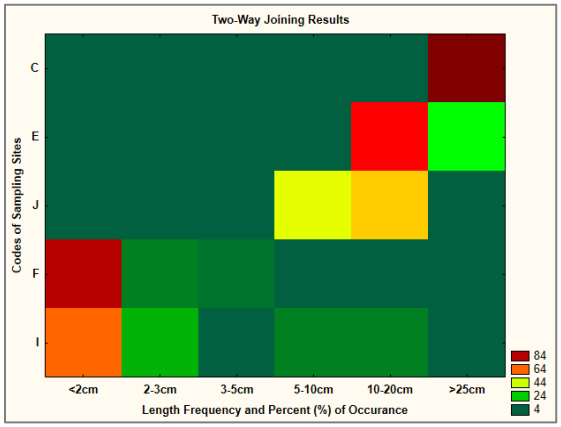
25th Monitoring, July 2020



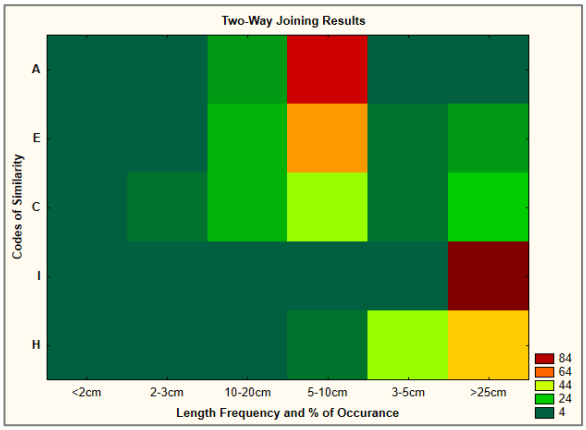
26th Monitoring, November 2021



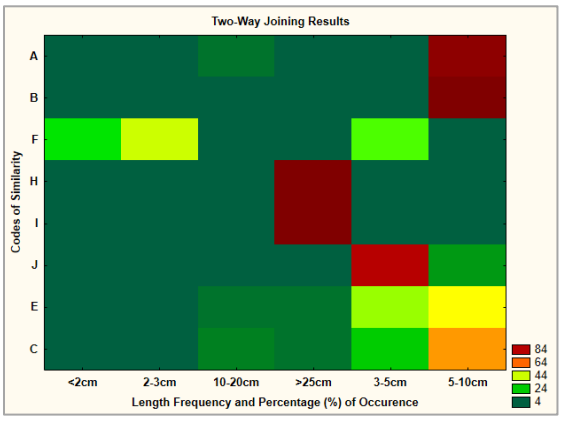
27th Monitoring, January, 2021



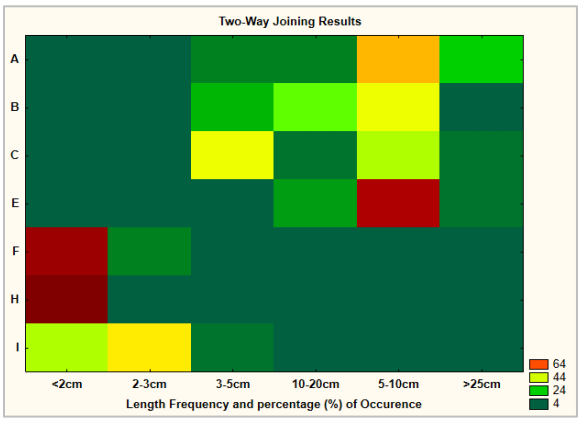
28th monitoring, April, 2021



29th monitoring, August, 2021

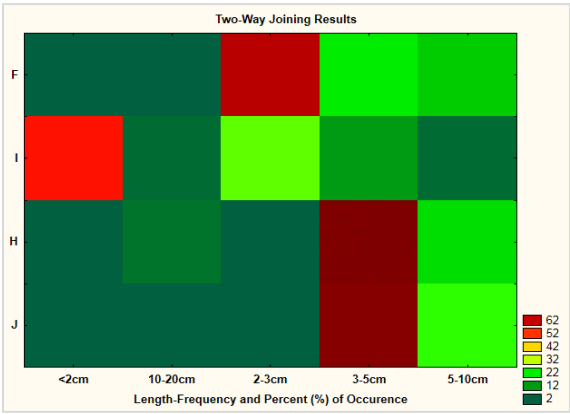


30th Monitoring, November, 2021

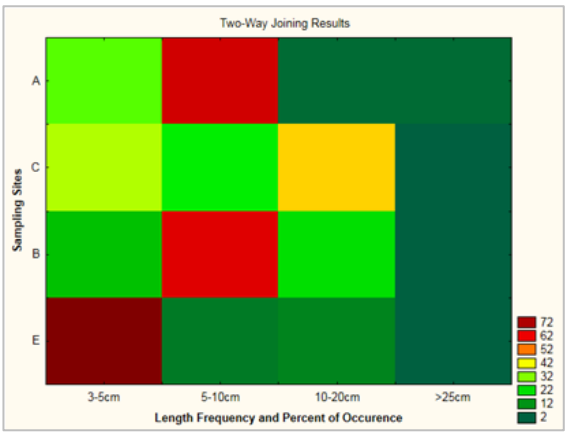


31st Monitoring, February, 2022

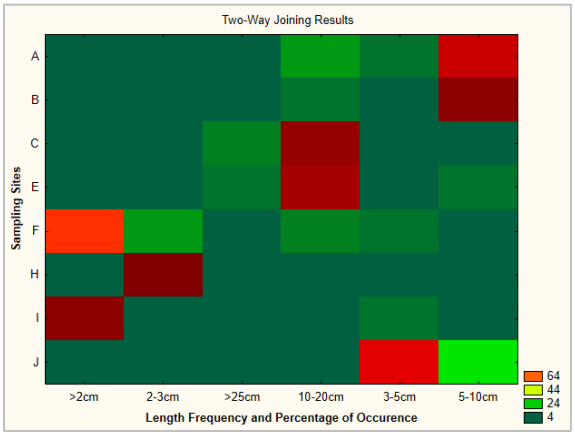
32nd Monitoring, May 2022



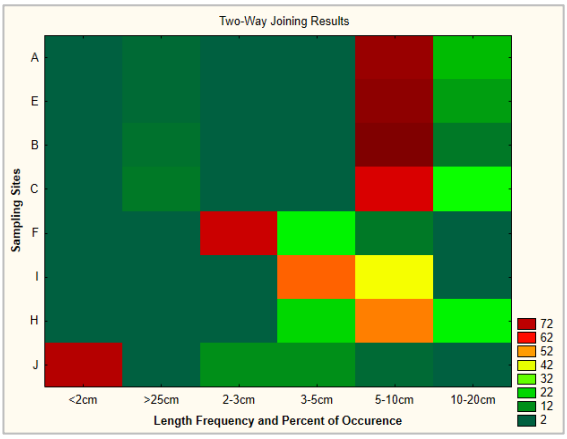
33rd Monitoring, July 2022



34th Monitoring, Oct 2022



35th Monitoring, Feb 2023



36th Monitoring, May 2023

D.5: 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	+	+	-	+	+	+	+	+	+	+	+	+
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	+	+	+	+	+	+	+	+	+	+	+	+

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											
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	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th 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	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th 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.6: 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)
Ayre	I	0.00	0.00	0.00	0.00	0.00	100.00
Baila	F	0.00	0.00	0.00	25.00	75.00	0.00
	I	0.00	0.00	0.00	0.00	100.00	0.00
Banspata	I	0.00	0.00	0.00	0.00	0.00	100.00
	J	0.00	0.00	0.00	0.00	0.00	100.00
Bata	J	100.00	0.00	0.00	0.00	0.00	0.00
Borguni	F	0.00	0.00	0.00	100.00	0.00	0.00
Chali	I	0.00	0.00	100.00	0.00	0.00	0.00
Chamua	E	0.00	0.00	100.00	0.00	0.00	0.00
	F	0.00	0.00	65.96	34.04	0.00	0.00
Chapila	F	0.00	100.00	0.00	0.00	0.00	0.00
	I	0.00	0.00	100.00	0.00	0.00	0.00
Chela	E	0.00	0.00	0.00	100.00	0.00	0.00
	F	0.00	0.00	50.00	50.00	0.00	0.00
Chota Baila	I	0.00	0.00	0.00	0.00	0.00	100.00
	J	0.00	0.00	0.00	0.00	100.00	0.00
Datina	A	0.00	0.00	0.00	0.00	16.67	83.33
	C	0.00	0.00	0.00	0.00	100.00	0.00
	I	0.00	0.00	0.00	0.00	100.00	0.00
Dogra	F	0.00	0.00	0.00	100.00	0.00	0.00
	I	0.00	0.00	100.00	0.00	0.00	0.00
Gagla	A	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)
	C	0.00	0.00	0.00	0.00	30.00	70.00
	E	0.00	0.00	0.00	0.00	100.00	0.00
	F	0.00	0.00	0.00	0.00	100.00	0.00
Goda Icha	F	0.00	0.00	0.00	100.00	0.00	0.00
	I	0.00	0.00	100.00	0.00	0.00	0.00
Golda	A	0.00	0.00	0.00	0.00	50.00	50.00
	C	0.00	0.00	0.00	0.00	70.59	29.41
	E	0.00	0.00	0.00	0.00	37.50	62.50
	I	0.00	0.00	0.00	0.00	0.00	100.00
Harina	E	0.00	0.00	100.00	0.00	0.00	0.00
	F	0.00	0.00	0.00	100.00	0.00	0.00
Kain Magur	A	0.00	0.00	0.00	0.00	0.00	100.00
	C	0.00	0.00	0.00	0.00	0.00	88.89
Kakila	J	0.00	0.00	0.00	100.00	0.00	0.00
Kathali Chingri	E	0.00	0.00	0.00	100.00	0.00	0.00
Kechki	J	0.00	0.00	100.00	0.00	0.00	0.00
Khalisa	I	0.00	100.00	0.00	0.00	0.00	0.00
Khorulla	I	0.00	0.00	0.00	66.67	33.33	0.00
	J	100.00	0.00	0.00	0.00	0.00	0.00
Kuste Bola	A	0.00	0.00	0.00	0.00	0.00	100.00
Motka	F	0.00	0.00	0.00	100.00	0.00	0.00
	I	0.00	0.00	100.00	0.00	0.00	0.00
Mutkura	E	0.00	0.00	0.00	100.00	0.00	0.00
Parse	E	0.00	0.00	0.00	100.00	0.00	0.00
	F	0.00	0.00	0.00	87.50	12.50	0.00
	I	0.00	0.00	0.00	100.00	0.00	0.00
Pheksa	J	0.00	0.00	0.00	0.00	100.00	0.00
Poa	A	0.00	0.00	0.00	0.00	100.00	0.00
	C	0.00	0.00	0.00	0.00	100.00	0.00
	I	0.00	0.00	0.00	0.00	0.00	100.00
	J	0.00	0.00	0.00	0.00	84.96	15.04
Ramchos	F	0.00	0.00	0.00	0.00	100.00	0.00
	J	0.00	0.00	0.00	0.00	100.00	0.00
Silong	I	0.00	0.00	0.00	0.00	100.00	0.00
Tairel	E	0.00	0.00	0.00	100.00	0.00	0.00
Topse	J	0.00	0.00	0.00	0.00	0.00	100.00
Tulardandi	J	0.00	0.00	0.00	0.00	90.00	10.00
Vetki	A	0.00	0.00	0.00	0.00	0.00	100.00

Source: CEGIS Field Survey;2014 up to 2023

D.7: 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	-	-	-		-	-
		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	-	-	-	-	-	-	-		-	-

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
	South-west of the Project	Age-1 adult	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
Loitta	Haldikhali	Juvenile and Age-1 adult	Feeding and Growing	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Akram Point	Juvenile	Feeding and Growing	-	-	-	Feeding and Growing	-	-	-	-		-	-
	Akram Point	Age-1 adult	-	-	Feeding and Growing	-	Feeding and Growing	-	-	-	-		-	-
	Chandpai	Juvenile	Feeding and Growing	-	-	-	-	-	-	-	-		-	-
	Harbaria	Fry, Juvenile and Age-1 adult	-	Nursing, Feeding and Growing	-	-	-	-	-	-	-		-	-
	Chalna Point	Age-1 adult	-	Feeding and Growing	-	-	Feeding and Growing	-	-	-	-		-	-
		Fry	-	-	-	-	-	-	-	-	Nursing		-	-
Poma	Haldikhali	Juvenile	Feeding and Growing	-	-	Feeding	-	-	-		-		-	-
	Akram Point	Juvenile	Feeding and Growing	-	-	-	-	-	-	Growing and Feeding	-		-	-
		Age-1 adult	-	-	Feeding and Growing	-	-	-	Feeding	Feeding	-		-	-
		Adult	-	-	-	-	-	-			-		-	-
	Chandpai	Fry and Juvenile	Breeding and Spawning	Nursing	-	-	-	Feeding	-	-	-		-	-
		Juvenile	-	-	Feeding and Growing	Feeding	Feeding and Growing	-	Feeding and Growing		-		Feeding and Growing	
		Adult	-	-	-	-	-	-	Feeding		-			
		Brood Fish	-	-	-	-	-	-	-		-		Spawning	-
	Haldikhali	Fry and Juvenile	-	-	Nursing	-	-	-	-	-	-		-	-
	Harbaria	Adult and Brood Fish	-	-	Breeding and Spawning	-	-	-	-	-	-		Feeding and Spawning	-
		Adult	-	-	-	-	-	-	Feeding		-		-	Feeding
		Fry and Juvenile						Spawning and Nursery	-	-	Feeding and Growing		-	-
	Mongla Point	Fry, Juvenile and Age-1 adult	-	-	Spawning, Feeding and Growing	-	-	-	-	Nursing	-		-	Nursing
		Juvenile	-	-	-	-	-	-	Feeding and Growing		-		-	-
		Age-1 Adult	-	-	-	-	-	-	Feeding	Feeding	-		-	-
		Adult	-	-		Feeding	-	Feeding	-	-	-		Feeding	-
		Brood Fish	-	-	-	-	-	-	-	-	-		Spawning	-
	South-west of the Project	Adult	-	-	Feeding	Feeding	-	Feeding	-	-	-		-	-

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	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	-	-	-	-	-		-	-
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		-	-

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
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing	-	and Growing		-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-		Feeding and Growing	-
Potka	Haldikhali	Adult	Feeding and Breeding	-	-	-	-	-	-	-	-		-	-
	Chandpai	Fry	Spawning	Spawning and Nursing	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	Feeding
		Adult	-	-	-	Feeding	-	-	-	-	-		Feeding	-
	Mongla Point	Fry	Spawning	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Harbaria	Fry	-	-	-	-	-	Nursery	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	-
Paira Chanda	Akram Point	Adult	Feeding	-	-	-	-	-	-	-	-		-	-
	Chandpai	Fry	Breeding and Spawning	-	-	-	-	-	-	-	-		-	-
Chewa	Akram Point	Juvenile and Adult	Feeding	-	Feeding and Growing	-	-	-	-	-			-	-
	Chandpai	Fry and Juvenile	Spawning	-	Feeding and Growing	-	Nursing and Grazing	Nursery	Feeding and Growing	-	Nursing		-	-
		Adult	-	-	-	Feeding	-	Feeding	-	Feeding	-		-	-
	Haldikhali	Juvenile and Adult	-	-	Feeding and Growing	-	-	-	-	-	-		-	-
	Harbaria	Juvenile and Adult	-	-	Feeding and Growing	-	-	Feeding and Nursery	-	Feeding	-		-	-
	Mongla Point	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
	South-west of the Project	Juvenile	-	Feeding and Growing	-	-	-	-	-	-	-		-	-
	Chalna Point	Adult	-	-	-	-	Feeding	-	-	-	-		-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
Bele	Akram Point	Adult	Feeding	-	Feeding	Feeding	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	-
	Haldikhali	Juvenile-1, Juvenile and Adult	-	-	Nursing and Growing	Feeding	-	-	-	-	-		-	-
	Harbaria	Juvenile and Adult	-	-	Feeding and Growing	-	Feeding and Growing	Nursery and Feeding	Feeding and Growing	-	-		-	-
	Chandpai	Fry	Breeding and Spawning	Nursing	-	-	Nursing	Nursery	-	-	Nursery		-	-

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

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

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
	Chandpai	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	21th QM	22th QM	23th QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th QM
Tapsi	Haldikhali	Juvenile and Age-1 adult	-	-	G	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	F	-
	Charaputia	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-
	Chalna Point	Age-1 adult and Brood fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	M&F	-	-	-	-	M&F
		Adult	-	F	-	-	F	-	-	F	F		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile and Age-1 adult	F	-	-	-	-	-	-	-	-		-	-	-	-	-	F	F	-	-	-	-	-	F	-
	Chandpai	Juvenile	-	F&G	-	F&G	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	F&G	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Adult	-	-	-	-		-	-	-	-		F	-	-	-	-	-	-	-	-	-	-	-	-	-
		Age-1 adult	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Fry	-	-	N	-	-	-	-	-	-		-	N	-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	M	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Adult	-	-	-	-	F	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bairagi /Amadi	Haldikhali	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	M	-	-	-	-	F	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	F	F	-	-	-	-	F&G	F	-
	Chandpai	Fry	-	N	-	N	-	-		N	-		-	-	-	-	-	-	-	-	-	-	-	N	-	-
		Juvenile	-	F&G	F&G	F&G	-	M	F&G	-	N		-	-	-	-	-	-	-	F&G	-	-	-	-	-	-
	Chalna Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	F	-		-	-	-	-	-	-	-	-	M&F	-	-	-	-	-

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	21th QM	22th QM	23th QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th QM
		Fry	N	-	-	-	-	N	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	F&G	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	F	-
	Mongla Point	Fry	N	-	N	-	-	-	-	-	-		N	N	-	-	-	-	-	-	F&G	-	-	-	-	F&G
		Juvenile	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Juvenile	-	-	-	-	-	M	-	-	-	F&G	-	-	-	-	F&G	-	-	-	M	-	-	-	-	-
		Fry	N	-	N	-	-	N	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Charaputia	Adult	-	-	-	-	-	-	-	F	-		-	-	-	-	-	-	-	-	-	-	-	-	F	-
	Jongra	Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chapila	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	G	-	-	-	-	-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	M&F	-
	Harbaria	Juvenile	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Fry	-	-	-	-	N	-	-	-	-		-	-	-	-	-	-	-	N	-	-	-	-	-	N
		Juvenile	-	-	-	-	F&G	-	-	-	-		-	F&G	-	-	-	-	-	-	-	-	-	-	-	-
		Adult	-	-	-	-	F	-	M	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Adult	-	-	-	-	F	-	M	-	M	F	-	-	-	-	-	-	-	-	F&G	F&G	-	-	-	-
		Fry	-	-	-	-	-	N	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Juvenile to Age-1 adult	-	-	-	-	-	G&M	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Fry	-	-	N	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poma	Haldikhali	Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	M	-	-	-	-	-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	G	-	-	-	F&G	-	-
		Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	M	-	-	-	-	-	-	M&F	M&F
	Charaputia	Brood Fish	-	-	-	S	-	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile and Adult	-	-	-	F	-	-	G&M	F	-		G&M	-	-	G&M	M	-	M	G&M	-	-	-	-	M&F	M&F
	Chandpai	Fry	-	-	-	N	N	-	-	-	-		-	-	-	-	-	-	N	-	G	-	-	-	-	-
		Juvenile	F&G	-	-	F&G	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	G	-
		Adult		F	F	F	-	-	-	-	-		-	-	-	-	F	-	-	-	-	-	-	-	-	-
		Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Haldikhali	Fry and Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	G	-	-	-	-	-	-
	Harbaria	Adult and Brood Fish	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-
		Adult	F	-	-	-	-	F	-	-	-		-	-	-	-	-	M	-	M	-	-	-	-	-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-		N	-	-	-	-	-	-	-	-	-	-	F&G	-	-
	Mongla Point	Fry	N	N	-	-	N	-	F&G	-	N		N&M	N	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-

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	21th QM	22th QM	23th QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th QM
		Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	M	-	-	-	-	-	-	-	-
	Maidara	Adult	-	F	-	-	-	-	M&F	-	-		F	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	M&F	-	-	-	-	-	-	-	-	-	-	-	M&F
		Fry	-	-	-	-	-	N	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Juvenile and Adult	-	F&G	-	-	-	M&F	M&F	-	M&F		-	M&F	-	-	-	-	-	-	M&F	M&F	-	-	-	M&F
		Fry	N	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chhuri	Akram Point	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-
Chela	Akram Point	Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	M&F	-	-	-	F	-	-	-	-	F	-
	Charaputia	Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-
	Harbaria	Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	-	-	N&M	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Fry and Juvenile	-	-	-	N&F	-	-	-	-	-	N&M	-	N&M	-	-	-	-	-	-	-	M&F	-	-	M&F	N&F
	Chandpai	Fry and Juvenile	-	-	F&G		-	-	-	N	N		-	-	N&M	-	F&G	-	F&G	-	-	-	-	-	-	-
	Mongla Point	Fry and Juvenile	-	N	-	-	-	-	-	-	-	N&M	-	-	-	-	-	-	-	-	F&G	-	-	-	-	M&F
Ghagra Tengra	Chandpai	Juvenile and Age-1 adult	-	-	-	-	-	M		-	-		-	-	M	-	M	-	-	-	-	-	-	M	-	-
		Brood Fish	-	-	B	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Fry	-	-	-	-	N	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Age-1 adult	-	-	-	-	-	-	M&F	-	M&F		-		-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	F&G	-	-	-	N	-	-	-	-	-	-	-	-
	Akram Point	Juvenile and Adult	F	-	-	-	-	-	-	F&G	-		-	-	M	-	-	-	-	-	-	-	M&F	-	-	M&F
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	F&G	-	-	-	-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-	M&F	-
	Harbaria	Adult	F	B	-	-	-	-	F	-		-	-	-	M	-	M	F	M	-	-	-	-		-	-
		Juvenile	-	-	-	-	M	-	M	-		-	-	-	-	-	-	-	-	-	-	-	-	F&G	M&F	-
	Charaputia	Juvenile and Age-1 adult	-					M	-	-		M	-	-	M	-	M	-	M	-	-	-	M&F	M	-	-
Gulsha Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	M	-	-	-	-	-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	M	-	-	-	-	M&F	-
	Chandpai	Age-1 adult	F	-	F&G	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	M&F	-
		Juvenile	-	F&G	-	F&G	-	-	-	-	-		-	-	-	-	-	-	F&G	-	F&G	F&G	-	-	-	-
	Charaputia	Juvenile	-	-	-		-	-	F&G	-	-		-	-	-	-	-	-	-	-	-	-	-	-	M&F	-
		Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	M	-	-	-	-	-	-	-
	Mongla Point	Age-1 adult	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Age-1 adult	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-

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	21th QM	22th QM	23th QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th QM
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-	-	-	F&G		-	-	-	-	-	-	M	-	-	M&F	-
Potka	Akram point	Adult	-	-	-	--		-	-	-	-	-	--		-	-	-	-	-	F	-	-	-	-	-	-
	Haldikhali	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-
	Chalna Point	Fry	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chandpai	Fry	-	-	-	-	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M&F	-
		Juvenile	F	-	-	-	-	-	F&G	-	-		-	-	-	-	F and G	-	-	-	-	-	-	-	-	-
		Adult	-	F&G	F	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	M&F	-
	Mongla Point	Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Fry	-	-	-	N	-	N	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	M	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Fry	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Charaputia	Juvenile and adult	-	-	-	-	-	-	F&G	-	-	-	-	-	-	F&G	-	-	F&G	-	-	-	-	-	-	-
Paira Chanda	Akram Point	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M&F	-	-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F&G	-	-	-	-	-	-	-
Chewa	Chandpai	Fry and Juvenile	-	-	-	-	-	-	-	N	-		-	-	-	-	F&G	-	F&G	-	-	-	-	-	-	-
		Juvenile	-	F&G	-	-	-	-	-	-	F&G		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	M&F	M&F
	Jongra	Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	-	-	N	M	M	-	-	-	-	F	-	-	-	-	-	-	M&F	-
		Fry	-	-	-	-	N	-	-	-	-		-	-	-	-	-	-	-	-	-	F&G	-	-	-	-
	Maidara	Juvenile	-	-	-	-	-	-	-	-	-	M	-	-	-	-	M	-	-	-	-	-	-	-	-	-
		Fry	-	-	N	-	-	-	-	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Adult	-	-	-	-	F	-	-	-	-	F	-	F	-	-	-	-	-	-	-	-	-	-	-	-
		Age-1 Juvenile	-	-	-	-	-	-	-	-	-		M	-	-	-	-	-	-	-	-	-	-	-	-	-
Bele	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile and Adult	-	-	-	-	-	-	-				-	-	-	F	-	-	F&G	F&G	-	-	M&F	-	-	-
	Chandpai	Fry	-	-	-	N	N	-	-	N	-	N	-	-	-	-	M	-	-	-	-	-	-	N	-	-
		Juvenile and Adult	F&G	-	F&G	-	-	-	-	F&G		-	-	-	M&F	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F&M	M	-	-	F	-	-	-
	Mongla Point	Fry	-	N	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	M&F	-	-	-	-	-	-	-	-	-	M&F	M&F	-	-	-	M&F
	Chalna Point	Fry	-	-	N	N	-	-	-	-			-		-	-	-	-	-	-	-	-	-	-		-

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	21th QM	22th QM	23th QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th QM
		Fingerling	-	-	-	-	N	-	-	-	-		N	N	-	-	-	-	-	-	-	-	-	-	M&F	M&F
		Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	M&F	-	-	-	-	F&M	-	-	-	-	-	-	-
	Maidara	Juvenile and Age-1 adult	-	-	F&G	-	F&G	F&G	-	-	M& F	M& F	M&F	-	-	-	F&G	-	-	-	-	-	-	-	-	M&F
		Fry	N	-	N	-	-	-	-	-		-	-		-	-	-	-	-	N	-	-	-	N	-	-
	Charaputia	Juvenile and Age-1 adult	-	-	-	-	-	M	-	-		-	-		-	-	-	M	-	M	-	-	-	-	M&F	-
Tular Dandi	Akram Point	Adult	-	-	-	-	-	-	-	F&M	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chandpai	Age-1 Adult	-	-	F	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	G	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	M&F
		Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	M&F
	Jongra	Fry	-	-	-	-	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Adult	-	F	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M&F	-
	Chalna Point	Adult	-	-	-	-	-	-	M	M	M&F	-	-	-	M&F	-	M&F	-	-	-	-	-	-	-	-	-
Tairel	Akram Point	Adult	-	-	-	F	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
		Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	M	-	-	-	-	-	-	-
	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G&M	-	-	-
	Charaputia	Juvenile	-	-	-	-	-	-	-	M	-		-	-	-	-	-	-	M	-	-	-	-	-	-	-
	Harbaria	Age-1 Adult	-	F&G	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chandpai	Juvenile	-	-	-	-	-	G	-	-	F&G		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	G		-	-	-	-	-	-	-	-	-	-	-	-	M&F	-
	Maidara	Juvenile	-	-	-	-	-	G	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pheksa	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	M	M	-	-	-	-		M	-
	Charaputia	Juvenile and Adult	-	-	-	-	-	-	-	F&M	-			-	-	-	-	-	-	M	-	-	-		M&F	-
	Chalna Point	Juvenile and Adult	-	-	-	F&G	-	-	-	M	M			-	M	-	M	-	-	-	-	-	-		-	-
		Adult	-	F	-	-	-	-	M	-	-	F		-	-	-	-	-	M	-	-	-	-		-	-
	Mongla Point	Adult	-	-	-	-	-	-	M	-	-		M	-	-	-	-	-	-	M	-	-	-		-	-
		Juvenile	-	-	-	G	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
	Chandpai	Juvenile and Adult	-	-	-	F&G	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-		M&F	-
	Maidara	Adult	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		M&F	-
Paissa	Akram Point	Juvenile and Adult	F	-	-	-	-	G&M	-	-	-	-	-	-	-	G&M	-	-	G&M	G&M	-	-	G&M	G&M	-	-
		Brood	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Charaputia	Brood Fish	-	-	-	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	G&M	G&M	-	-	G&M	-	-	-
		Fry	-	-	-	-	-	-	-	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile and Adult	-	F&G	-	-	-	-	-	-	-		-	-	F&G	-	-	F	G&M M	G&M	-	-	G&M	-		-
		Adult	-	F	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-		M&F

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	21th QM	22th QM	23th QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th QM
	Chalna	Fry	-	-	-	-	-	-	F&G	-	F&G		N	N	-	F	-	-	-	-	-	G&M	-	-		-
	Chandpai	Fry	-	-	-	N	-	-	F&G	N	N	N	N	-	F&G	F	F&G	-	-	N	G&M	-	-	-		-
		Juvenile and Adult	F	F&G	-	F&G	-	M	-	-			-	-	-	-	-	-	-	-	-	-	-	-		M&F
	Jongra	Fry	-	-	-	-	-	-	-	N			-	-	-	-	-	-	-	-	-	-	-	-		-
	Harbaria	Juvenile	-	-	F&G	-	-	M	-	-			-	-	F&G	-	-	-	F&G	F&G	-	-	G&M	-		M&F
	Mongla Point	Fry	-	-	N	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-		-
		Age-1 Adult	-	-	-	-	-	-	-	-		M	-	-	-	-	-	-	-	-	-	G&M	-	-		M&F
	Maidara	Fry, Juvenile and Age-1 adult	-	-	-	-	-	-	F&G	-	F&G		-	-	F&G	-	-	-	-	-	M	G&M	-	-		-
		Juvenile	-	-	-	-	-	G	-	-	-		M	-	-	-	-	-	-	-	-	-	-	-		-
Banshpata	Chandpai	Juvenile	-	-	-	G	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	N		-
		Adult	-	F	F	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-		M&F
	Jongra	Juvenile	-	-	-	-	-	-	-	M	-		-	-	-	-	-	-	-	-	-	-	-	-		-
	Charaputia	Juvenile and Age-1 Adult	-	-	-	F	-	-	G&M	-	-		-	-	-	G&M	-	-	G&M	M	-	-	-	-		-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	G&M	-	-	-	G&M		G&M
	Haldikhali	Juvnile and adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	M	-	-	-	-		-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	F& G	-	-	-	-	-	G&M	-
	Mongla Point	Juvenile	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	G&M	G&M	-	-		-	-	M	-	-	-	-	-	-	-	-	-	-	-
		Adult	-	F	-	-	-	F	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	M&F	M&F
	Chalna Point	Juvenile and Age-1 Adult	-	-	-	-	-	-	G&M	F	G&M		-	G&M	-	-	-	-	-	-	-	-	-	-	M&F	-
Hilsa	Akram Point	Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	M	-	-	-	-	-	-	M&F	-
	Maidara	Age-1 Adult	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	M	M	-	-	-	-	-	M&F	-
	Chalna Point	Adult	-	-	-	-	-	M	-	-	-	F	-	-	-	-	-	-	M	-	M	-	-	-	-	-
	Mongla	Age-1 Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	-	-	-	-	-
Pangas	Akram Point	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-
	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-
	Charaputia	Adult	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	F&G	-	F&G	-	-	-	-	-	-	N	-	-	-	-	-	-	-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	-	-	-	F&G	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Source: CEGIS Field Survey; 2014 up to 2023;*Only Age-1 to Brood fish was allowed to interpret the migration purpose; F = Feeding; B=Breeding, S = Spawning, N=Nursing, G=Growing, M=Maturatio*

D.8: The Present Catch in Three Sampling Ghers

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

Source: CEGIS Field Survey, 2014-2015

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

Source: CEGIS Field Survey, 2015-2016

Sampling Site	Total Catch (ton): 2016-2017							
	9th QM		10th QM		11th QM		12th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
1	-	0	-	-	Bagda	3	-	0
	-	0	-	-	Tengra	0.1	-	0
	-	0	-	-	Horina Chingri	0.8	-	0
	-	0	-	-	Paissa	0.1	-	0
	-	0	-	-	Vetki	2	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
	-	0	-	-	-	0	-	0
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		20th QM	
	Species	ton	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	-	Bagda	3.2
	Horina Chingri	1	Rui (kg)	1.3	-	-	Golda	0.10	Bele	0.20	Catla	1.2	Paissa	-	Horina	4.8
	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	-	-	=	8.0
2	Bagda	0	Bagda	5	-	-	Bagda	**3.93**	Bagda	1.48	Bagda	5	Bagda	-	Bagda	1.41
	-	-	Vetki	0.5	-	-	Golda	**0.13**	Bele	0.06	Bhangan	0.05	Paissa	-	Paissa	0.60
	-	-	Paissa	7	-	-	Rui	**8.41**	Bhangan	0.01	Catla	3	Datina	-	Crab	0.00
	-	-	Phessa	1	-	-	Tilapia	**5.90**	Catla	0.00	Chali	0.4			Tilapia	0.30
	-	-	Bhangan	0.7	-	-	Nilotica	**0.00**	Chali	0.04	Golda	0.08			Golda	0.10
							Khorulla	**0.00**	Chel	0.01	Horina	1.8			Horina	2.92
							Mrigel	**0.00**	Golda	0.00	Paissa	0.8			Chali	1.52
							Catla	**0.00**	Horina	0.50	Rui	3			Bele	1.35
							Grass Carp	**0.11**	Motka	0.05	Tengra	0.8			Tengra	0.27
							Common Carp	**5.55**	Paissa	0.03	Tilapia	8			Major Carp	0.55
							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**			**=**	**9.0**
3	Bagda	0	Bagda	2	-	-	Bagda	**0.50**	Bagda	0.10	-	0	Bagda	-	Bagda	0.04
	-	-	Paissa	8	-	-	Tilapia	**1.50**	Horina Chingri	0.00			Golda	-	Paissa	0.00
	-	-	Tengra	2	-	-	Tengra	**0.12**	Paissa	0.00			Paissa	-	Khorsula	0.00

Sampling Site	Total Catch (ton): 2017-2018 and 2018-19															
	13th QM		14th QM		15th QM		16th QM		17th QM		18th QM		19th QM		20th QM	
	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton	Species	ton
	-	-	Tilapia	5	-	-	Paissa	**0.00**	Tengra	0.00			Nilotica	-	Horina	0.10
	-	-	Rui	3	-	-	Horina Chingri	**0.60**	Tilapia	0.20			Khorsul	-	Motka	0.04
	-	-	Vetki	2	-	-									Chali	0.03
	-	-	Catla	10	-	-									Chaka	0.01
	-														Bele	0.01
															Crab	0.03
Sub-total =	**-**	**0**	**-**	**32**	-	-									=	0.24
Grand-total =	**-**	**1**	**-**	**49.8**	-	-	**=**	**2.72**	**=**	**0.30**	**=**	**0**				**17.27**

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

Source: CEGIS Field Survey, 2019-20, 2020-21, 2021-22 and 2022-23.

Sampling Site	Species	Total Catch (ton): 2014-2015																
		20th QM	21tst QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th QM
1	Bagda	3.2	2.72	0.8	-	-	0.3	-	0.7	0.5	-	-	1.2	1.2	0.7	0.7	1.35	2.0
	Golda	-	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-
	Harina	4.8	3.44	1.0	0.02	2.0	0.2	-	0.15	0.6	0.1	-	0.5	0.2	0.2	0.2	0.59	1.6
	Bele	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2
	Chali	-	-	0.2	-	-	-	-	-	0.3	0.1	-	-	-	-	-	-	-
	Chaka	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
	Paissa	-	0.17	-	-	-	0.05	-	-	0.05	-	-	-	-	0.05	0.05	-	0.2
	Vetki/Patari	-	-	0.3	-	-	0.2	-	-	-	0.3	-	-	-	0.05	0.05	-	-
	Gulsha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kailla	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
	Tilapia		0.7	0.5	-	-	0.5	-		2.0	1.2	-	-	-	2.0	0.2	0.53	4.0
	Rui	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-
	Catla	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
	Minar Carp	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-
	Grass Carp	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-
	Tairel	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Datina	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kakra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
	Sub-total =	**8.0**	**7.0**	**2.8**	**0.02**	**4.2**	**2.37**	**-**	**0.85**	**3.45**	**1.7**	**-**	**1.7**	**1.4**	**3.0**	**3.0**	**2.47**	**8.1**
2	Bagda	1.41	6.74	3.42	-	4.48	1.45	-	0.04	2.73	0.07	-	3.2	1.5	0.07	-	2.4	1.6
	Golda	0.1	0.01	0.4	-	0.03	0.3	-	-	-	-	-	-	-	-	-	0.22	0.4
	Harina	2.92	-	3.96	0.01	0.92	1.08	-	0.14	0.96	0.81	-	0.28	0.16	0.8	-	0.4	0.6
	Chali	1.52	0.04	0.38	-	0.20	0.3	-	0.03	0.11	0.01	-	0.12	0.1	0.12	-	-	-
	Bele	1.35	0.09	2.11	-	0.27	0.19	-	-	0.44	0.58	-	0.15	0.15	0.52	-	-	0.15
	Tengra	0.27	0.57	-	-	0.01	0.17	-	-	0.01	0.02	-	-	0.1	0.02	-	-	-
	Paissa	0.6	0.01	2.62	-	0.04	1.8	-	-	0.23	0.34	-	0.1	0.2	0.32	-	0.25	0.4
	Vetki/Patari	-	-	2.25	-	0.25	0.25	-	-	-	1.75	-	0.04	0.6	1.6	-	-	0.2
	Bhangan	-	0.08	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tilapia	0.3	0.22	9.85	-	3.87	6.93	-	-	12.9	7.82	-	4.5	-	7.0	-	0.35	-
	Rui	0.35	-	1.27	-	1.95	-	-	-	-	0.27	-	-	0.6	0.24	-	-	2.0
	Catla	0.20	-	-	-	0.04	0.05	-	-	-	-	-	-	-	-	-	-	0.2
	Kailla	-	-	0.96	-	-	-	-	-	-	0.03	-	-	0.1	-	-	-	-
	Grass Carp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sampling Site	Species	Total Catch (ton): 2014-2015																
		20th QM	21tst QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33rd QM	34th QM	35th QM	36th QM	37th QM
	Kakra	-	0.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Datina	-	-	1.01	-	-	-	-	-	-	0.06	-	-	0.14	0.06	-	-	-
	Chemo	-	-	0.02	-	0.32	0.32	-	-	-	-	-	-	-	-	-	-	-
	Chaka	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nundi Bele	-	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kakra	-	-	0.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total =		**9.0**	**8.4**	**28.58**	**0.01**	**12.38**	**12.57**	**-**	**0.21**	**17.38**	**11.76**	**-**	**8.39**	**5.15**	**10.75**		**3.62**	**5.35**
3	Bagda	0.04	0.02	0.02	-	0.1	0.02	-	0.01	0.04	0.04	-	0.04	0.05	0.06	-	0.02	0.14
	Golda	-	0.03	0.01	-	0.03	0.01	-	-	0.01	0.01	-	-	-	-	-	0.01	0.04
	Harina	0.1	0.02	0.01	-	0.15	0.02	-	0.06	0.06	0.04	-	0.07	0.4	0.40	-	0.12	0.18
	Chali	0.03	-	0.01	-	-	0.02	-	-	-	-	-	-	-	-	-	-	0.02
	Chaka	-	0.01	-	-	0.01	0.02	-	-	0.04	0.04	-	-	-	-	-	-	
	Paissa	-	0.01	0.06	-	0.05	0.03	-	-	0.12	0.08	-	-	-	0.8	-	0.02	0.1
	Kharsul	-	-	0.01	-	0.01	-	-	-	-	-		-	-	0.05	-	-	0.04
	Tengra	-	-	0.01	-	0.02	0.01	-	-	-	-	-	-	-	-	-	-	0.12
	Bele	0.01	-	-	-	0.03	-	-	-	0.01	-	-	-	-	-	-	-	0.02
	Tilapia	-	-	0.24	-	-	0.06	-	-	0.08	0.16	-	-	-	0.12	-	-	0.11
	Vetki/Patari	-	0.01	0.02	-	-	0.02	-	-	0.02	0.04	-	-	0.4	0.04	-	-	0.04
	Chaina Punti	-	-	0.05	-	-	-	-	-	-	-		-	-	-	-	-	
	Chami	-	-	-	-	-	-	-	-	0.04	0.04	-	-	-	-	-	-	
	Ilish	-	-	-	-	-	0.005	-	-	-	-		-	-	-	-	-	
	Motka	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02
	Chaka	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Kakra	0.03	-	-	-	-	-	-	0.01	0.12	-	-	-	-	-	-	-	
	Tairu	-	0.01	-	-	0.02	0.01	-	-	-	-	-	-	-	-	-	-	0.02
	Bhangan	-	0.01	-	-	-	0.005	-	-	-	-	-	-	-	-	-	-	0.02
	Datina	-	0.03	0.02	-	0.02	0.02	-	-	-	-	-	-	-	-	-	-	
Sub-total =		**2.4**	**0.15**	**0.46**	**-**	**0.44**	**0.25**	**-**	**0.08**	**0.54**	**0.45**	**-**	**0.11**	**0.85**	**1.47**	**-**	**0.17**	**0.87**
Grand-total =		**19.4**	**15.55**	**31.84**	**0.03**	**17.02**	**15.19**	**-**	**1.14**	**21.37**	**13.91**	**-**	**10.2**	**7.40**	**15.22**	**3.0**	**6.26**	**14.32**

Source: CEGIS Field Survey; 2014 up to 2023;

(E) Traffic Survey Data

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

Date: August 31, 2023

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	16	13	0	13	10	0	20	9	0
Auto Rickshaw	0.8	0	0	0	1	1	1	0	0	0
Van	0.6	97	104	120	98	136	140	14	138	91
Cycle	0.2	21	14	7	10	10	4	1	22	5
Human Howler	0.6	6	5	6	6	7	8	3	4	4
CNG	0.5	12	9	10	15	10	12	1	22	11
Private Car	1	19	28	47	28	25	53	1	21	22
Motor Cycle	0.3	116	116	69	121	102	67	10	187	59
Jeep	1	6	5	10	4	14	18	1	2	3
Pick-up	2	14	11	49	13	16	57	4	21	49

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**
Micro	1	15	21	36	12	20	32	3	23	26
Bus	2.5	33	66	246	41	46	216	0	51	126
Light Truck	2	17	28	88	11	25	71	0	17	33
Medium Truck	2	35	37	144	36	49	170	0	48	96
Heavy Truck	2	5	6	20	6	9	29	0	11	21
			Total	**853**			**877**			**545**

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

Date: August 30, 2023

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	20	9	0	18	3	0	14	13	0
Auto Rickshaw	0.8	0	0	0	0	0	0	0	0	0
Van	0.6	70	37	64	55	38	56	60	52	67
Cycle	0.2	10	4	3	6	2	2	7	8	3
Human Howler	0.6	23	4	16	30	12	25	19	13	19
CNG	0.5	53	21	37	44	8	26	28	24	26
Private Car	1	11	3	14	10	10	20	9	26	35
Motor Cycle	0.3	73	25	30	61	24	25	63	72	40
Jeep	1	2	0	2	4	0	4	3	3	6
Pick-up	2	3	2	10	7	2	16	5	3	16
Micro	1	6	3	8	3	1	3	5	10	15
Bus	2.5	6	8	35	9	5	33	6	13	46
Light Truck	2	2	2	8	6	6	22	1	8	18
Medium Truck	2	13	4	35	13	4	33	12	39	101
Heavy Truck	2	4	2	12	3	8	22	9	10	36
			Total	**273**			**285**			**428**

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

Date: Aigist 29, 2023

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	11	5	0	5	6	0	13	11	0
Auto Rickshaw	0.8	0	0	0	0	0	0	0	0	0
Van	0.6	30	35	39	22	25	28	14	33	28
Cycle	0.2	56	4	12	21	13	7	1	16	3
Human Howler	0.6	12	4	9	4	7	6	3	5	5
CNG	0.5	7	8	7	3	4	3	1	3	2
Private Car	1	5	1	6	1	2	3	1	4	5

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**
Motor Cycle	0.3	81	10	27	29	32	18	10	31	12
Jeep	1	0	1	1	0	0	0	1	0	1
Pick-up	2	2	2	9	1	3	7	4	8	24
Micro	1	4	0	4	1	3	3	3	8	11
Bus	2.5	1	1	3	0	0	0	0	0	0
Light Truck	2	0	0	1	0	1	1	0	1	2
Medium Truck	2	1	0	2	1	3	6	0	6	12
Heavy Truck	2	1	0	2	1	1	3	0	3	6
			Total	**124**			**84**			**111**

Monitoring Results

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Environmental Laboratory

Memo No. ELAB202309003242 Date: 31/10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_001 Collection Date: 23/08-07/09/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_1	Sulphate ($SO4^{2-}$)	-	-	-	-	20.708	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	-	-	7	-	2.2736	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0..9723	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2023

Compiled & Approved by

Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

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Environmental Laboratory

Memo No. ELAB202309003243 Date: 31/10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_002 Collection Date: 23/08-07/09/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_2	Sulphate ($SO4^{2-}$)	-	-	-	-	13.224	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	-	-	7	-	1.9372	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	1.4290	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

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Signature: 31.10.2023

Compiled & Approved by

Name: Md. Rafiqul Alam

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Signature: 31.10.2023

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Environmental Laboratory

Memo No. ELAB202309003244 Date: 31/10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_003 Collection Date: 23/08-07/09/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_3	Sulphate (SO_4^{2-})	-	-	-	-	33.642	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate (NO_3^-)	-	-	7	-	0.6756	ppm	UV-VIS	
03		Phosphate (PO_4^{3-})	-	-	0.5	-	1.2576	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

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Environmental Laboratory

Memo No. ELAB202309003245 Date: 31/10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_004 Collection Date: 23/08-07/09/23

Location: Jetty.

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_4	Sulphate (SO_4^{2-})	-	-	-	-	20.522	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate (NO_3^-)	-	-	7	-	2.4419	ppm	UV-VIS	
03		Phosphate (PO_4^{3-})	-	-	0.5	-	2.5303	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

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Designation: Laboratory Expert

Signature: 31.10.2023

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Environmental Laboratory

Memo No. ELAB202309003246 Date: 31/10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_005 Collection Date: 23/08-07/09/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_5	Sulphate ($SO4^{2-}$)	-	-	-	-	24.943	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	-	-	7	-	1.0961	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0115	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

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Signature: 31.10.2023

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Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

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Environmental Laboratory

Memo No. ELAB202309003247 Date: 31/10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_006 Collection Date: 23/08-07/09/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	I Others	Drinking	Others				
01	SW_6	Sulphate ($SO4^{2-}$)	-	-	-	-	17.493	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	-	-	7	-	4.1871	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0989	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

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Environmental Laboratory

Memo No. ELAB202309003248 Date: 31/10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_007 Collection Date: 23/08-07/09/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_7	Sulphate ($SO4^{2-}$)	-	-	-	-	24.125	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	-	-	7	-	2.0003	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0026	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

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Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

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Environmental Laboratory

Memo No. ELAB202309003249 Date: 31/10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_008 Collection Date: 23/08-07/09/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_8	Sulphate ($SO4^{2-}$)	-	-	-	-	36.427	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	-	-	7	-	4.4394	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0235	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam

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Name: Md. Rafiqul Alam

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Environmental Laboratory

Memo No. ELAB202309003250 Date: 31/10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_009 Collection Date: 23/08-07/09/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_9	Sulphate (SO_4^{2-})	-	-	-	-	12.000	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate (NO_3^-)	-	-	7	-	5.3226	ppm	UV-VIS	
03		Phosphate (PO_4^{3-})	-	-	0.5	-	0.0011	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2023

Compiled & Approved by

Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

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Environmental Laboratory

Memo No. ELAB202309003251 Date: 31 /10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_010 Collection Date: 23/08-07/09/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_{10}	Sulphate (SO_4^{2-})	-	-	-	-	39.894	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate (NO_3^-)	-	-	7	-	3.5773	ppm	UV-VIS	
03		Phosphate (PO_4^{3-})	-	-	0.5	-	0.0443	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2023

Compiled & Approved by

Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

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Environmental Laboratory

Memo No. ELAB202309003252 Date: 31 //10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_011 Collection Date: 23/08-07/09/23

Location: Shapmari.

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_{11}	Sulphate ($SO4^{2-}$)	-	-	-	-	38.215	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	1.2013	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0370	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam

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Signature: 31.10.2023

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Name: Md. Rafiqul Alam

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Environmental Laboratory

Memo No. ELAB202309003253 Date: 31 //10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_012 Collection Date: 23/08-07/09/23

Location: Mongla.

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_{12}	Sulphate ($SO4^{2-}$)	-	-	-	-	54.137	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	13.965	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.5430	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

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Signature: 31.10.2023

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Name: Md. Rafiqul Alam

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Environmental Laboratory

Memo No. ELAB202309003254 Date: 31 //10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_013 Collection Date: 23/08-07/09/23

Location: Harbaria.

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_{13}	Sulphate ($SO4^{2-}$)	-	-	-	-	59.705	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	1.5377	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0048	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam ✓

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2023

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Name: Md. Rafiqul Alam

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Environmental Laboratory

Memo No. ELAB202309003255 Date: /31 //10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_014 Collection Date: 23/08-07/09/23

Location: Akrampoint.

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_{14}	Sulphate ($SO4^{2-}$)	-	-	-	-	194.84	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	0.5284	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0790	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam ✓

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2023

Compiled & Approved by

Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

CEGIS Center for Environmental and Geographic Information Services
(A Public Trust under the Ministry of Water Resources)
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh.
Tel: 88 02 58817649-52; 9842581, 9842551 Fax: 88 02 9843128 e-mail: cegis@cegisbd.com http://www.cegisbd.com

Environmental Laboratory

Memo No. ELAB202309003256 Date: 31 /10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Surface Water ID: FPC008_015 Collection Date: 23/08-07/09/23

Location: Hiron Point.

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Remarks
			Drinking	Others	Drinking	Others				
01	SW_{15}	Sulphate ($SO4^{2-}$)	-	-	-	-	209.55	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	0.6756	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0547	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2023

Compiled & Approved by

Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

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(A Public Trust under the Ministry of Water Resources)
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh.
Tel: 88 02 58817649-52; 9842581, 9842551 Fax: 88 02 9843128 e-mail: cegis@cegisbd.com http://www.cegisbd.com

Environmental Laboratory

Memo No. ELAB202309003257 Date: 31 /10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Drinking Water ID: FPC008_016 Collection Date: 23/08-07/09/23

Location: PPJ RO drinking.

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Rem arks
			Drinking	Others	Drinking	Others				
01	GW_1	Sulphate ($SO4^{2-}$)	400	-	250	-	14.700	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	10	-	45	-	2.0003	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	6	-	-	-	0.0143	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2023

Compiled & Approved by

Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

CEGIS Center for Environmental and Geographic Information Services
(A Public Trust under the Ministry of Water Resources)
House 6, Road 23/C, Gulshan-1, Dhaka-1212. Bangladesh.
Tel: 88 02 58817649-52; 9842581, 9842551 Fax: 88 02 9843128 e-mail: cegis@cegisbd.com http://www.cegisbd.com

Environmental Laboratory

Memo No. ELAB202309003258 Date: 31 //10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Drinking Water ID: FPC008_017 Collection Date: 23/08-07/09/23

Location: Rajnagar.

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Rem arks
			Drinking	Others	Drinking	Others				
01	GW_2	Sulphate ($SO4^{2-}$)	400	-	250	-	0.8883	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	10	-	45	-	0.7807	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	6	-	-	-	0.4496	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer.

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2023

Compiled & Approved by

Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

CEGIS Center for Environmental and Geographic Information Services
(A Public Trust under the Ministry of Water Resources)
House 6, Road 23/C, Gulshan-1, Dhaka-1212. Bangladesh.
Tel: 88 02 58817649-52; 9842581, 9842551 Fax: 88 02 9843128 e-mail: cegis@cegisbd.com http://www.cegisbd.com

Environmental Laboratory

Memo No. ELAB202309003259 Date: 31 //10/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Compliance Monitoring of MSTPP. Code: FPC008

Sample Type: Drinking Water ID: FPC008_018 Collection Date: 23/08-07/09/23

Location: Kapashdanga.

Received From: Md. Mutasim Billah Received Date: 12/09/2023 Testing Date: 18-31 /10/23

Laboratory Test Results:

SL.#	Name of Sample	Water quality parameters	Bangladesh standard ECR/97		Bangladesh Standard ECR/2023		Concentration Present	Unit	Analysis Method	Rem arks
			Drinking	Others	Drinking	Others				
01	GW_3	Sulphate ($SO4^{2-}$)	400	-	250	-	3.9427	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	10	-	45	-	6.3108	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	6	-	-	-	1.2589	ppm	UV-VIS	

N.B: UV-VIS means UV-1800 Spectrophotometer

Test Performed by & Checked by

Name: Rafiqul Islam & Md. Rafiqul Alam

Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert

Signature: 31.10.2023

Compiled & Approved by

Name: Md. Rafiqul Alam

Designation: Laboratory Expert

Signature: 31.10.2023

Form No. QSF-22 Revision No. 12 Revision Date: 04 November, 2022

জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন, সব মানুষের উন্নয়ন"

37

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ

BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Institute of National Analytical Research and Service (INARS)

ANALYSIS REPORT

ASC Ref No. : IN-376 of Analytical Service Cell
BCSIR, 18/06/2023

Lab/Sample ID : A-1014-1034

Client's Details : মোহাম্মদ মোক্তারুজ্জামান
ডিরেক্টর (ইন-চার্জ) এন্ড সিনিয়র স্পেশালিস্ট
পাওয়ার, এনার্জি এন্ড মিনারেল রিসোর্স ডিভিশন
Center For Environmental And Geographic Information Service (CEGIS)
House No. 06, Road No. 23/C, Gulshan-01, Dhaka-1212.

Number of Sample : 21 (Twenty one)

Sample Description : রামপাল ২x৬৬০ মেঃ ওঃ বিদ্যুৎ প্রকল্পের অধীনে পানির নমুনা পরীক্ষণ প্রসংগে, তারিখ ঃ ১৮/০৬/২০২৩ ইং।

Test Commencement Date : 18/06/2023

Test Completion Date : 20/07/2023

Lab ID	Particulars of supplied sample	Parameters	Results	Test Method (APHA)
A-1014	Ground water (Mongla Confluence)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-1014	Ground water (Moidara)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-1014	Ground water (Harbaria)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-1014	Ground water (Akram Point)	Oil and Grease	Less than 2.0 mg/L	5520.B

Page 1 of 2

Note:
a. The results reported here are based only on the supplied samples in this laboratory.
b. Any complain about test report will not be acceptable after one month from the date of issuing of the said report.
c. This report/result shall not be reproduced/published without prior approval of the authority.

Analytical Service Cell
Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh
Telephone: 9671108, Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Wedsite: www.bcsir.gov.bd

Form No. QSF-22 Revision No. 12 Revision Date: 04 November, 2022

জীবনের জন্য বিজ্ঞান "শেখ হাসিনার দর্শন, সব মানুষের উন্নয়ন"

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ

BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Lab ID	Particulars of supplied sample	Parameter	Results	Test Method (APHA)
A-1018	Ground water (Sample-01)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1019	Ground water (Sample-02)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1020	Ground water (Sample-03)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1021	Ground water (Sample-04)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1022	Ground water (Sample-06)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1023	Ground water (Sample-07)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1024	Ground water (Sample-08)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1025	Ground water (Sample-09)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1026	Ground water (Sample-10)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1027	Ground water (Sample-11)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1028	Ground water (Mongla Confluence)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1029	Ground water (Harbaria)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1030	Ground water (Akram Point)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1031	Ground water (P.P, GW)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1032	Ground water (Sapmari)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1033	Ground water (Rajnagar)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-1034	Ground water (kapashdanga)	Mercury (Hg)	Less than 0.001 mg/L	3112.B

20.7.23 20/7/23 20/7/23

Analyst
Sharmin Ahmed
Scientific Officer
Institute of National Analytical Research and Service (INARS)
BCSIR, Dhaka-1205

Supervisor
Dr. Muhammad Abdullah Al-Mansur
Principal Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

Director
Sarker Kamruzzaman
Director (Addl. Charge)
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka-1205

Page 2 of 2

Note:
a. The results reported here are based only on the supplied samples in this laboratory.
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Analytical Service Cell
Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh
Telephone: 9671108, Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Wedsite: www.bcsir.gov.bd

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

Lab Memo: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080193	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-01)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	464	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	436	mg/L	CRM	4.0
5	Chloride	150-600	10600	mg/L	Titrimetic	-
6	Bi-Carbonate (HCO3-)	0.0	30	mg/L	Titrimetic	-
7	Cr (Total)	0.05	0.019	mg/L	AAS	0.0003
8	Hardness	200-500	4700	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	13.10	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.008	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	755	mg/L	AAS	0.05
12	Phosphate	6.0	0.30	mg/L	UVS	0.10
13	Potassium (K)	12.0	538	mg/L	AAS	-
14	Total Dissolved Solid (TDS)	1000	16900	mg/L	Multimeter	-
15	Total Suspended Solid (TSS)	10	25	mg/L	Gravimetric Method	-
16	Turbidity	10	540	NTU	Turbidity Meter	-
17	Carbonate (CO3)	-	0.24	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.

07/09/2023
Md. Biplab Hossain
Chief Chemist
Department of Public Health Engineering
Central Laboratory Mohakhali, Dhaka

Page 1 of 2

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:

Signature

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
07.09.2023

2.) Name: Taslima Akhter
Designation: Sample Analyzer
07.09.2023

Countersigned/Approved by:

Signature

1.) Name: Mita Sarker
Designation: Senior Chemist
07/09/2023

2.) Name: Md. Biplab Hossain
Designation: Chief Chemist

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

Page 2 of 2

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

Lab Memo: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080194	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-02)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	236	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.020	mg/L	AAS	0.0003
5	Hardness	200-500	4800	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
7	Phosphate	6.0	0.15	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	17500	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	20	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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080195	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-03)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	248	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.023	mg/L	AAS	0.0003
5	Hardness	200-500	4700	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Phosphate	6.0	0.26	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	18000	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	16	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS - Atomic Absorption Spectrophotometer, UVS - UV-Visible Spectrophotometer, 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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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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Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080196	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-04)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	Calcium (Ca)	75	351	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	288	mg/L	CRM	4.0
5	Chloride	150-600	11000	mg/L	Titrimetic	-
6	Bi-Carbonate (HCO3-)	0.0	30	mg/L	Titrimetic	-
7	Cr (Total)	0.05	0.020	mg/L	AAS	0.0003
8	Hardness	200-500	4500	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	13.72	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.010	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	635	mg/L	AAS	0.05
12	Phosphate	6.0	0.10	mg/L	UVS	0.10
13	Potassium (K)	12.0	514	mg/L	AAS	-
14	Total Dissolved Solid (TDS)	1000	17400	mg/L	Multimeter	-
15	Total Suspended Solid (TSS)	10	18	mg/L	Gravimetric Method	-
16	Turbidity	10	375	NTU	Turbidity Meter	-
17	Carbonate (CO3)	-	0.30	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.

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

Page 1 of 2

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080197	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-05)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	412	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.018	mg/L	AAS	0.0003
5	Hardness	200-500	4650	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.012	mg/L	AAS	0.001
7	Phosphate	6.0	0.35	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	17800	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	12	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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080198	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-06)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	296	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.017	mg/L	AAS	0.0003
5	Hardness	200-500	4750	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Phosphate	6.0	0.40	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	17900	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	13	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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080199	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-07)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	373	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	416	mg/L	CRM	4.0
5	Chloride	150-600	11200	mg/L	Titrimetic	-
6	Bi-Carbonate (HCO3-)	0.0	20	mg/L	Titrimetic	-
7	Cr (Total)	0.05	0.016	mg/L	AAS	0.0003
8	Hardness	200-500	4600	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	12.49	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	736	mg/L	AAS	0.05
12	Phosphate	6.0	0.36	mg/L	UVS	0.10
13	Potassium (K)	12.0	520	mg/L	AAS	-
14	Total Dissolved Solid (TDS)	1000	17600	mg/L	Multimeter	-
15	Total Suspended Solid (TSS)	10	10	mg/L	Gravimetric Method	-
16	Turbidity	10	324	NTU	Turbidity Meter	-
17	Carbonate (CO3)	-	0.19	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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Chief Chemist
Department of Public Health Engineering
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Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080200	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-08)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	412	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.023	mg/L	AAS	0.0003
5	Hardness	200-500	4850	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.010	mg/L	AAS	0.001
7	Phosphate	6.0	0.39	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	17500	mg/L	Multimeter	-
9	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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080201	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-09)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	492	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.029	mg/L	AAS	0.0003
5	Hardness	200-500	4800	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.009	mg/L	AAS	0.001
7	Phosphate	6.0	0.42	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	17800	mg/L	Multimeter	-
9	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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080202	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-10)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	348	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.030	mg/L	AAS	0.0003
5	Hardness	200-500	4550	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.003	mg/L	AAS	0.001
7	Phosphate	6.0	0.45	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	17600	mg/L	Multimeter	-
9	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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080203	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-11)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00015	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	480	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.021	mg/L	AAS	0.0003
5	Hardness	200-500	4400	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
7	Phosphate	6.0	0.56	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	15200	mg/L	Multimeter	-
9	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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080204	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-12)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Cadmium (Cd)	0.005	0.00016	mg/L	AAS	0.00015
3	Chemical Oxygen Demand (COD)	4.0	248	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.030	mg/L	AAS	0.0003
5	Hardness	200-500	4600	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Phosphate	6.0	0.48	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	16700	mg/L	Multimeter	-
9	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	07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080205	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-13)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	236	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.024	mg/L	AAS	0.0003
5	Hardness	200-500	4650	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
7	Phosphate	6.0	0.50	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	16800	mg/L	Multimeter	-
9	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	07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080206	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW-14)	Union:, Vill.:
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	436	mg/L	CRM	4.0
4	Cr (Total)	0.05	0.026	mg/L	AAS	0.0003
5	Hardness	200-500	5250	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.005	mg/L	AAS	0.001
7	Phosphate	6.0	0.36	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	21000	mg/L	Multimeter	-
9	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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080207	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Deep Tube Well
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW-01)	Union:, Vill.:Karpasdanga
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.042	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	36	mg/L	CRM	4.0
3	Hardness	200-500	1200	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Phosphate	6.0	4.62	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	1300	mg/L	Multimeter	-
7	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	Alam 07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080208	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Deep Tube Well
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW-02)	Union:, Vill.:Rajnagar
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

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	Chemical Oxygen Demand (COD)	4.0	28	mg/L	CRM	4.0
3	Hardness	200-500	190	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
5	Phosphate	6.0	1.0	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	350	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

Comments: Sample was collected & supplied by client.
N.B: AAS - Atomic Absorption Spectrophotometer, UVS - UV-Visible Spectrophotometer, 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	07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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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Government of the People's Republic of Bangladesh
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Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 228/ CC, DPHE, CL, Dhaka

Date: 07-09-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023080209	Sample Receiving date: 13-06-2023
Ref. Memo No: 42.06.2626.119.37.001.23-02315 & Dated: 12-06-2023	Sample Source: Deep Tube Well
Sent by:Mohammed Mukteruzzaman ,Director (in charge) Sr.Specialist , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW-03)	Union:, Vill.:Project Site
Sample Collection date:	Date of Testing: 13/06/2023-13/08/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.005	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	32	mg/L	CRM	4.0
3	Hardness	200-500	237	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Phosphate	6.0	1.8	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	890	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

Comments: Sample was collected & 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	07.09.2023	1.) Name: Mita Sarker Designation: Senior Chemist	07/09/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	07.09.2023	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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পরিবেশ বিজ্ঞান ডিসিপ্লিন খুলনা বিশ্ববিদ্যালয়

Environmental Science Discipline

Khulna University

Sample analysis Feb 2023 and July 2023 (sample 1 and 2 accordingly):

Experiment point	Total species diversity/L	*Individual number of species/L*	Abundance(n/L)		Abundance(n/L)	Benthos	Abundance(n/L)
		Phytoplankton		**Zooplankton**			
Pashur Con.	9	*Oscillatoria princeps*	656			*Chroomonascoerulea*	76
		Raphidiopsis mediterranea skuja	456			*Raphidiopsis mediterranea skuja*	67
		Rhodophyta sp	555			*Nitzschia longissimi*	
		Spirogyra sp	345			Unidentified sp	13
		Eudorina sp	567				
Harberia	11	*Coscinodiscus wailesii*	291			*Oscillatoriaprinceps*	69
		Actinocyclusoctonarius	1163			*Pinnularia brevicostata*	456
		Asterolampramarylandica	436				
		Pseudo-nitzchia australis	1000				
		Eudorina	73				
		Coscinodiscus granii Gough	290				
		Coscinodiscus centralis	16				
		Coscinodiscus excentricus	364				
		Coscinodiscus oculus	146				
Hiron point	7	*Coscinodiscus excentricus*	131			polychaeta	467
		Lyngbyaconfervoides	80			Unidentified	23
		Rhizosolenia setigara	50				
		Asterionellopsis glacialis					
		Oscillatoriaprinceps	385				
Akram point	12	*Nitzschia sigma*	345			Polychaeta	
						Mollusk	345
		Thalassionema sp.	567				
		Pleurosigma angulatum	456				
		Coscinodiscus excentricus	234				
		Anabaena flos-aquae	345				

		Thalassionema sp.	567				
		Pleurosigma angulatum	345				
		Rhizosolenia setigara	556				
		Licmophora sp	456				
		Pseudonitzschiapungens	450				
Koidaskathi		*Coscinodiscus excentricus*	36				
		Gyrosigmaacuminatum	255				
		Pleurosigma angulatum	1045				
		Ceratium sp.	299				
		Gonatozygonaculeatum	359				
		Pleurosigmaangulatum	205				
		P. micans	2130				
		Pinnularia	288				
		Oscillatoriaprinceps	429				
		Coscinodiscus oculus	289				
Jetty	3	*Closteriopsis longissimi*	300				
		Entomoneis	759				
		Boreadinium	163				
Maidarakhal	10	*Coscinodiscus granii Gough*	342				
		Pleurosigma angulatum	170				
		Pyrocystis fusiformis	220				
		Eudorina	600				
		Coscinodiscus excentricus	160				
		Staurastrum	457				
		Pleurosigma diverse-striatum	147				
		Alexandriumcyst	900				
		Gyrosigmaacuminatum	110				
		Nitzschia longissimi	806				
Kheleker ber	10	Oscillatoria princeps	2604				
		Closterium tumidum	155				
		Coscinodiscus granii Gough	80				
		Euastrum gemmatum	635				
		Gonatozygon aculeatum	736				
		Pediastrum duplex	387				
		Phacus longicauda	110				
		Protoperidinium cyst	287				
		Snowella lacustris	174				
		Spirogyra	669				

July Sample 1	Diversity	*Phyto Plankton*	Abundance/L	Zooplankton	Abundance /L	Benthos	Abundance /L
Kheleker ber	19		Abundance/L			Benthos	
		Oscillatoria princeps	2604			Bosmina sp.	333
		Closterium tumidum	155			Brachionus quadridentatus	456
		Coscinodiscus granii Gough	80			Calanus sp.	555
		Euastrum gemmatum	635			Cyclops sp. Larvae	560
		Gonatozygon aculeatum	736			Daphnia sp.	344
		Pediastrum duplex	387			Diaptomus sp.	2000
		Phacus longicauda	110			Keratella cochlearis	456
		Protoperidinium cyst	287			Lecane unguita	1090
		Snowella lacustris	174			Lepadella sp	345
		Spirogyra	669				
P.P.Jetty	4	*Closteriopsis longissimi*	450			Polychaeta	500
		Entomoneis	323				
		Boreadinium	123				
Koighardaskathi pond	13	*Oscillatoria princeps*	18999			Polychaete larvae	457
		Lyngbya confervoides	456				
		Coscinodiscus granii Gough	1000				
		alexandrium catenella	667				
		coscinodiscus radiatus	6789				
		Oscillatoria limosa	3456				
		Astasia cylindrical Pringsheim	455				
		chroomonas coerulea	789				
		Alexandriumcyst	3667				
		pinnularia brevicostata	456				
		raphidiopsis mediterranea skuja	2345				
		Euglena acus	666				
July Sample 2							
Mongla	3	Eudorina	1232			Polychaete larvae	920
		Oscillatoria princeps	249				
Harbaria	5	Zygabikodinium lenticulatum	456			Polychaete larvae	670
		Raphidiopsis mediterranea skuja	1067				
		Oscillatoria limosa	867				
		Coscinodiscus excentricus	433				

Akram point	14	*Thalassionema sp.*	367			Polychaeta larvae	1090
		Pleurosigma angulatum	256				
		Coscinodiscus excentricus	230				
		Anabaena flos-aquae	245				
		Thalassionema sp.	467				
		Pleurosigma angulatum	545				
		Rhizosolenia setigara	350				
		Licmophora sp	234				
		Pseudonitzschiapungens	432				
		Coscinodiscus excentricus	120				
		Gyrosigmaacuminatum	230				
		Pleurosigma angulatum	890				
		Ceratium sp.	234				
Pashur Con.	4	*Oscillatoria princeps*	460			*Chroomonascoerulea*	800
		Raphidiopsis mediterranea skuja	770			*Raphidiopsis mediterraneaskuja*	78

02.12.2023

(Dr. Salma Begum)

Professor
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Environmental Laboratory

Memo No. ELAB202309003260 **Date: 09/10/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_001 Experiment Date: (24-25)/08/2023

Location: 89°33' 13.7"E; 22° 35' 43"N; Maitree Township Area, Khulna

Experiment Time:10: 00 AM to 10:00 AM Downloaded Date:11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-01	1440	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	28.30	150	150
02		1440	Fine particulate matter ($PM_{2.5}$)		µg/m³	25.70	65	75
03		1440	Suspended Particulate matter (SPM)		µg/m³	24.23 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.162	05	-
05		1440	Sulphur dioxide (SO_2)		µg/m³	7.57	80	120
06		1440	Oxide of Nitrogen (NO_X)		µg/m³	30.51	80	200
07		480	Ozone (O_3)		µg/m³	18.58	100	-

Test Performed by & checked by
Name: Md. Rafiqul Islam
Designation: Research Associate & Scientific Instrument In-Charge (addl.)
Signature: 22.11.23

Compiled & Approved by
Name: Md. Rafiqul Alam
Designation: Laboratory Expert
Signature: 22.11.2023

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Environmental Laboratory

Memo No. ELAB202309003261 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_002 Experiment Date: 25/08/2023

Location: 89°35'16.49"; 22°34'37.11"N; Access Road bridge area or Taltola Bazar/BIFPCL (Project)

Experiment Time: 11: 00 AM to 19:00 PM Downloaded Date:11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-02	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	33.23	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	28.36	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	27.24 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.213	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	4.64	80	120
06		480	Oxide of Nitrogen (NO_X)		µg/m³	26.49	80	200
07		480	Ozone (O_3)		µg/m³	18.65	100	-

Test Performed by & Checked by
Name: Md. Rafiqul Islam
Designation: Research Associate & Scientific Instrument In-Charge (addl.)
Signature: 22.11.23

Compiled & Approved by
Name: Md. Rafiqul Alam
Designation: Laboratory Expert
Signature: 22.11.2023

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Environmental Laboratory

Memo No. ELAB202309003262 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_003 Testing Date:26/08/2023

Location: 89°31'24.2"E; 22°36'6.7"N; Chalna Bazar Area, Dacope

Experiment Time: 12: 00 PM to 20:00 PM Downloaded Date:11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-03	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	54.87	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	45.44	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	43.77 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.370	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	12.22	80	120
06		480	Oxide of Nitrogen (NO_x)		µg/m³	28.75	80	200
07		480	Ozone (O_3)		µg/m³	18.41	100	-

Test Performed by & Checked by
Name: Md. Rafiqul Islam
Designation: Research Associate & Scientific Instrument In-Charge (addl.)
Signature: 22.11.23

Compiled & Approved by
Name: Md. Rafiqul Alam
Designation: Laboratory Expert
Signature: 22.11.2023

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Environmental Laboratory

Memo No. ELAB202309003263 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_004 Experiment Date: 27/08/2023

Location: 89°33'34.5"E; 22°34'33.8"N; South-West corner of the project Boundary, Moidara

Experiment Time: 12: 00 PM to 19:00 PM Downloaded Date:11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-04	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	67.47	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	53.38	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	52.28 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.4385	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	3.044	80	120
06		480	Oxide of Nitrogen (NO_x)		µg/m³	30.46	80	200
07		480	Ozone (O_3)		µg/m³	21.77	100	-

Test Performed by & checked by
Name: Md. Rafiqul Islam
Designation: Research Associate & Scientific Instrument In-Charge (addl.)
Signature: 22.11.23

Compiled & Approved by
Name: Md. Rafiqul Alam
Designation: Laboratory Expert
Signature: 22.11.2023

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Environmental Laboratory

Memo No. ELAB202309003264 **Date: 21/09/2023**

Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_005 Experiment Date: 28/08/2023

Location: 89°32'3.8"E; 22°36'32.5"N; Propose Township area near Chimney location, Sapmari.

Experiment Time: 11: 00 AM to 19:00 PM Downloaded Date: 11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-05	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	54.76	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	44.65	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	43.17 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.282	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	7.21	80	120
06		480	Oxide of Nitrogen (NO_X)		µg/m³	33.00	80	200
07		480	Ozone (O_3)		µg/m³	21.83	100	-

Test Performed by & checked by
Name: Md. Rafiqul Islam
Designation: Research Associate & Scientific Instrument In-Charge (addl.)
Signature: 22.11.23

Compiled & Approved by
Name: Md. Rafiqul Alam
Designation: Laboratory Expert
Signature: 22.11.2023

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Memo No. ELAB202309003265 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_006 Experiment Date: 29/08/2023

Location: 89°33'51.8"E; 22°36'1.06"N; North west corner of the project boundary (Koigardas Kathir Char)

Experiment Time: 10: 00 AM to 18:00 PM Downloaded Date: 10/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-06	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	58.91	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	46.66	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	45.76 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.234	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	6.60	80	120
06		480	Oxide of Nitrogen (NO_X)		µg/m³	41.60	80	200
07		480	Ozone (O_3)		µg/m³	20.39	100	-

Test Performed by & checked by
Name: Md. Rafiqul Islam
Designation: Research Associate & Scientific Instrument In-Charge (addl.)
Signature: 22.11.23

Compiled & Approved by
Name: Md. Rafiqul Alam
Designation: Laboratory Expert
Signature: 22.11.2023

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Environmental Laboratory

Memo No. ELAB202309003266 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_007 Experiment Date: 30/08/2023

Location: 89°34'01.1"E; 22°32'3.3"N; Bauja Union 4km south west from the chimney location

Experiment Time: 10:00 AM to 18:00 PM Downloaded Date: 11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-07	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	73.88	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	59.21	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	57.88 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.442	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	19.42	80	120
06		480	Oxide of Nitrogen (NO_x)		µg/m³	38.37	80	200
07		480	Ozone (O_3)		µg/m³	22.38	100	-

Test Performed by & checked by
Name: Md. Rafiqul Islam
Designation: Research Associate & Scientific Instrument In-Charge (addl.)
Signature: 22.11.23

Compiled & Approved by
Name: Md. Rafiqul Alam
Designation: Laboratory Expert
Signature: 22.11.2023

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Environmental Laboratory

Memo No. ELAB202309003267 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_008 Experiment Date: 31/08/2023

Location: 89°34'37.7"E; 22°38'51.8"N; Barni, Gaurambha 4 KM North-West from the Chimney location

Experiment Time: 11:00 AM to 19:00 PM Downloaded Date: 11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-08	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	65.17	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	52.33	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	50.75 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.221	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	8.82	80	120
06		480	Oxide of Nitrogen (NO_x)		µg/m³	34.68	80	200
07		480	Ozone (O_3)		µg/m³	22.45	100	-

Test Performed by & checked by
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Signature: 22.11.23

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Name: Md. Rafiqul Alam
Designation: Laboratory Expert
Signature: 22.11.2023

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Environmental Laboratory

Memo No. ELAB202309003268 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_009 Experiment Date: 01/09/2023

Location: 89°35'35.5"E; 22°46'36.8"N; Khulna Khan Jahan Ali Bridge near toll plaza area

Experiment Time: 10:00 AM to 18:00 PM Downloaded Date:11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-09	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	99.54	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	86.08	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	81.37 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.572	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	22.14	80	120
06		480	Oxide of Nitrogen (NO_x)		µg/m³	34.49	80	200
07		480	Ozone (O_3)		µg/m³	22.91	100	-

Test Performed by & checked by
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Signature: 22.11.23

Compiled & Approved by
Name: Md. Rafiqul Alam
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Environmental Laboratory

Memo No. ELAB202309003269 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_010 Experiment Date: 02/09/2023

Location: 89°35'50.4"E; 22°28'24.8"N; Mongla Port Area

Experiment Time: 09:00 AM to 17:00 PM Downloaded Date:11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-10	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	74.70	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	49.15	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	47.16 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.40	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	14.90	80	120
06		480	Oxide of Nitrogen (NO_x)		µg/m³	20.80	80	200
07		480	Ozone (O_3)		µg/m³	21.85	100	-

Test Performed by & checked by
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Signature: 22.11.23

Compiled & Approved by
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Designation: Laboratory Expert
Signature: 22.11.2023

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Environmental Laboratory

Memo No. ELAB202309003270 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_011 Experiment Date: 03/09/2023

Location: 89°35'34.2"E 22°17'43.1"N; Harbaria, Sundarban

Experiment Time: 07:00 AM to 16:00 PM Downloaded Date:11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-11	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	15.28	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	13.93	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	13.43 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.614	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	7.70	80	120
06		480	Oxide of Nitrogen (NO_x)		µg/m³	35.17	80	200
07		480	Ozone (O_3)		µg/m³	17.73	100	-

Test Performed by & checked by
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Signature: 22.11.23

Compiled & Approved by
Name: Md. Rafiqul Alam
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Environmental Laboratory

Memo No. ELAB202309003271 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_012 Experiment Date: 05/09/2023

Location: 89°27'53.2"E; 21°46'27.60"N; Hiron Point, Sundarban

Experiment Time: 06:00 AM to 14:00 PM Downloaded Date:11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-12	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	2.61	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	2.28	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	2.26 (Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.138	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	1.27	80	120
06		480	Oxide of Nitrogen (NO_x)		µg/m³	17.53	80	200
07		480	Ozone (O_3)		µg/m³	9.17	100	-

Test Performed by & checked by
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Signature: 22.11.23

Compiled & Approved by
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Environmental Laboratory

Memo No. ELAB202309003272 **Date: 21/09/2023**

Test Report
Analysis of Ambient Air

Project Name: Monitoring of Environmental Parameter & Implementation of EMP along with engineering activities during construction period of 2x660 MW MSTPP at Rampal, Bagerhat. Code: FPC008

Sample Type: Ambient Air Quality ID: FPC008_013 Testing Date: 06/09/2023

Location: 89°30'54.1"E, 22° '23.50"N; Akram Point (Sibsa River)

Experiment Time: 06:40 AM to 15:00 PM Downloaded Date:11/09/23

Pollutant Results:

SL. NO.	Sampling ID	Test Duration (min.)	Name of the Criteria Pollutants	Method	Unit	Concentration Present	Bangladesh (DoE) Standard	IFC/ World Bank Standard
01	AQ-13	480	Suspended Coarse Particulate matter (PM_{10})	Sensor based instrumentation	µg/m³	3.07	150	150
02		480	Fine particulate matter ($PM_{2.5}$)		µg/m³	2.63	65	75
03		480	Suspended Particulate matter (SPM)		µg/m³	2.59(Calculated value)	200 (ECR'97)	150
04		480	Carbon Monoxide (CO)		mg/m³	0.204	05	-
05		480	Sulphur dioxide (SO_2)		µg/m³	1.08	80	120
06		480	Oxide of Nitrogen (NO_x)		µg/m³	17.88	80	200
07		480	Ozone (O_3)		µg/m³	8.32	100	-

Test Performed by & checked by

Name: Md. Rafiqul Islam
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Signature: 22.11.23

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