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

35th Quarter Monitoring Report

Monitoring Period: November 2022 – January 2023

July 2023

Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212. Bangladesh. http://www.cegisbd.com

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

35th Quarterly Monitoring Report

Monitoring Period: November 2022 – January 2023

Acknowledgements

The Center for Environmental and Geographic Information Services (CEGIS) is indebted to Bangladesh-India Friendship Power Company (Pvt.) Limited (BIFPCL) for awarding the contract on "Monitoring of Environment Parameter and Implementation of environmental Management Plan During Construction Period Along with Engineering Activities for 2x660 MW Maitree Super Thermal Power Project at Rampal, Bagerhat." to CEGIS. The current document constitutes 35th quarterly monitoring aspects covering all the preselected parameters and locations as specified in EIA of Power plant as well as EIA of coal transportation.

CEGIS is Obliged to Mr. Habibur Rahman, Secretary, Power Division, Ministry of Power, Energy and Mineral Resources for his dynamic leadership in this sector. CEGIS is also grateful to Mr. Gurdeep Singh, Chairman, BIFPCL for his vibrant role and wise guidance in completing the study. CEGIS expresses its gratitude to Engr. Md Mahbubur Rahman, Chairman, Bangladesh Power Development Board (BPDB), for his continuous inspiration and support in all respect for conducting the study successfully. Moreover, CEGIS Team appreciates and acknowledges Engr. Sayeed Akram Ullah, Managing Director of BIFPCL for his kind considerations and anticipations. In addition, CEGIS is also thankful to Ravindra Kumar, Chief Technical Officer; and Kamlendra Kumar Sharma, GM-EMG, BIFPCL throughout the study period.

In addition, CEGIS is also grateful to the field officials of different Government and Non-Government Organizations (NGOs) for contributing and sharing their ideas and views towards the project activities and associated existing problems of the study area along with their suggestions for sustainable continuation of the project activities and associated issues regarding power plant construction.

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.

Table of Contents

Acknowledgements ... **i**

List of Tables ... **vi**

List of Figures ... **vii**

Abbreviations and Acronyms ... **xi**

Units ... **xiii**

Units Conversion Table ... **xv**

Glossary ... **xvii**

Executive Summary ... **xix**

1. Introduction ... **1**

1.1 Background ... 1

1.2 Objectives ... 1

1.3 Criteria for Selection of Monitoring Sites/Locations ... 1

1.4 Main Stakeholders ... 7

1.4.1 Forest Department ... 7

1.4.2 Department of Environment (DoE) ... 7

1.4.3 Bangladesh India Friendship Power Company (Pvt.) Limited (BIFPCL) ... 7

1.4.4 Local Community ... 7

1.4.5 Major Component of Monitoring Study ... 8

2. Physical Environment ... **9**

2.1 Air Quality ... 9

2.1.1 Methodology ... 9

2.1.2 Method of Sampling and Laboratory Testing ... 9

2.1.3 Pollution Sources in the Sundarbans ... 9

2.1.4 Monitoring Locations ... 9

2.1.5 Status of Air Quality ... 13

2.1.6 Findings ... 16

2.2 Noise Quality ... 16

2.2.1 Methodology ... 16

2.2.2 Noise in the study area ... 17

2.2.3 Locations of Noise Level Monitoring ... 17

2.2.4 Status of Noise ... 18

2.3 Water Quality ... 21

2.3.1 Methodology 22
2.3.2 Selection of Parameters 22
2.3.3 Surface Water Sampling Procedure 22
2.3.4 Water Quality Parameter Analysis Techniques/Methods 23
2.3.5 Water Quality Reporting Arrangement 29
2.3.6 Status of the Groundwater quality 38
2.4 Land and Agricultural Resources Monitoring 40
2.4.1 Methodology of land resources monitoring 40
2.4.2 Process of Soil Samples Collection 45
2.4.3 Status of soil quality of monitoring plots 45
2.4.4 Agriculture Resources Monitoring 55
2.4.5 Livestock Resources Monitoring 55
2.5 Water resources monitoring 55
2.5.1 Methodology 55
2.5.2 Collection and Processing of Images 55
2.5.3 Delineation of Banklines 55
2.5.4 Monitoring of Erosion & Accretion and Shifting of the Banklines 55
2.5.5 Tidal Water Level Data Analysis 57
2.6 Transportation Monitoring 59
2.6.1 Location of Traffic Survey 59
2.6.2 Methodology 59
2.6.3 Traffic Volume Calculation 59
2.6.4 Results of Monitoring 60
3. Biological Environment 63
3.1 Fisheries Resources 63
3.1.1 Methodology 63
3.1.2 Status of Monitoring 64
3.2 Monitoring of Ecosystem and Bio-diversity 80
3.2.1 Indicators Selection 80
3.2.2 Rationales for Selection of Locations 80
3.2.3 Terrestrial Ecosystem 80
3.2.4 Aquatic Ecosystem Monitoring 92
3.2.5 Status of benthos and planktons in river systems 99
3.3 Sundarbans Forest Health monitoring 102
3.3.1 Background 102

3.3.2 Methodology 102
3.3.3 Sampling Design of Permanent Sample Plots (PSPs) 107
3.3.4 Bio-Indicators for Forest Health Monitoring 108
3.3.5 Monitoring Result and discussion of SRF Health 112
4. Social Environment 123
4.1 Introduction 123
4.1.1 Methodology 123
4.1.2 Findings of Social Safeguard Monitoring 123
4.1.3 Autonomous Development due to MSTPP 129
4.1.4 Recommendations 129
5. Environmental Compliance 131
5.1 Introduction 131
5.2 Compliance to the Conditions of DoE (EIA study of Coal Transportation) 164
References 175
Appendix I: Checklist of Monitoring Environmental Compliances 183
Appendix II: Photo Album 191
Appendix III: Terms of References (ToR) 193
Appendix IV: Monitoring Data 199

List of Tables

Table 2.1: Air Quality Monitoring Plan 10

Table 2.2: Air Quality Monitoring Results (35th Quarterly Program) 15

Table 2.3: Noise Monitoring Plan 17

Table 2.4: Summary of the Ambient Noise Levels Recorded in Consecutive Monitoring Periods 21

Table 2.5: Testing Methodology of Water Quality Parameter 23

Table 2.6: Groundwater Quality Monitoring Parameters, Locations and Plan 24

Table 2.7: Surface Water Quality Monitoring Parameters, Locations and Plan 24

Table 2.8: Monitoring Sites and Characteristics 29

Table 2.9: Land Resources Monitoring Plan 41

Table 2.10: Vehicle Conversion Factors 59

Table 2.11: Calculated PCU in Three Locations at Three Different Time Period 60

Table 3.1: The Sampling Locations for Monitoring of Fisheries Resources 63

Table 3.2: Classification of habitat use of 10 sampling sites 67

Table 3.3: Site wise Rich Species Number (1st to 12th QM) 70

Table 3.4: Site wise Rich Species Number (13th to 35th QM) 71

Table 3.5: Site Wise Species Diversity using Shannon–Weiner Index (1st to 13th QM) 71

Table 3.6: Site Wise Species Diversity using Shannon–Weiner Index (14th to 35th QM) 72

Table 3.7: Stocking Pattern of Fish/Shrimp Farm 76

Table 3.8: Growth Rate and Mortality of Fish/Shrimp (1st to 17th QM) 77

Table 3.9: Growth Rate and Mortality of Fish/Shrimp (18th to 35th QM) 77

Table 3.10: Total Catch in Different Gears in the Sampling Sites 78

Table 3.11: Total Catch in the Sampling Sites 78

Table 3.12: Plant species composition of the sampled homesteads 83

Table 3.13: Proportion of healthy and unhealthy plants in studied homesteads 86

Table 3.14: Vegetation Canopy Cover in different studied homesteads 88

Table 3.15: Bird Nest Monitoring Datasheet 89

Table 3.16: Dolphin observation Datasheet 98

Table 3.17: Species composition and abundance of Benthos in different monitoring locations 100

Table 3.18: Species composition and abundance of Phytoplankton in different monitoring locations 100

Table 3.19: Species composition and abundance of zooplanktons 101

Table 3.20: General Description of Permanent Sampling Plots (PSPs) 103

Table 3.21: Classification of Wooden Debris 110

Table 3.22: Number of wood debris found in two different monitoring periods....117

Table 3.23: Species diversity index, evenness index and richness index of the monitoring site in SRF 119

Table 3.24: Mean carbon density in Baseline and Present condition of the four monitoring sites 120

Table 3.25: Phenological Behavior of Major Mangrove Species in the PSPs....120

Table 3.26: Observation of disease among the monitoring plots....121

Table 5.1: Monitoring of Environmental and Social Management System Action Plan Implementation 133

Table 5.2: Monitoring of Labor and Working Condition....139

Table 5.3: Monitoring of Community Health, Safety and Security....143

Table 5.4: Monitoring of Biodiversity and Sustainable Management of Living Natural Resources....147

Table 5.5: Status of Compliance to the Conditions of DoE....149

Table 5.6: Compliance conditions of DoE (EIA study of Coal transportation)....164

List of Figures

Figure 1.1: Location Map of the Study Area....3

Figure 1.2: AOI of Environmental and Socio-economic Monitoring....5

Figure 2.1: Acquisition of Air Quality Monitoring data....10

Figure 2.2: Air Quality Monitoring Locations....11

Figure 2.3: Seasonal Variation of the Air Quality Parameters....14

Figure 2.4: Dendogram of the Monitoring Stations using Euclidean Distance....16

Figure 2.5: Ambient Noise Acquisition during the monitoring period....17

Figure 2.6: Status of average seasonal variations of noise level at different monitoring locations....18

Figure 2.7: Noise Level Monitoring Locations....19

Figure 2.8: Status of noise level of 35th monitoring season at different locatons....21

Figure 2.9: Water sample (Surface water and groundwater) collection and Insitu Testing of Water Parameters....23

Figure 2.10: Surface Water and Groundwater Quality Monitoring Location....27

Figure 2.11: Variations in pH values in different monitoring sites....31

Figure 2.12: Variations in Temperature values in different monitoring sites....31

Figure 2.13: Variations in Salinity values in different monitoring sites....31

Figure 2.14: Variations in DO values in different monitoring sites....31

Figure 2.15: Variations in TDS values in different monitoring sites....31

Figure 2.16: Variations in TH values in different monitoring sites....31

Figure 2.17: Variations in TSS values in different monitoring sites ... 32
Figure 2.18: Variations in COD values in different monitoring sites ... 32
Figure 2.19: Variations in Nitrate values in different monitoring sites ... 32
Figure 2.20: Variations in Sulphate values in different monitoring sites ... 32
Figure 2.21: Variations in Phosphate values in different monitoring sites ... 32
Figure 2.22: Variations in Arsenic values in different monitoring sites ... 32
Figure 2.23: Variations in Lead values in different monitoring sites ... 33
Figure 2.24: Variations in G-pH values in different monitoring sites ... 33
Figure 2.25: Variations in G-Temperature values in different monitoring sites ... 33
Figure 2.26: Variations in G-Salinity values in different monitoring sites ... 33
Figure 2.27: Variations in G-DO values in different monitoring sites ... 33
Figure 2.28: Variations in G-TDS values in different monitoring sites ... 33
Figure 2.29: Variations in monsoon G-TSS values in different monitoring sites ... 34
Figure 2.30: Variations in monsoon G-TH values in different monitoring sites ... 34
Figure 2.31: Variations in G-COD values in different monitoring sites ... 34
Figure 2.32: Variations in G-Nitrate values in different monitoring sites ... 34
Figure 2.33: Variations in monsoon G-Sulphate values in different monitoring sites ... 34
Figure 2.34: Variations in monsoon G-Phosphate values in different monitoring sites ... 34
Figure 2.35: Variations in monsoon G-Arsenic values in different monitoring sites ... 35
Figure 2.36: Variations in monsoon G-Lead values in different monitoring sites ... 35
Figure 2.37: Land and Agricultural Resource Monitoring Locations ... 43
Figure 2.38: Changes of EC (dS/m) in wet seasons in sampling locations throughout the monitoring period ... 47
Figure 2.39: Changes of pH in wet seasons in sampling locations throughout the monitoring period ... 47
Figure 2.40: Changes of Organic matter (%) in wet seasons in sampling locations throughout the monitoring period ... 48
Figure 2.41: Changes of Nitrogen (%) in wet seasons in sampling locations throughout the monitoring period ... 48
Figure 2.42: Changes of Phosphorus (ppm) in wet seasons in sampling locations throughout the monitoring period ... 49
Figure 2.43: Changes of Sulfur (ppm) in wet seasons in sampling locations throughout the monitoring period ... 49
Figure 2.44: Changes of Potassium (meq/100g) in wet seasons in sampling locations throughout the monitoring period ... 50
Figure 2.45: Changes of Sodium (meq/100g) in wet seasons in sampling locations throughout the monitoring period ... 50

Figure 2.46: Changes of Calcium (meq/100g) in wet seasons in sampling locations throughout the monitoring period 51
Figure 2.47: Changes of Magnesium (meq/100g) in wet seasons in sampling locations throughout the monitoring period 51
Figure 2.48: Changes of Manganese (ppm) in wet seasons in sampling locations throughout the monitoring period 52
Figure 2.49: Changes of Zinc (ppm) in wet seasons in sampling locations throughout the monitoring period 52
Figure 2.50: Changes of Boron (ppm) in wet seasons in sampling locations throughout the monitoring period 53
Figure 2.51: Changes of Iron (ppm) in wet seasons in sampling locations throughout the monitoring period 53
Figure 2.52: Changes of Lead (ppm) in wet seasons in sampling locations throughout the monitoring period 54
Figure 2.53: Changes of Cadmium (ppm) in wet seasons in sampling locations throughout the monitoring period 54
Figure 2.54: Riverbank erosion and accretion of the Passur River from July 2022 to May 2023 56
Figure 2.55: Peak water level at Hiron Point and Mongla Port for the period from July 2022 to December 2022 57
Figure 2.56: Process of calculation of lag time & peak attenuation during the period July-September 2022 58
Figure 2.57: Peak water level at Hiron Point and Mongla Port for the period from October to December 2022 58
Figure 2.58: Locations of Traffic Survey 61
Figure 3.1: Fisheries Resources Monitoring Locations 65
Figure 3.2: Habitat classification on the basis of different life stages of fish species 69
Figure 3.3: Dendogram showing similarity in binary species composition in three sampling sites 69
Figure 3.4: In-situ catch observed in the sampling site 74
Figure 3.5: Site-wise fish species richness (FSR) in the Passur River System 74
Figure 3.6: Habitat Distribution of Different Life Stages of Fish Species 75
Figure 3.7: Relative abundance of major migratory fish species in sampling sites 75
Figure 3.8: Migration extent of major migratory fish species in sampling sites 76
Figure 3.9: Fishing gears observed during 35th quarterly monitoring 79
Figure 3.9: Overviews of the monitoring site of Rajnagar 85
Figure 3.10: Occurrence of dolphins in Passur and Maidara River along the project site 95
Figure 3.11: Location of dolphin occurrences in Dhangmari Khal 97
Figure 3.12: Location of dolphin occurrences in Chandpai 97
Figure 3.13: Location of dolphin occurrence in Bhadra Khal 98

Figure 3.14: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)........105
Figure 3.15: Layout of the subplots and transect line perpendicular from ecotone (river or canal bank 107
Figure 3.16: Layout of the Survey Activities in each Subplot........107
Figure 3.17: Team members measuring tree DBH and Height in the Plot........108
Figure 3.18: Team member taking canopy cover and light intensity using Densitometer and Lux meter 109
Figure 3.19: Flowering at Sundari at Akram point........111
Figure 3.20: Fruiting at Amoor at Sutarkhali........111
Figure 3.21: Dying branches on one side of crownat Karamjol........112
Figure 3.22: Spots or bumps on Passur leaves at Harbaria........112
Figure 3.23: Mean seedlings density among the yearly surveys in five PSPs........113
Figure 3.24: Mean Pneumatophores Density among the yearly surveys in five PSPs........114
Figure 3.25: Mean Crabhole Density among the yearly surveys in five PSPs........115
Figure 3.26: Mean Canopy coverage % among the yearly surveys in five PSPs........116
Figure 3.27: Mean LAI % among the yearly surveys in five PSPs........117
Figure 3.28: Mean carbon density variation in two different monitoring periods in five PSPs........118
Figure 4.1: Discussion with local stakeholders........124
Figure 4.2: Socio-Economic Environment Monitoring Location........125
Figure 4.3: Unsafe asbestos management........127
Figure 4.4: Improper management of construction debris........127
Figure 4.5: RO treatment and filtering system installation in the study area........128
Figure 4.6: Medical Campaign from November 2022 to January 2023........128
Figure 4.7: Award giving ceremony of freedom fighters and family members........129

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 35th quarterly monitoring report covers the status of EMP (Environmental Management Plan) implementation for the concurrent period (during construction stage) as recommended in the EIA (Environmental Impact Assessment) study of power plant vide Memo No: DoE/Clearance/5062/2011 dt. 05/08/2013 as well as EIA report of Coal Transportation vide Memo No: DoE/Clearance/5532/2016 dtd.31/01/2018. During the month of January, 2023 CEGIS team carried out the monitoring activities covering every monitoring aspects as assigned in the ToR (Terms of Reference) and approval conditions of DoE along with valuable suggestions and recommendations from different national and international organizations. In other words, the aspects can briefly be addressed as monitoring of the Environmental Compliances and monitoring of the selected environmental parameters such as ambient air quality, noise level, water quality, land resource, traffic management status, water resources management status, agricultural resources monitoring, fisheries resources, Socio-economic monitoring, aquatic & terrestrial ecosystem monitoring and the Sundarbans Reserve Forest (SRF) health monitoring.

However, the present environmental compliance monitoring includes the status of EMP implementation based on physical observation, investigation and interviews/discussion to the proponents, 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 35th 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.
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.
5. Coal Conveyor belt from jetty area to 1st Transportation Point (About 20 to 25 m) found 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.

On the other hand, during the monitoring period, the concentration of major air pollutants was found comparatively lower in the Sundarbans area than that of the other monitoring locations. Seasonal effect the concentration of the particulate matters ($PM_{2.5}$, PM_{10} and SPM) has been found to be slightly higher at Khan Jahan Ali Bridge area comparing to the standards set by DOE (Air pollution control rules, 2022). On the contrary, the concentration of SO_2, & NOx which found to be higher in monsoon periods and CO concentration was found higher in post monsoon seasons. However, major sources of criteria pollutants generation in and around the project site as observed were the piling activities, digging, tunneling and burrowing works, jetty erection activities, major construction works, dust from unpaved roads and vehicle movement, construction materials and goods transportation activities through the roads and river Passur etc. Other sources of pollutants which may contribute to the existing pollution load are the small industries like cement works and refinery industries etc., diffuse sources like wood stoves, fires and wind generated dust etc.

In course of noise level monitoring, noise generation activities were observed to be higher in mongla port and mongla ghat area than in Khan Jahan Ali bridge area followed by power plant adjascent area i.e. Maidara, Koigordashkatir char, bajua and shapmari area. On the other hand, lowest noise level has been observed in the Sundarbans reserve forest area and completely complied with the Noise Control Rules 2006 the noise generation sources in the study area can mainly be divided into two types; one is natural and the other one is anthropogenic. Natural sources of noise generation were birds' chirping, stormy wind, wave breaking on the shoreline, howling of leaves and so on. On the other hand, traffic mobilization, industrial activities, vessels movement within the rivers and local vehicles were the anthropogenic sources of noise. However, the observed noise level was not found to exceed the Bangladesh standard limit of noise.

The physico-chemical properties of Passur River changes with the tidal intrusion in different seasons. During 35th quarterly monitoring, pH was found slightly basic in nature. Salinity, Temperature and Dissolved oxygen level was found in fair and favourable for the aquatic life forms. During the last post-monsoon, 2022, TDS and TH has been relatively same with respect to the same seasons of last consecutive years. Nitrate (NO_3^-) and Phosphate level remained relatively lower. Sulphate was found relatively higher than the previous post monsoon periods. In case of metal pollution, no 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 for aquaculture. 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. In course of groundwater quality, the condition is still in good with slight variation in pH and salinity. The reason being saline water intrusion and infiltration due to excessive withdrawn of groundwater by the surrounding communities during the dry season. During the monitoring tier As concentration was found breaching the national water quality standard for two times at Kapashdanga. In addition, evaporation also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes in salinity. Chemical characteristics of the groundwater quality are also found relatively good comparing to the standards set in ECR'2023.

Again, 35th monitoring soil analysis report represents the samples collected in 34th monitoring which is considered as wet season. Decrease of soil salinity is the major observation during this monitoring. Organic matter concentration increased in all locations except Bidyarbon. Among the base cation, monovalent cation (NA and K) concentration has mostly decreased in all locations. Zn concentration increased in all locations while others elements concentration reduced. Pb and Cd concentrations has been found to be higher than the previous monitoring year, but still remained within the permissible limit.

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 35-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 08 sites as fishing in other sites in the river were not observed. Amongst the effective sites, five (05) were in the river and three (03) were in the country side (shrimp farms. The followings are the key findings of the 35th quarter monitoring in the fiscal year of 2022-23. 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 and 2021-22), 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 analysing 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) ground for maturation and feeding. Shannon-Weiner diversity index has also been observed to vary between 35-quarter with that of all previous quarters. Highest Shannon-Weiner index was found at Akram Point (0.58) indicating high evenly distributed fish species. On the contrary, lowest evenness was found at Mongla Point (0.20). However, maximum FSR was obtained at Akram point (n=13), while very low FSR was recorded at Charaputia (n=03). Among the habitats in down-stream of the Passur River system, Akram point was home to rich assemblage of Chaka Chingri, Datina and Paissa, Haldikhali was rich of Chali Chingri, Golda and Paissa, Charaputia was rich assemblage of Golda and Gagra Tengra, Harbaria was rich of Golda, Gagra Tengra and Datina. Fish species like Paissa, Khorolla, Amadi and Phesa attain the maximum abundance among the migratory fish species. Moreover, among the migratory species, Paissa, Gagrat Tengra, Datina, Bele and Banshata were observed to migrate long distance. In this monitoring, the highest productivity was found at Akram point followed by Harbaria. The present study revealed that the highest catch susceptibility was also found in case of Charpata Jal (16.5 kg/haul).

Vegetation composition, plant diversity, vegetation canopy status, plant health, bird habitat status, dolphin occurrence, benthos and plankton in aquatic ecosystems have been monitored for this monitoring season. A total of 38 tree species were recorded from all the monitoring sites with Shanon-Winner diversity index of 1.58 which denotes the diversity deteriorated than previous monitoring tier. One monitoring sites shows drastically drop of plant health due to an effect from land development by the sand. Accordingly, Canopy status at this site revealed significant change comparing the same seasonal monitoring in last year. None of the site recorded any nests of resident avifauna.

Occurrences of dolphin in Passur-Maidara River revealed improving trend and significantly at all the sites than previous monitoring and this may be due to abundance of fishes and stringent of fishing activities within the restricted khals. A total of 41 phytoplankton and only three zooplankton species and three types of benthos has been recorded from the Passur river system and inland ponds.

In light of Rampal Power plant installation, the authority took initiative to monitor Sundarbans forest health periodically along the Passur River.In the permanent sample plots (PSPs) along the Passur River, many bio-indicators including tree growth, species diversity, seedling regeneration capacity, pneumatophore occurrence, crab hole density, canopy cover changes, Leaf Area Index, leaf phenology, pest and disease observations were made throughout time. Following Gewa (Excoecaria agallocha), Sundari (Heritiera fomes), and Kakra (Bruguiera gymnorrhiza) as the leading species among all PSPs, according to monitoring results. Compared to the rest of PSP' s canopy cover percentage, Akram Point' s canopy cover was lower. Seedling and crab hole density among the studied plot was mostly similar and shows a slightly increasing trend. The highest density of seedlings was recorded during the 5th and 6th years in all plots compared to the baseline period. However, the monitoring results of this period have revealed that the number of seedlings at all points was lower than the previous year. This may be attributed to unfavourable conditions and high natural stresses that have limited the growth of the seedlings. the pneumatophore density in these five locations has fluctuated over time, with some experiencing growth and others experiencing decline. On the other hand, Hiron point has the lowest crab hole density among the five monitoring sites. This may be attributed to the fact that the first subplot in this area is always carpeted by sandy soil, which could disturb crab activity and cause them to dig their holes deeper inside the forest floor where it is not being disturbed by the sand. This could result in lower crab hole density in the first subplot of Hiron point. there has been an increase in the amount of carbon stored in all the locations in the present status compared to the baseline status of all PSPs. The Sundarbans forest health is being monitored quarterly as per monitoring schedule and thirty fifth (35^{th}) surveys were conducted at Five locations. Due to the first subplot of Hiron Point's sandy soil's heavy silting and constant washout from the forest floor, a new subplot has been taken into account to evaluate the area 39;s genuine status..

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. 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;

c. It is required to installed a grievance box in the main gate of the project office and establish a grievance redress committee (GRC) to monitor and solve the problem (especially during selecting beneficiaries for providing any services from the MSTTP) of localities regarding the aspect of construction activities of MSTTP;

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

e. 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;

f. 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.

g. Plantation program should be re-initiated to complete the targeted volume of the plantation before initiating the full phase of operational activities and it is under the condition of DoE for ensuring greenery effect; CSR activities should be performed primarily among the PAPs on equitable manner. This should be audited by a third party monitoring team;

h. River water should be used for dust suppression activities and ground water use should be prohibited in this regard;

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

j. Mindset of local people have been changed and people are more positive about the project. To increase more awareness, it is required to arrange some consciousness program in which they can be more aware about how this power plant will be operated and how this project will be beneficial for the local people;

k. It is required to arrange program at local schools, colleges and UP offices about the operation and impact of the power plant to disseminate the progress of the project and create more awareness about the MSTPP;

l. Installation of the ROs for ensuring safe and quality drinking in different location of the project surrounding is well accepted to the villagers, but it should have sufficient need assessment for selecting the installation location;

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, in January, 2023 CEGIS team has carried out the 35th quarterly monitoring activities covering all the preselected monitoring parameters.

1.2 Objectives

The prime objectives of the study are:

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

1.3 Criteria for Selection of Monitoring Sites/Locations

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

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

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

Figure 1.1: Location Map of the Study Area

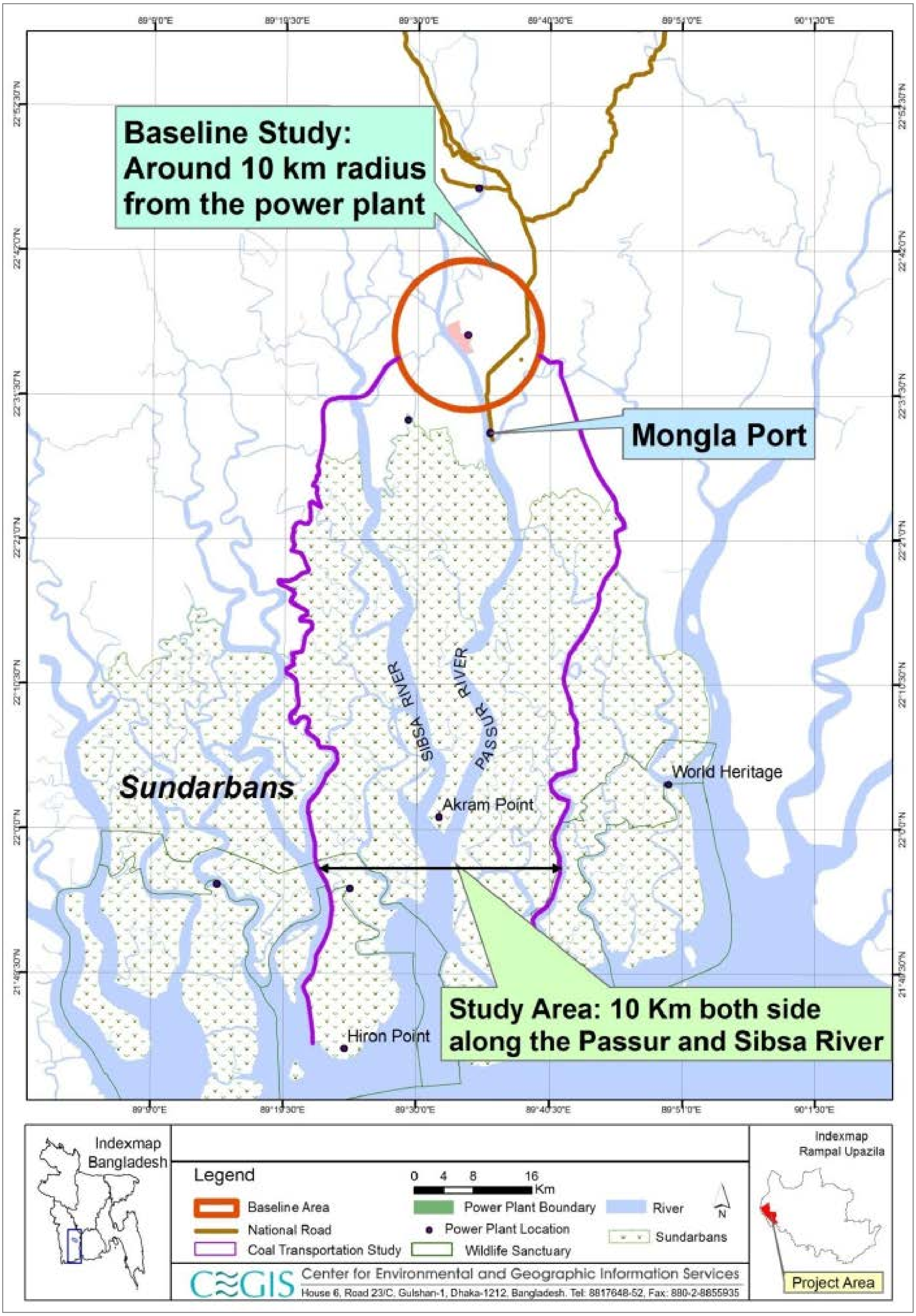


Figure 1.2: AOI of Environmental and Socio-economic Monitoring

1.4 Main Stakeholders

1.4.1 Forest Department

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

- Inclusion of a Soil Scientist and a Botanist in the monitoring team,
- Monitoring of regeneration, in growths (seedlings), diseases and pests (if necessary, to carry out laboratory analysis),
- Monitoring of soil nutrients (macro, micro) and heavy metals,
- Monitoring of floral diversity, species richness and 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 35th 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.

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.

2.1.2 Method of Sampling and Laboratory Testing

In order to collect the air samples from the selected sites, Respirable Dust Sampler (Model-Envirotech India APM-460 BL) and Fine Particulate Sampler (Model-Envirotech India APM-550) were used. On the other hand, the $PM_{2.5}$, PM_{10}, and SPM were tested by gravimetric method and the concentration was analysed by West-Gaeke method. Likewise, the concentration of NO_2 was tested by Jacob and Hochheiser method. Moreover, the concentration of Carbon Monoxide (CO) and Ozone (O_3) were measured by Metravi CO-10 meter and Tongdy O_3 Monitor respectively.

2.1.3 Pollution Sources in the Sundarbans

The key sources of air pollution 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**.

2.1.4 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	Method of testing $PM_{2.5}$: Gravimetric
2		Proposed township area near Chimney location, Mauza: Sapmari Katakhali.	89°32'3.8"E; 22°36'32.5"N		Method of testing PM_{10}: USEPA (1997) Method 201 or 201A (as appropriate)
3		North West corner of the Project boundary (Kaigar Daskati)	89°33'51.8"E; 22°36'1.06"N		Method of testing SO_X: USEPA (2000) Method 6 or 6A or 6B or ISO (1998)
4		Barni, Gaurambha Union (4km North East from the chimney location)	89°34'37.7"E; 22°38'51.8"N		Method 11632 (as appropriate)
5		Chunkuri-2, Bajua Union (4km South West from the chimney location)	89°34'01.1"E; 22°32'3.3"N		Method of testing NOX: USEPA (2000) Method 7, 7A, 7B, 7C, 7D, or ISO (1993) Method 10396 (as appropriate).
6		Pankhali, Dacope, (4km North West from the Chimney location)	89°31'24.2"E; 22°36'6.7"N		
7		Mongla Port Area	89°35'50.4"E; 22°28'24.8"N		
8		Harbaria, Sundarbans	89°35'34.2"E 22°17'43.1"N		
9		Akram point, Sundarbans	89°30'54.1"E 22° '23.50"N		
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 Air Quality Monitoring data

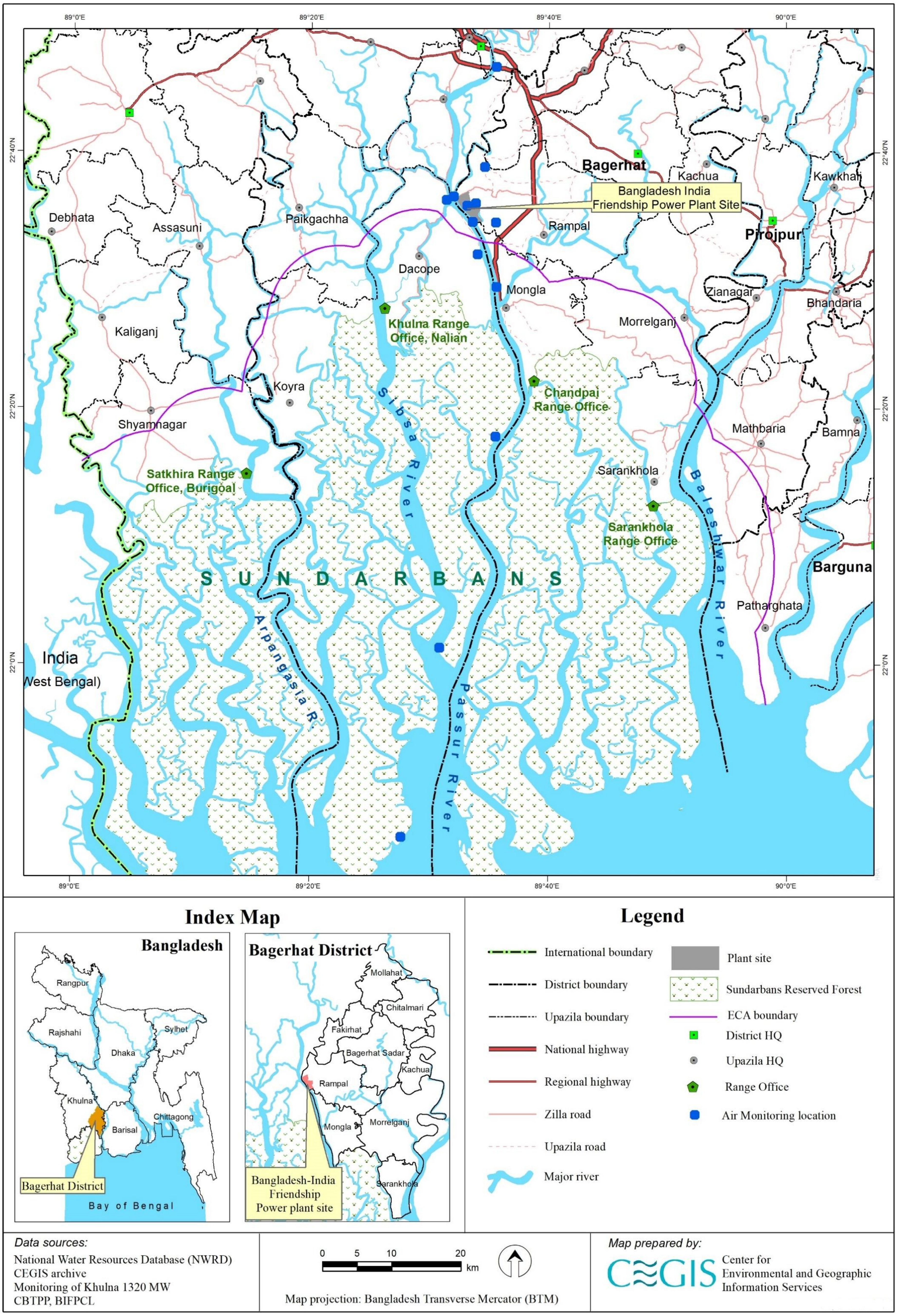


Figure 2.2: Air Quality Monitoring Locations

2.1.5 Status of Air Quality

During this monitoring tier, the maximum value (59.24µg/m3) of PM2.5 was found at Township area whereas the minimum value (35.19 µg/m3) was recorded at Harbaria of Sundarbans. On the other hand, the concentration of PM10 was found highest (97.62 µg/m3) at Akram point area the and lowest (42.07 µg/m3) at the Harbaria of Sundarbans area. The concentration of SPM was also found highest (161.53 µg/m3) at Bajua area the and lowest (85.63 µg/m3) at the Harbaria.

However, the concentration of Sulphur dioxide (SO2) in ambient air was found lower than the Bangladesh standard limit of (80µg/m3) at all the sampling locations. Among those, the maximum concentration (26.24 µg/m3) was found at Bajua area while the minimum concentration (11.09 µg/m3) was recorded at Access road/Taltola bridge area. Similarly, the values of NOx were also observed well below than the Bangladesh standard value of 80 µg/m3. though the maximum concentration (31.59 µg/m3) of NOx was also found at Bajua area whereas the lowest concentration (15.72 µg/m3) was recorded at SHapmari area i.e. North East corner of the project boundary. The contributor of such NOx emission may be from local human hauler, car, bus etc. Moreover, the maximum values of CO (0.9 mg/m3) and O3 (63 µg/m3) were found at Bajua area and Akram point 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 35th 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 SO_2, & NOx which found to be higher in monsoon periods and CO concentration was found higher in post monsoon seasons at Khan Jahan Ali Bridge. It can be mentioned here that the concentration was always observed to be much lower in SRF area than the other areas and never exceeded comparing to the standards set by DoE (ECR, 1997) (**Figure 2.3**).

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 (35th Quarterly Program)

Sl. No.	Location	Parameters						
		$PM_{2.5}$	PM_{10}	SPM	SO_2	NOx	CO	O_3
		(μg/m³)	(μg/m³)	(μg/m³)	(μg/m³)	(μg/m³)	(mg/m³)	(μg/m³)
1	South-West corner of the project Boundary, Moidara	39.63	57.26	109.27	10.18	17.64	0.6	19
2	Propose Township area near Chimney location, Mouza-Sapmari Katakhali	49.63	58.48	123.62	16.71	25.45	0.4	14
3	North west corner of the project boundary (Koigardas Kathir Char)	46.32	64.18	139.24	14.66	21.43	0.2	13
4	Barni, Gaurambha Union 4 KM North-West from the Chimney location	41.59	64.71	111.39	13.88	20.31	0.1	33
5	Bauja Union 4km south west from the chimney location	30.22	39.66	77.36	10.52	18.03	0.1	14
6	Chalna Bazar Area, Dacope	48.3	74.05	138.51	15.42	22.14	0.6	24
7	Mongla Port area	58.46	93.43	170.28	21.41	34	1.9	59
8	Harbaria, Sundarban	53.98	76.18	142.09	12.37	20.41	0.3	41
9	Akram Point (Sibsa River)	35.35	50.14	99.42	11.06	18.2	1	19
10	Hiron Point, Sundarban	57.2	89.22	164.2	16.82	27.87	0.5	28
11	Khulna Khan Jahan Ali Bridge near toll plaza area	63.57	92.2	169.49	21.71	36.56	1.6	64
12	Padma Abashan area	61.47	84.89	158.26	23.49	39.35	1	49
13	Taltola Bazar/BIFPCL (Project)	42.84	71.49	127.77	13.27	20.63	1.1	14
Std* (Air pollution Control Rules, 2022)		**65**	**150**	**200 (ECR'97)**	**80**	**80**	**5**	**100**

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

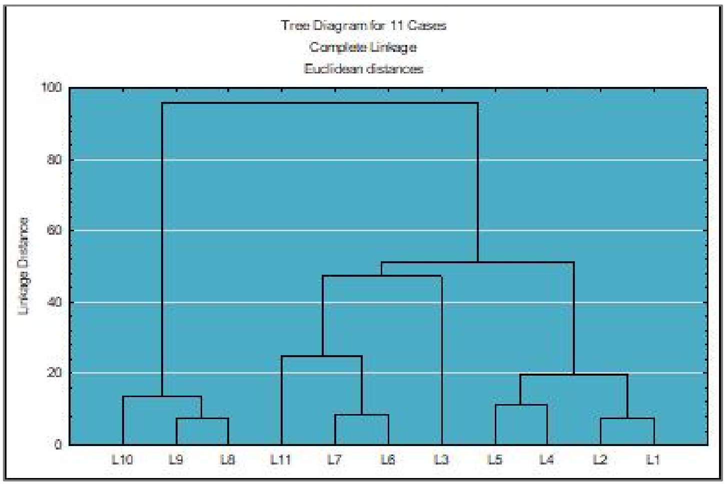


Figure 2.4: Dendogram of the Monitoring Stations using Euclidean Distance

2.1.6 Findings

According to the observed data it can be concluded that the concentration of major air pollutants was found comparatively lower in the Sundarbans area than that of the other monitoring locations. Seasonal effect the concentration of the particulate matters ($PM_{2.5}$, PM_{10} and SPM) has been found to be slightly higher at Khan Jahan Ali Bridge area comparing to the standards set by DOE (Air pollution control rules, 2022). On the contrary, the concentration of SO_2, & NOx which found to be higher in monsoon periods and CO concentration was found higher in post monsoon seasons. However, major sources of criteria pollutants generation in and around the project site as observed were the piling activities, digging, tunneling and burrowing works, jetty erection activities, major construction works, dust from unpaved roads and vehicle movement, construction materials and goods transportation activities through the roads and river Passur etc. Other sources of pollutants which may contribute to the existing pollution load are the small industries like cement works and refinery industries etc., diffuse sources like wood stoves, fires and wind generated dust etc.

2.2 Noise Quality

During this 35th Quarterly monitoring, the noise level recorded was nothing out of the ordinary as it prevailed in normal period. It has been found that the Noise was generated from the commonly known sources like the rural vehicles (human hauer/ Nosimon, auto-rickshaw) while working beside the roads; whereas in case of the monitoring spot in or around the waterways, the sources of noise were trawler, ship, random waves breaking against the shore, etc. Barges, trawlers and ships were seen plying over the waterway as usual at this time.

2.2.1 Methodology

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

Figure 2.5: Ambient Noise Acquisition during the monitoring period

2.2.2 Noise in the study area

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

2.2.3 Locations of Noise Level Monitoring

Out of (11) locations, three (03) locations were inside the Sundarbans, six (06) locations were in and around the Project site, one at Khan Jahan Ali Bridge and the remaining one was at Mongla Ghat area (**Figure 2.7** and **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

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 2.4** 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 proposed chimney location was recorded as 66.40 dB whereas its standard level is 70 dB **(Table: 2.4).** Levels of noise at *Kaigar Daskati (*48.30 dB) situated at the Gucchha Gram (a residential area located at north-west corner of the project area) and Chunkuri-2 (53.50 dB) located at 4km south-west direction from the chimney location did not exceed their corresponding standard. 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 (proposed township area) were recorded as 51.80 dB and 52.17 dB respectively that denotes, the levels of noise didn't cross their corresponding standard value (55 dB) in these locations **(Table: 2.4).** The level of noise at *Barni (Gaurambha)* was recorded as 58.45 dB which was 1.55 dB lower than that of standard limit (60 dB) of noise level for this location **(Table: 2.4).** *Harbaria (44.94 dB)* and *Akram Point* (40.21 dB), the two ecologically silent zones were not found to exceed the Bangladesh standard limit (50 dB) of their corresponding standard values (**Table: 2.4).**

The level of observed noise at Khan Jahan Ali Bridge and the Mongla port area were recorded as 71.67 dB and 63.23 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.

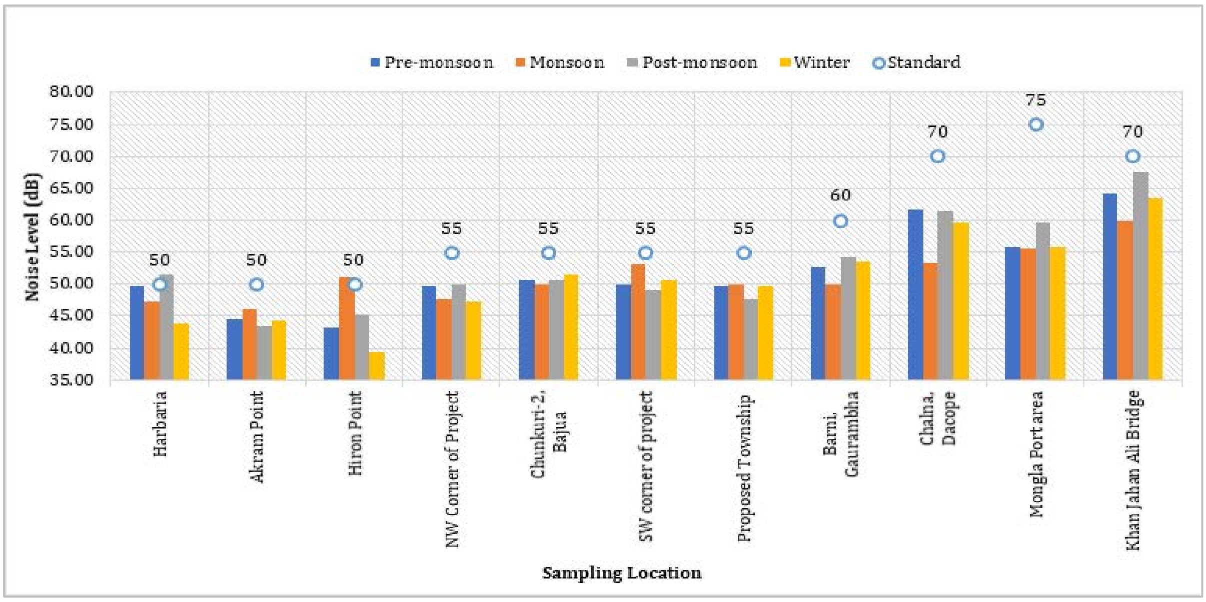


Figure 2.6: Status of average seasonal variations of noise level at different monitoring locations

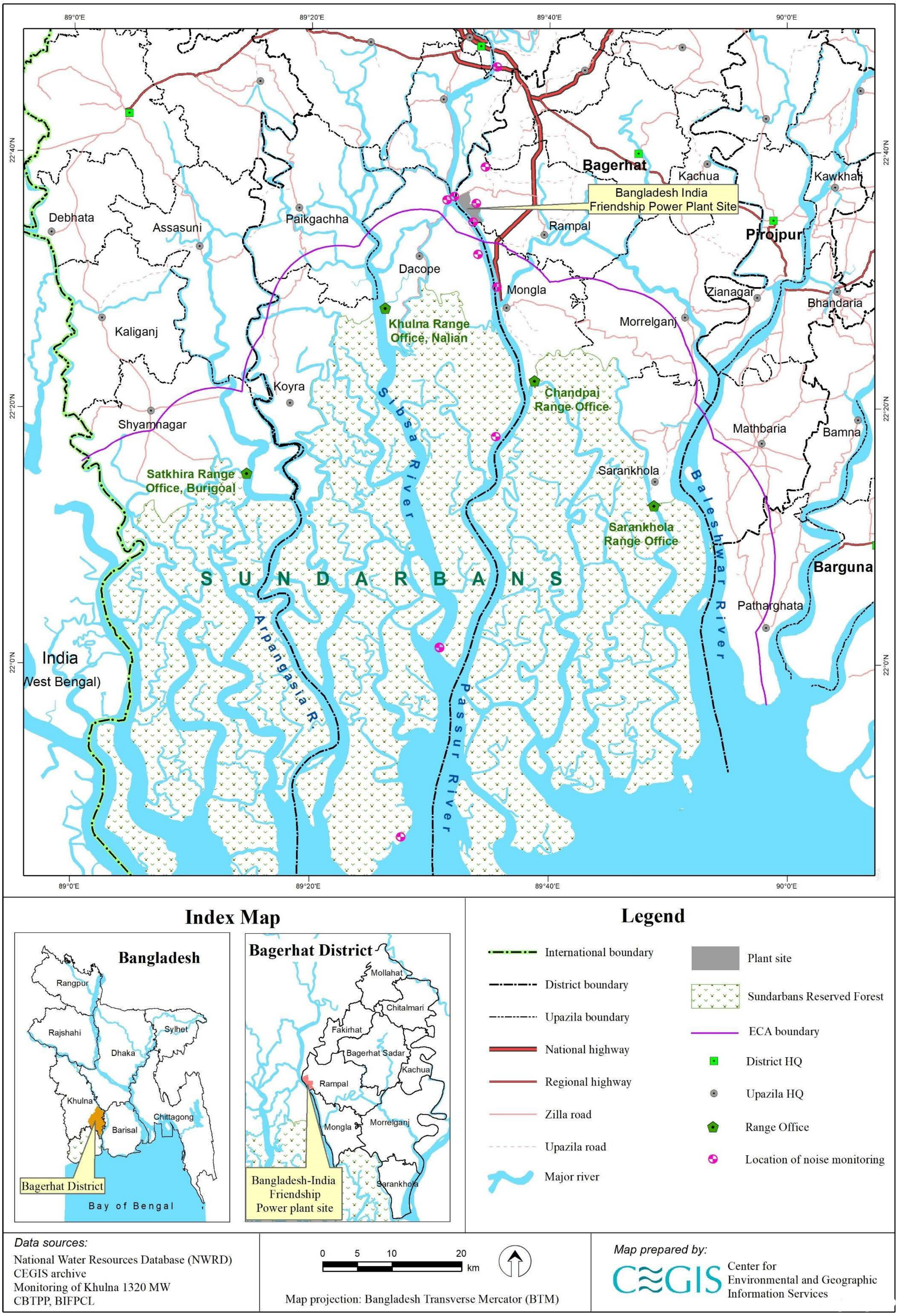


Figure 2.7: Noise Level Monitoring Locations

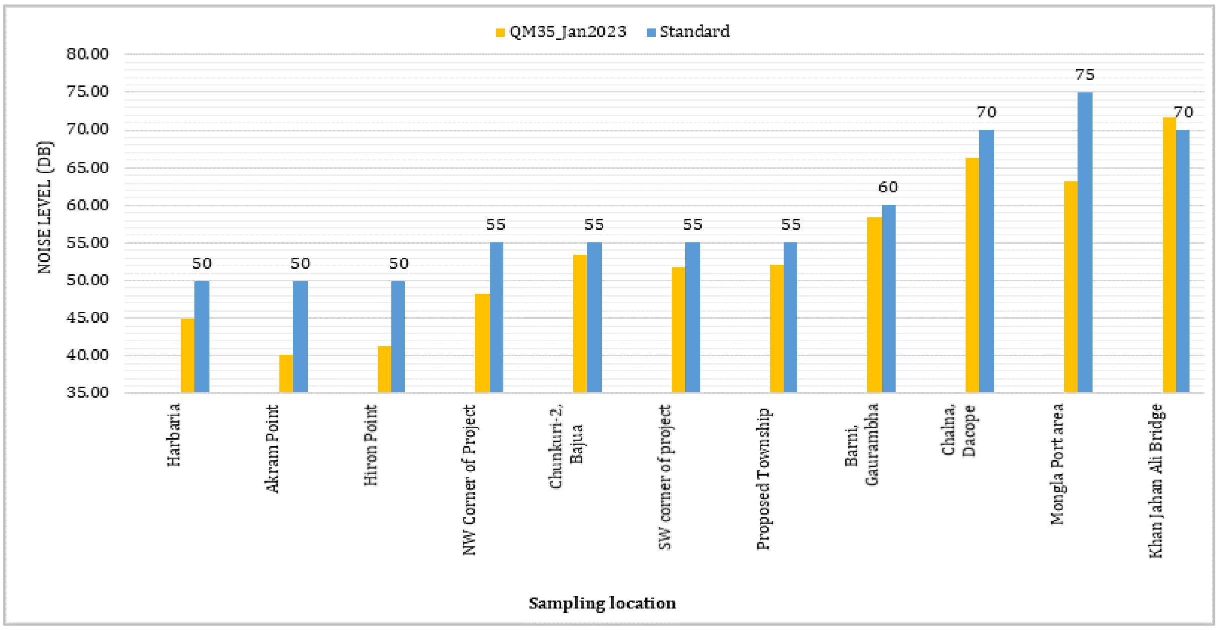


Figure 2.8: Status of noise level of 35th monitoring season at different locatons

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

Sl No	Location	QM35 (Noise Level in dB (A) January, 2023			
		Morning (9:00)	Afternoon (13:00)	Evening (18:00)	Day time AVG
1	Chalna, Dacope	69.50	67.00	62.70	66.40
2	NW Corner of the Project area (Kaigar Daskati)	53.40	48.30	43.20	48.30
3	Chunkuri-2, Bajua	51.80	55.40	53.30	53.50
4	SW corner of the Project area (Moidara)	49.80	53.80	NM	51.80
5	Proposed Township area (Shapmari)	56.30	53.80	46.40	52.17
6	Barni, Gaurambha	59.90	57.00	58.45	58.45
7	Khan Jahan Ali Bridge, Khulna	70.20	68.9	75.90	71.67
8	Mongla Port area	65.2	68.10	56.4	63.23
9	Harbaria, Sundarbans	48.10	41.78	NM	44.94
10	Akram Point, Sundarbans	42.85	37.56	NM	40.21
11	Hiron Point, Sundarbans	41.30	41.30	NM	41.30

Source: CEGIS field survey, January, 2023

2.3 Water Quality

An updated water quality status of the Passur-Sibsa River system and adjacent water bodies have been depicted in this section. Both 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 35th quarterly monitoring tier (January, 2023) and the test results obtained from the laboratory up to October, 2023 (34th quarterly monitoring program). A number of 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 monitoring results are presented and compared with the national standards (ECR, 2023 and all available amendments). The samples were collected from eighteen (18) pre-selected locations (15 locations for surface water along the Passur River from Chalna to 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. Each 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 2.6** and **Table 2.7** respectively.

2.3.2 Selection of Parameters

The selected parameters for Ground water 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 analysed data of the additional parameters are recorded and submitted to the DoE and other authorities periodically.

2.3.3 Surface Water Sampling Procedure

The study area is highly influenced by tidal variation. Hence, temporal and spatial variations of tides were considered in sampling procedure. Surface water samples were collected at a distance of 50-100m away from the river bank and at a depth of 6cm below the water surface during low tides or relative slag period after the low tide for all parameters except oil and grease. The non-acidified sampling bottles were rinsed with respective water samples before sampling. Acidified sampling bottles were used for heavy metal (As, Pb, Hg) sample collection. 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 storing. Acidified sampling bottles were used for heavy metals (As, Pb, Hg) sample collection and were preserved following standard procedure.

Figure 2.9: Water sample (Surface water and groundwater) collection and Insitu Testing of Water Parameters

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 2.5**.

Table 2.5: 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			
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 (NO_3^-)	UV-VIS Spectrophotometers	ppm or mg/L	45
Pjosphate	UV-VIS Spectrophotometers	ppm or mg/L	6
Sulphate (SO_4^{2-})	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 2.6: 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 2.7: Surface Water Quality Monitoring Parameters, Locations and Plan

Sl No	Monitoring Indicators	Sampling Locations ID	Locations	GPS (Decimal Degree)		Frequency	Methods/Tools/ Techniques
				Easting	Northing		
1	pH, Temperature, Salinity, DO, BOD_5, TDS, TH, TSS, COD, Nitrate, Sulphate, Phosphate, Arsenic, Lead, Mercury, Oil & Grease, 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		
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		

Sl No	Monitoring Indicators	Sampling Locations ID	Locations	GPS (Decimal Degree)		Frequency	Methods/Tools/ Techniques
				Easting	Northing		
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		

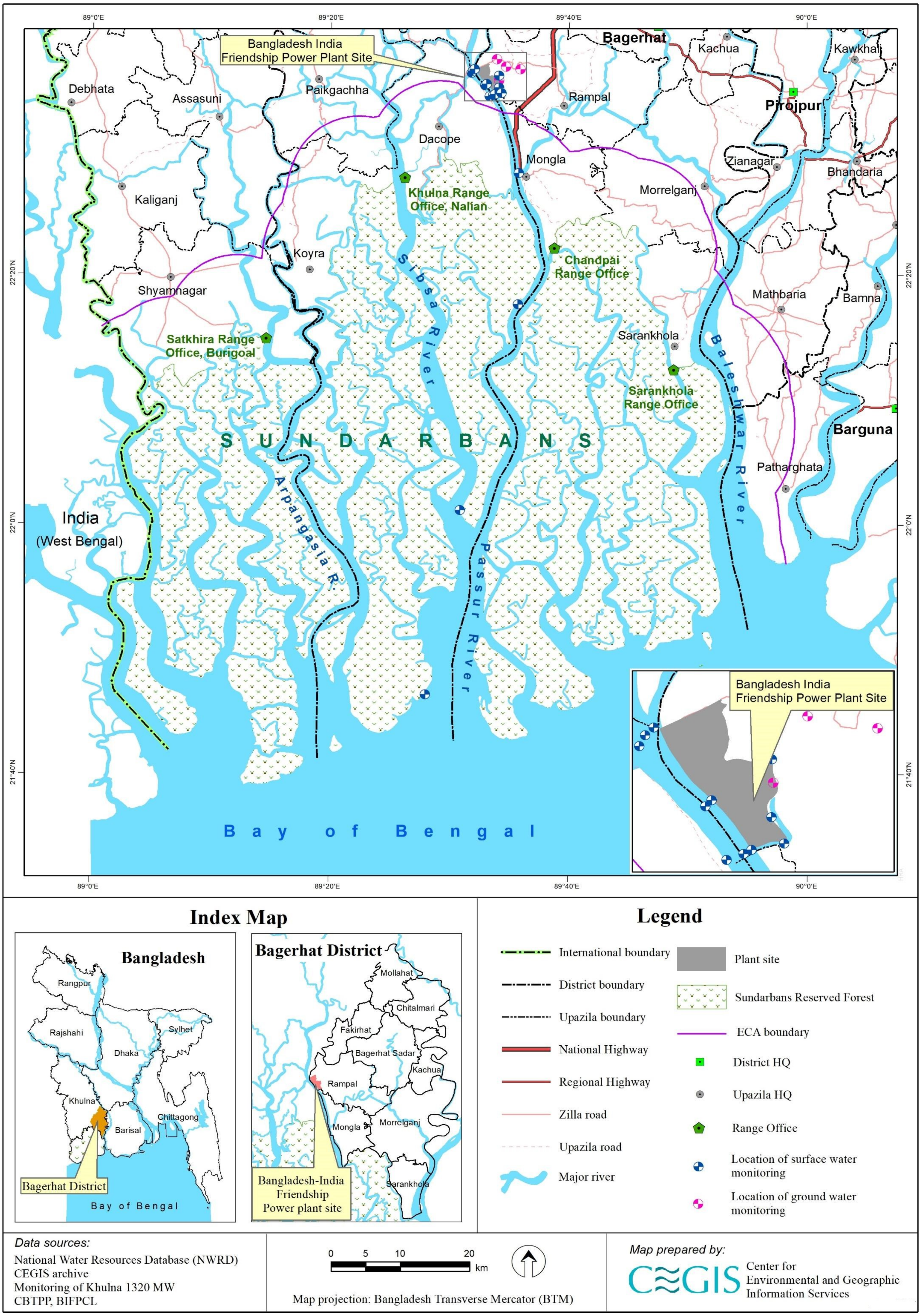


Figure 2.10: Surface Water and Groundwater Quality Monitoring Location

2.3.5 Water Quality Reporting Arrangement

Water quality status of the adjacent water bodies of power plants and the Sundarbans Reserve Forest (SRF) are being observed since April, 2014. The 35th quarterly report covers yearly variations of post-monsoon up to October, 2022 for chemical water quality status and yearly variations for wintter in physical water quality status up to January, 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 T**able 2.8.**

Table 2.8: 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 is 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.

Status of Surface Water Quality

<u>*In-situ tested parameters*</u>

The in-situ tested results obtained up to 35th monitoring period (January, 2023: winter season) are described below:

pH

During the visit, observed pH values were ranged between 8.35 and 7.2. The highest value (8.35) was found at Maidhara River near Shapmari area and lowest (7.2) was observed at Akram point of Sundarbans area. However, the values indicated slightly basic in nature during this winter season.

However, the pH values of pre-monsoon and winter seasons were found to be comparatively higher than those of the monsoon and post-monsoon seasons (**Table B.1: Appendix-IV**) which might be due to the decreased river water level triggered by inadequate rainfall and insufficient inflow from U/S (upstream) of Passur-Sibsa RS (River System) which has also been reported by others (*Rahman et al., 2013*). Fluctuations in pH values during different season of the year can be attributed to factors like removal of CO_2 by photosynthesis through bicarbonate degradation, dilution of waste with freshwater, reduction in salinity and temperature, and decomposition of organic matter (*Rajasegar, 2003*).

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

Temperature

Temperature varied from 28.1^{0}C- 21.91^{0}C among the monitored sites. The maximum water temperature (28.1^{0}C) was recorded at Maidhara River near Shapmari area. However, the surface water temperature largely depends on daily weather condition (*Bartram. J. et. al., 1996*). According to the seasonal weather pattern of Bangladesh the temperature drops to a minimum level during winter and reach to the maximum level which is also applicable for the water temperature. Recorded temperatures indicated that there was spatial variation among the monitoring sites even in the same seasons.

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

Salinity

The observed salinity concentration ranged between 9.5 ppt. and 2.9 ppt. during the last monitoring season. The maximum salinity (9.5 ppt.) was observed at Hiron point of the Sundarbans while minimum value was observed near the Passur river at Passur-Mongla confluence area. Insufficient fresh water flow from upstream increase the salinity concentrations during winter and pre-monsoon seasons.

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

Dissolved Oxygen

The standard DO level for aquaculture is more than 5 mg/L (ECR' 2023) in the coastal area. During the last winter season, DO values ranged from 7.6 mg/L to 5.8 mg/L which was found within the permissible limit recommended by DoE. In general, higher DO levels are observed in monsoon and post-monsoon season basically for heavy rainfall and freshwater availability & upstream flow. Seasonal variations of DO at the monitoring sites of Passur-Sibsa RS for the monitoring periods are shown in **Figure 2.14** and all the observed dataset are attached in **Table B.4** of **Appendix- IV.**

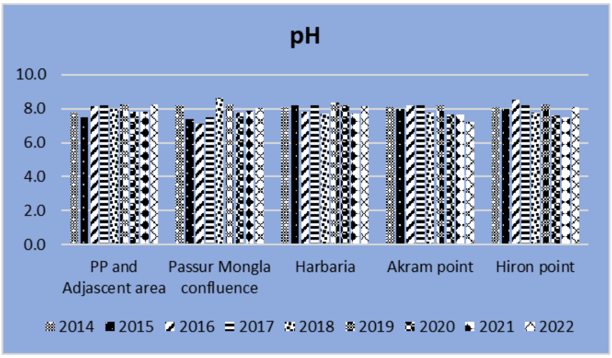


Figure 2.11: Variations in pH values in different monitoring sites

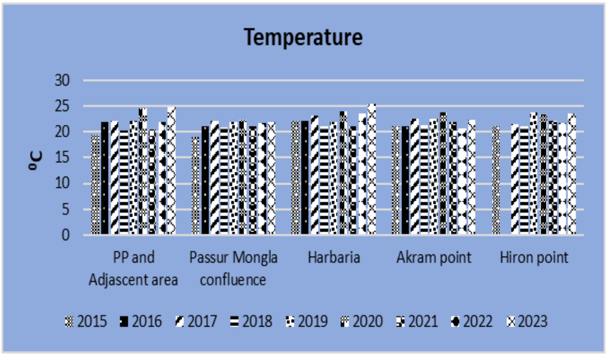


Figure 2.12: Variations in Temperature values in different monitoring sites

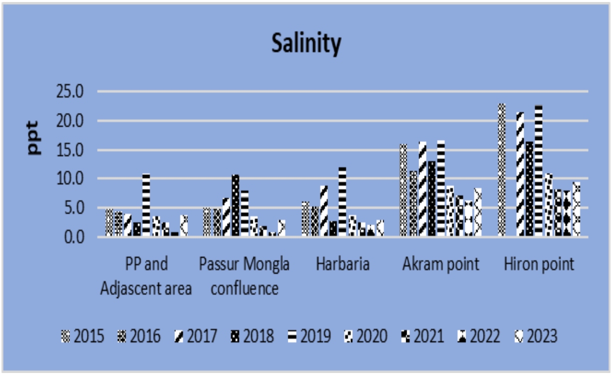


Figure 2.13: Variations in Salinity values in different monitoring sites

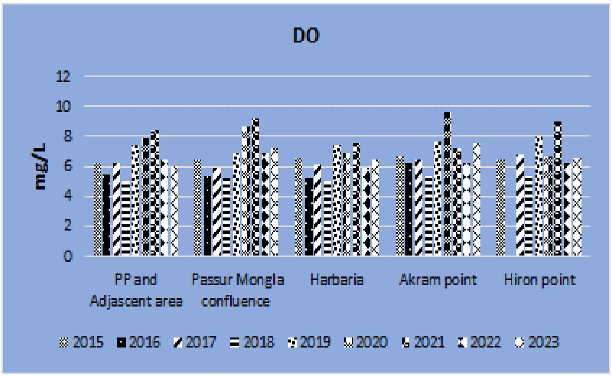


Figure 2.14: Variations in DO values in different monitoring sites

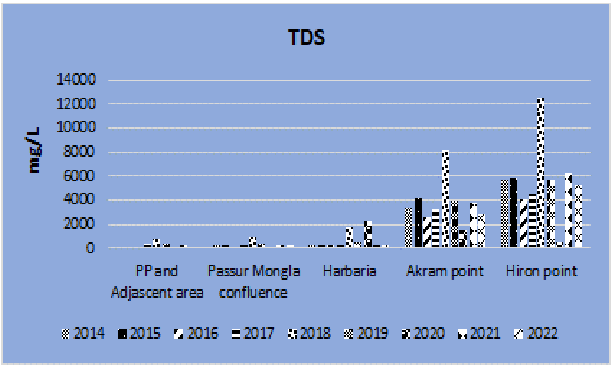


Figure 2.15: Variations in TDS values in different monitoring sites

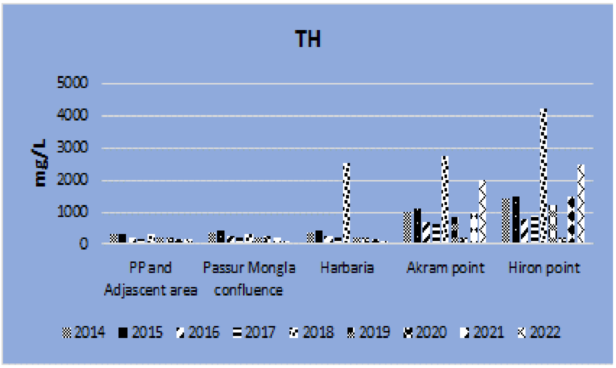


Figure 2.16: Variations in TH values in different monitoring sites

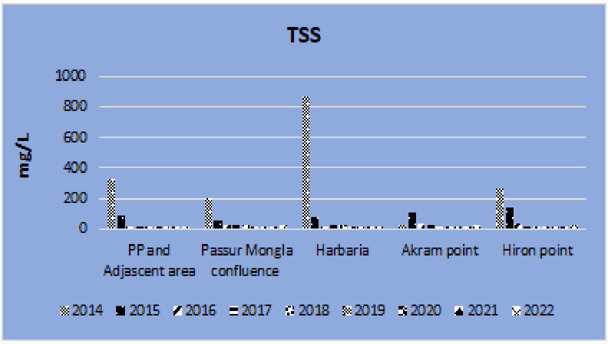


Figure 2.17: Variations in TSS values in different monitoring sites

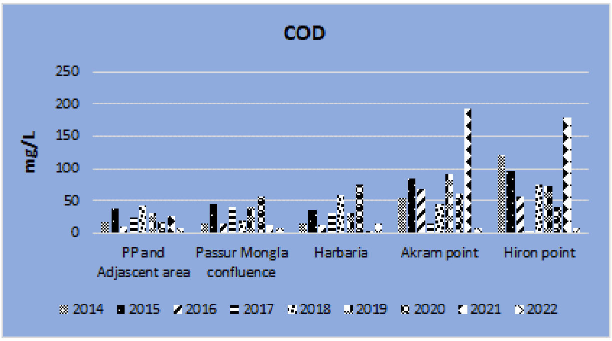


Figure 2.18: Variations in COD values in different monitoring sites

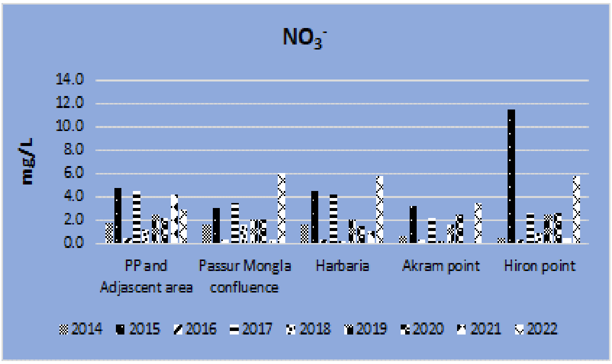


Figure 2.19: Variations in Nitrate values in different monitoring sites

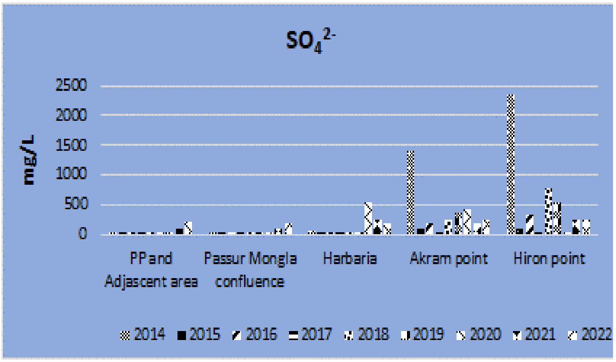


Figure 2.20: Variations in Sulphate values in different monitoring sites

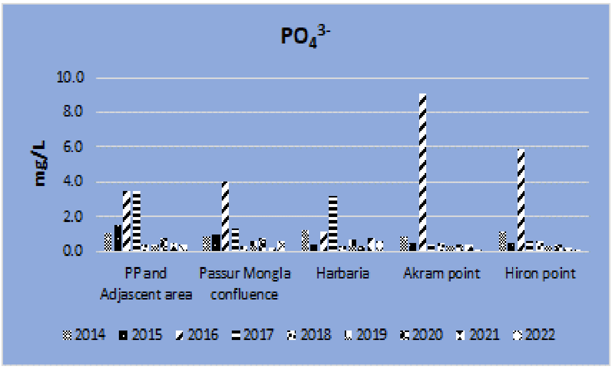


Figure 2.21: Variations in Phosphate values in different monitoring sites

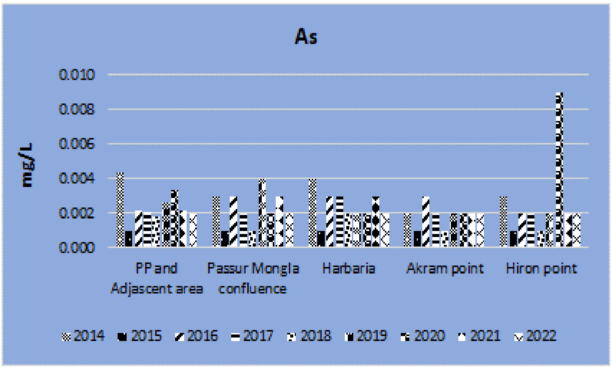


Figure 2.22: Variations in Arsenic values in different monitoring sites

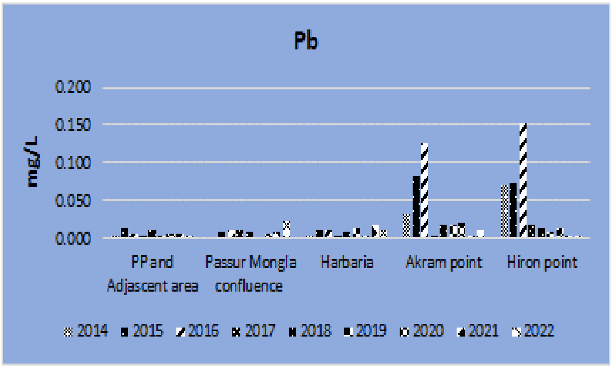


Figure 2.23: Variations in Lead values in different monitoring sites

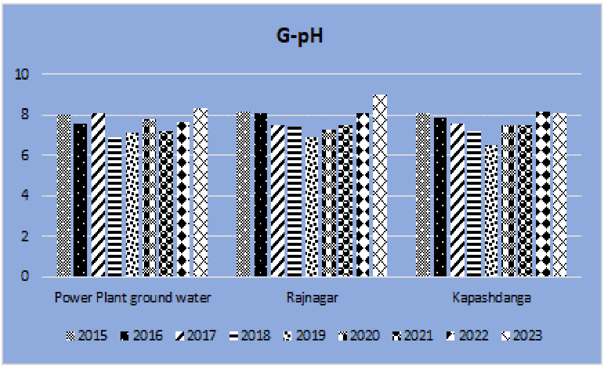


Figure 2.24: Variations in G-pH values in different monitoring sites

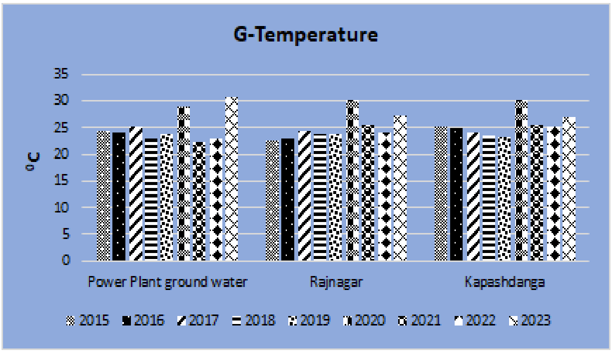


Figure 2.25: Variations in G-Temperature values in different monitoring sites

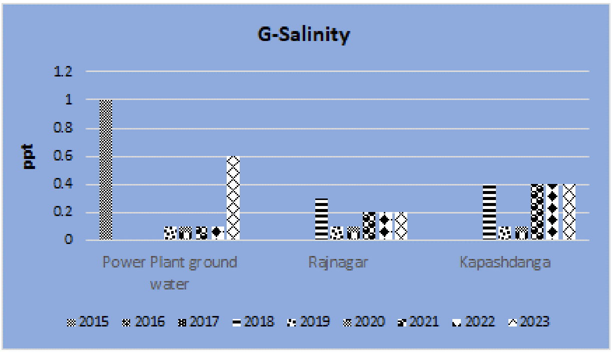


Figure 2.26: Variations in G-Salinity values in different monitoring sites

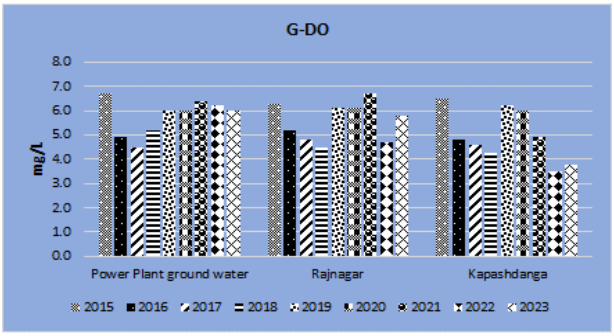


Figure 2.27: Variations in G-DO values in different monitoring sites

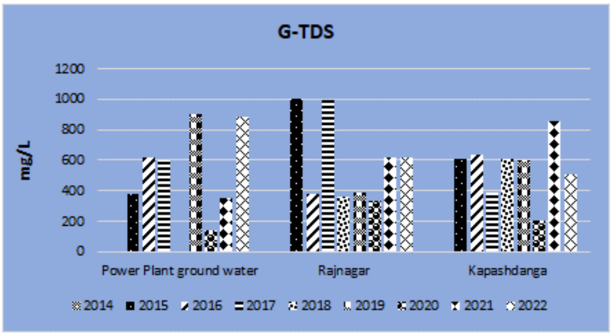


Figure 2.28: Variations in G-TDS values in different monitoring sites

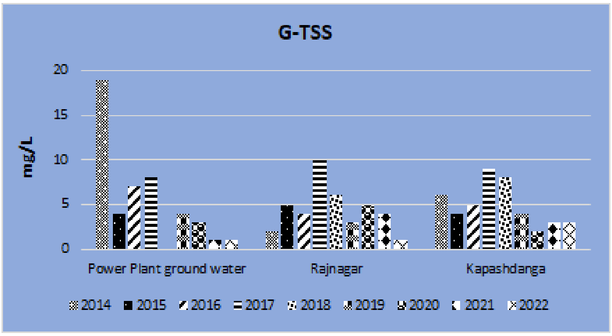


Figure 2.29: Variations in monsoon G-TSS values in different monitoring sites

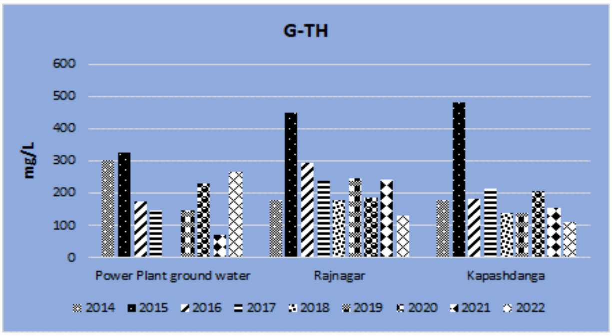


Figure 2.30: Variations in monsoon G-TH values in different monitoring sites

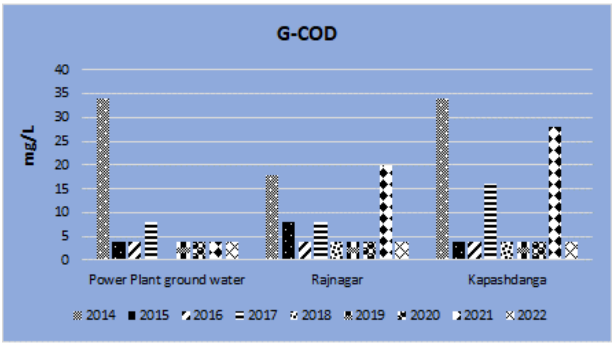


Figure 2.31: Variations in G-COD values in different monitoring sites

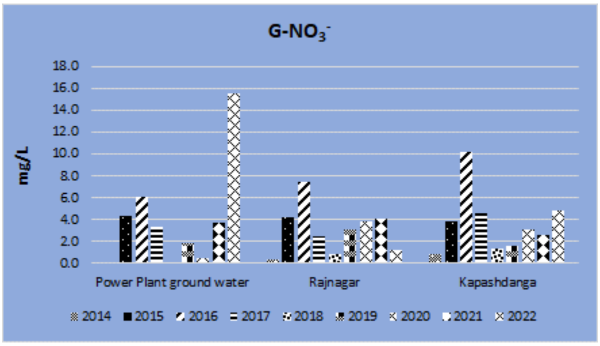


Figure 2.32: Variations in G-Nitrate values in different monitoring sites

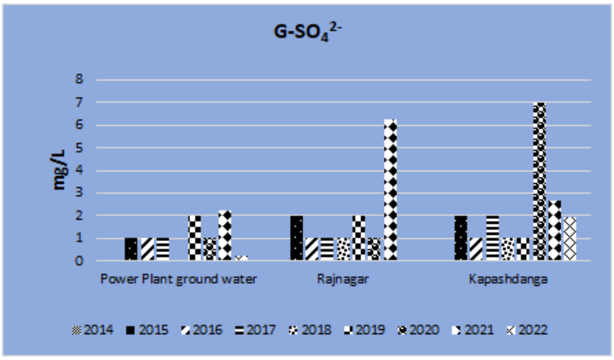


Figure 2.33: Variations in monsoon G-Sulphate values in different monitoring sites

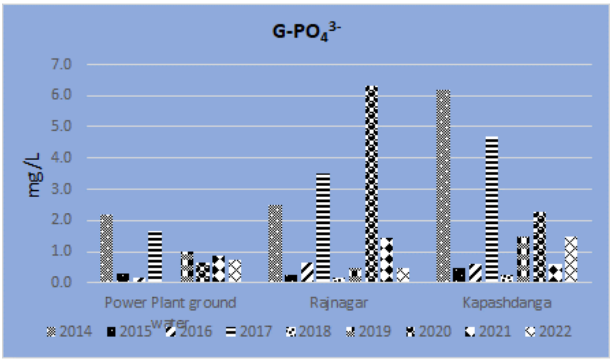


Figure 2.34: Variations in monsoon G-Phosphate values in different monitoring sites

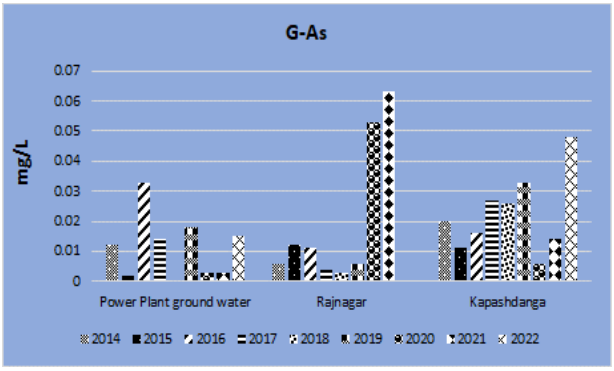


Figure 2.35: Variations in monsoon G-Arsenic values in different monitoring sites

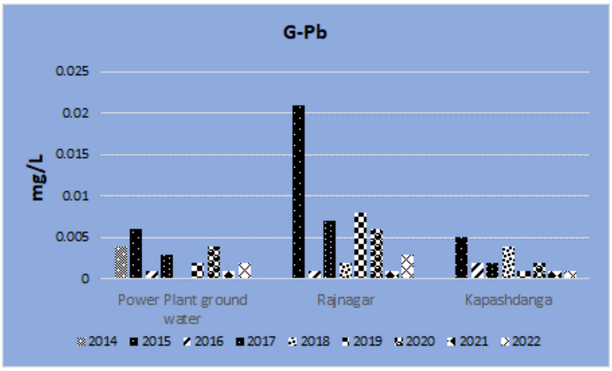


Figure 2.36: Variations in monsoon G-Lead values in different monitoring sites

Laboratory tested parameters

The laboratory tested results obtained up to 34th monitoring period (October, 2022: Post-monsoon season) are described below:

<u>Total Dissolved Solids (TDS), Total Hardness (TH) and Total Suspended Solids (TSS)</u>

TDS mainly indicates the presence of various kinds of minerals like ammonia, nitrate, phosphate, alkalis, some acids, sulphates and metallic ions etc., in water which comprise both colloidal and dissolved solids in water (Tareq. M. S. *et al.,* 2013). During the last visit, the TDS values were found to be ranged between 5300-132 mg/L (**Figure 2.15**). Among the monitoring sites highest TDS was observed at Hiron point (5300 mg/L) and lowest was found at Right Bank of Passur River at South West corner from the Project boundary (132 mg/L). 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)[1]. TDS values in Passur River increased as it progressed towards the Sea. Therefore, HIron point of Sundarbans showed the highest TDS with respect to remaining sampling point. **Table B.7**: **Appendix IV**). On the other hand, towards downstream of the River System, usually high TDS occurs due to tidal influence of the Bay of Bengal that contains lots of salts and other nutrients.

Total Hardness (TH) follows similar pattern as that of TDS e.g., high TH was found during pre-monsoon and winter season as of the TDS. Insufficient freshwater supply due to low rainfall during winter and pre-monsoon period and seawater i.e. saline water intrusion toward upstream (Rahman et al., 2013) contains huge quantity of minerals including calcium and magnesium, which make the water hard. During the monitoring period the TH values were found to be ranged between 2500 mg/L- 110. In the deep Sundarbans hardness always found to be comparatively higher than the standard value of surface water (**Figure 2.16**). On the other hand, water hardness is found to be higher in monsoon season but in Passur River, it is found to be higher in pre-monsoon and winter season due to the.

Total Suspended Solids (TSS) include solid materials of organic and inorganic in origins, which are normally suspended in water. In the Passur-Sibsa RS, the suspended matters generally contain sand, clay, silt and loam. TSS concentrations among the monitoring sites varied from 25 mg/L to 14 mg/L.

[1] 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.

In 2014, TSS reached more than 150 mg/L at Mongla-Passur Confluence due to the oil spillage incident occurred at *9th December, 2014* (**Figure 2.17**). After that, the issue was not found any more, and the water bodies reinstated its properties naturally. Above all, in the Passur-Sibsa RS, TSS showed consistency in the concentrations of suspended matters. Generally, in the Passur-Sibsa RS, 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.

The status of TDS, TH and TSS of Passur River in the observed Monsoon seasons at different monitoring sites are presented in **Figure 2.15, 2.16** and **2.17** respectively and all the observed dataset are attached in **Table B.7**, **Table B.8** and **Table B.9** of **Appendix- IV.**

Chemical Oxygen Demand (COD)

COD is an indicator of organic pollution, which is caused by the inflow of natural organic loads, domestic, livestock and industrial wastes, which contain elevated levels of organic pollutants (Ayati, 2003). In fact, the higher the organic matter, the higher will be the decomposition and hence there will be a higher demand of O_2 in the water body.

COD concentrations varied from 4 mg/L to 16 mg/L during the last post-monsoon season (**Figure 2.18)**. The lowest value was found in the Passur river near the power plant area while the highest value was found in Harbaria of Sundarbans. The higher values of COD indicate high level of organic matter in the river water (Sivasubramanium, 1999). **Figure 2.18** indicates that; organic loads are higher in the deep forests of Sundarbans than the upstream areas. Deep forests supply many organic loads in the river while upstream loads as well increase the organic materials concentrations in huge at the downstream of the RS.

Over the year, COD concentration was found to be higher in pre-monsoon followed by winter as these seasons had insignificant rainfall comparing to those of other seasons and which actually increased the density of organic matter. In monsoon, higher discharge diluted the COD load of the river water, which in turn reduced COD concentration in post monsoon. The status of the monsoon season variation of COD is shown in **Figure 2.18** and the completely monitored dataset are provided in **Table B.5** of **Appendix- IV.**

Nitrate, Sulphate and Phosphate

During monsoon the highest nitrate value was found to be 5.975 mg/L at mongla Passur confluence and lowest value was found to be 0.027 mg/L at Left Bank of Passur River at 100m u/s of North West corner from the Project boundary. The concentration of such Nitrate during the post-monsoon period could be the result of surface run-off, agricultural run-off, atmospheric deposition and domestic wastes dumping together with industrial pollution from upstream.

On the other hand, sulphate concentration was found to be higher in Hiron point (236.27 mg/L) and lowest (185.87 mg/L) at Harbaria of Sundarbans. In general, sulphate (SO_4^{2-}) concentration is higher in seawater as well as in coastal river due to the tidal influence. The monitored dataset substantiates this fact i.e., SO_4^{2-} concentration of Passur-Sibsa RS increases in the direction of upstream to downstream.

on the contrary, PO_4^{3-} concentrations was found highest (2.1427 mg/L) during the last post-monsoon period at Left Bank of Passur River at 100m u/s of North West corner from the Project boundary and lowest value (0.0049 mg/L) was found at Right Bank of Passur River at 100m u/s of North West corner from the Project boundary. However, the recorded low phosphates value during wet seasons might be attributed to the limited flow of upstream freshwater, high salinity and utilization of phosphate by phytoplankton, stated by Senthilkumar et al., 2002; Rajasegar, 2003.

The status of NO_3^-, SO_4^{2-} and PO_4^{3-} concentrations at different monitoring sites are shown in **Figure 2.19**, **Figure 2.20** and **Figure 2.21** and all the observed dataset are given in **Table B.10**, **Table B.11** and **Table B.12** of **Appendix- IV**.

Heavy Metals

During the last post-monsoon period Arsenic concentration was found to be 0.002 mg/L at all monitoring locations. Though As concentration remains very low yet the seasonal variations in arsenic might be due to seasonal differences in riverine input and the intrusion of water masses (Yuan, et al., 2021). On the other hand, the concentration of Pb ranged from 0.002 to 0.024 mg/L (**Figure 2.23**). Dissolved Pb is very harmful to aquatic organisms due to bioaccumulation, it increases in body tissue of organisms (Rompas, 2010). On the contrary, the maximum value (0.003 mg/L) of Mercury (Hg) was found in Middle of Passur River at South West corner from the Project boundary. However, the monitoring results revealed consistency among all the monitoring points in all the seasons in all monitoring quarters (0.001 mg/L).The average value of As and Pb concentrations at different monitoring sites of the consecutive monitoring quarters for monsoon seasons are presented in **Figure 2.22** and **Figure 2.23** and all the observed dataset of As, Pb and Hg are given in **Table B.13**, **Table B.14** and **Table B.15** of **Appendix- IV**.

Oil and Grease

In order to measure the concentration of oil and grease in Passur-Sibsa River, samples were collected at five locations from the surface layer and analysed following the standard testing method of APHA. The concentration of oil and grease are presented in **Table-B.6** of **Appendix-IV.** During monsoon and post monsoon periods, the concentration of Oil and Grease were found to be lower than that of winter and pre-monsoon season. It appears from the data that Passur and Sibsa river system recorded high concentration of oil and grease in winter period in 2014, which might be due to accidental oil spillage occurred on December 9, 2014. An amount of 350,000 litres (Philips, 2014) of furnace oil had spilled in the river and spread over an area of 350 km^2 (Welle, 2014). However, during the last post monsoon period, Oil and grease was found <2.0- mg/L for all the monitoring sites. Plying of motorized boats, launches and other tourist boats, Navy boats and fishing boat at Dublar char could be the reasons of Oil and Grease in that areas. Moreover, for the seasonal fishing at sea, the engine boats and other fishing boats contributes huge amount of oil and grease in the river water.

Findings

The physico-chemical properties of Passur River changes with the tidal intrusion in different seasons. During 35th quarterly monitoring, pH was found slightly basic in nature. Salinity, Temperature and Dissolved oxygen level was found in fair and favourable for the aquatic life forms. During the last post-monsoon, 2022, TDS and TH has been relatively same with respect to the same seasons of last consecutive years. Nitrate (NO_3^-) and Phosphate level remained relatively lower. Sulphate was found relatively higher than the previous post monsoon periods. In case of metal pollution, no 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 for aquaculture. 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.

2.3.6 Status of the Groundwater quality

In-situ tested parameters

The in-situ tested results obtained up to 35th monitoring period (January, 2023: winter season) are described below:

pH and Temperature

During the monitoring period highest pH and temperature (9.0 and 31⁰C respectively) was recorded at Rajnagar area and the values were found to be slightly exceeded the drinking water quality standards as specified in ECR' 2023 (20⁰C -30⁰C). When it comes to increasing drinking water alkalinity, various chemicals and pollutants are known to cause high pH levels. If the soil or bedrock around groundwater sources includes carbonate, bicarbonate, or hydroxide compounds, those materials get dissolved and travel with the water. These mineral deposits also increase the alkalinity of the water. On the other hand, no significant differences were observed against the previously monitored periods of the same seasons results. Temperature were found more or less consistent with the previously respective season's data. However, the monitoring results of pH and temperatures of selected sites are presented in **Figure 2.24** and **Figure 2.25** the observed dataset of pH and Temperature are attached in **Table B.16** of **Appendix- IV**.

Salinity and Dissolved Oxygen (DO)

Groundwater salinity concentration at all the monitoring sites were found to be increasing trend with respect to previous years. High ground water extraction, ground water salinity intrusion or surface saline water percolation may be the key reason for increasing the level of salinity into ground water over the years at all the monitoring sites. (**Table B.18: Appendix- IV**). However, during the monitoring period, highest salinity was found at Power Plant area (0.6 ppt.) and lowest at Rajnagar (0.2 ppt.). Again DO values ranged between 5.99 mg/L to 3.8 mg/L during this monitoring season. A slight low DO concentration in drinking water might only reduce the taste of water. Higher DO level makes water tastier but causes corrosion to the supply pipe.

All monitoring results of salinity and DO of the selected monitoring sites are presented in **Figure 2.26** and **Figure 2.27** and all the observed dataset of DO and Salinity are attached in **Table B.17** of **Appendix- IV** respectively.

Laboratory tested parameters

The laboratory tested results obtained up to 34th monitoring period (October, 2022: post-monsoon season) are described as follows:

TDS, TSS and TH

The highest TDS value of 885 mg/L was recorded at Project site well and lowest (510 mg/L) was observed in Kapashdanga area. The values were found to be complied with the ECR' 2023 (1,000 mg/L) (**Figure 2.28: TDS**). High ground water extraction, salinity intrusion or percolation may be the key reason for increasing the level of TDS. TSS also known as non-filterable residue, are the solids (minerals and organic material) which remain trapped on a 1.2µm filter (U.S.EPA, 1998). During the 34th monitoring period, maximum TSS concentrations (3 mg/L) was recorded at Kapashdanga area and minimum (1mg/L) at Power plant and rajnagar site, which complied within the Standard for Drinking Water, Bangladesh (TSS: 10mg/L, ECR, 2023) (**Figure 2.29: TSS**). On the other hand, TH concentrations of the three monitored spots varied from 265 mg/L to 110mg/L during the last post-monsoon period. The maximum value was found at project site and lowest at power Kapashdanga.

Groundwater TDS, TSS and TH values of the consecutive periods are presented in **Figure: 2.28, 2.29** and **2.30** and all the observed dataset are attached in **Table B.18** and **B.19** of **Appendix- IV**.

Chemical Oxygen Demand

Organic or inorganic compounds or ion in the ground water may be the major cause for COD in the ground water. During the last post-monsoon COD values was found to be 4mg/L at all locations . However the presence of COD in groundwatermay also be triggered by the decreased groundwater recharge into the aquifer. The COD concentrations of all seasons for the corresponding monitoring sites are given in **Figure 2.31** and all the observed dataset are attached in **Table B.19** of **Appendix-IV**.

Nitrate, Sulphate and Phosphate

Natural nitrate levels in groundwater are generally very low (typically less than 10 mg/l NO_3^-), but nitrate concentrations increase due to human activities, such as agriculture, industry, domestic effluents. The sources of nitrates pollution in groundwater are cultivation in areas where the soil layer is relatively thin, or has poor nutrient buffering capacity, or where there are changes in land use; over fertilization of crop for intensification of agricultural activity; spread cultivation of crops which require high fertilizes doses and which leave the soil bare over long periods (maize, tobacco and vegetables); drainage systems which lead to drainage of fertilizers; intensive agricultural rotation cycles involving frequent ploughing and extensive areas of bare soils during winters; organic fertilizers form animal husbandry and increased urbanization. However, among the monitoring tiers, the NO_3^- values were found to be highest during the monsoon of 2018 though it was found to be within the standard limit set by ECR'97. During last post-monsoon period, the nitrate values were found to be highest (15.50 mg/L) at Power Plant area and lowest at Rajnagar (1.22 mg/L) which are completely comply with the standard limit (45mg/L; ECR'2023)

On the other hand, Sulphate (SO_4^{2-}) results were found complying with the Bangladesh Standard for Drinking Water Quality (250 mg/L) from the beginning of the monitoring study. During the last monitoring period, highest (1.94 mg/L) values was found at Rajnagar area and lowest (0.23 mg/L) at Power plant area.

In addition, the concentrations of PO_4^{3-} were ranged between 1.5 mg/L and 0.75mg/L. PO_4^{3-} concentrations actually have both spatial and temporal variations but which is minor in the interest of this monitoring objectives as well as drinking purpose by the community resides there. The observed monsoon seasons NO_3^-, SO_4^{2-} and PO_4^{3-} concentrations of groundwater are presented in **Figure 2.32, 2.33** and **2.34** and all the observed dataset are attached in **Table B.20 and B.21** of **Appendix- IV.**

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

According to Bangladesh Standard (ECR, 2023), the maximum acceptable concentration of Arsenic (As) in groundwater is 0.05 mg/L. The As concentrations among all the monitoring locations ranged between 0.0003 mg/L and 0.048 mg/L. The prominent sources of arsenic contamination in groundwater of Bangladesh is still a matter of debate as no single cause can interpret the contamination processes (Islam et al., 2010)[2]. The most widely discovered two theories for the backgrounds of arsenic contamination of groundwater in Bangladesh may be the pyrite oxidation and

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

iron oxyhydroxide reduction (Saha and Rahman, 2020)[3]. Higher arsenic concentration in groundwater could be (i) the presence of suitable arsenic bearing source material (i.e., rocks, minerals, soils, sediments); (ii) efficient mobilization and/or transport processes (i.e., oxidation of arsenic bearing sulphides); and (iii) lack of rapid arsenic removal processes (Polya and Middleton, 2017)[4]. However the owner of the tube well will be informed to and monitoring will be continued in order to understand the facts.

On the other hand, during the last post-monsoon period Pb concentration was found to be ranged between 0.001mg/L-0.003mg/L. The concentration of Pb showed only spatial variation to some extent in some seasons (**Figure 2.36: Lead**). However, the water of the tube-wells was found suitable for drinking purpose in terms of metal pollution status. In addition, the concentration of Hg has been remaining same at all seasons i.e. <0.001 which is compatible with the ECR'97 standards. The observed values of As and Pb in all the seasons are presented in **Figure: 2.35** and **2.36** and all the observed dataset of As, Pb and Hg are presented in **Table B.21, B.22 and B.27** of **Appendix-IV**.

Remarks

This concluding remark represent that the physical characteristics of groundwater quality is still in good condition with slight variation in pH and salinity. The reason being saline water intrusion and infiltration due to excessive withdrawn of groundwater by the surrounding communities during the dry season. During the monitoring tier As concentration was found breaching the national water quality standard for two times at Kapashdanga. In addition, evaporation also responsible for this slight salinity in groundwater. Project activities are not related to this sort of changes in salinity. Chemical characteristics of the groundwater quality are also found relatively good.

2.4 Land and Agricultural Resources Monitoring

2.4.1 Methodology of land resources monitoring

Monitoring of selected indicators is very crucial for better management of land resources in the study area. Plot/land use, soil fertility/nutrient status, soil contamination with heavy metals and soil salinity have been considered as the major indicators for land resources monitoring.

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.

Monitoring Indicators

The continuous monitoring provides an opportunity to observe seasonal change along with spatial change of selected indicators of sampling plots. The selected indicators are soil reaction (pH), soil salinity (EC), Organic matter (OM), base cations-Ca, Mg, K and Na, status of macro nutrients (N, P and S), status of micro nutrients (B, Fe, Mn and Zn) and presence of heavy metals (Pb and Cd). Sodium

[3] 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.

[4] D.A. Polya, D.R.S. Middleton., Arsenic in drinking water: sources & human exposure. Best Pract. Guid. Control Arsen. Drink. Water., 15 (2017)

absorption ratio (SAR), exchangeable sodium percentage (ESP) can be calculated from the analysed data. It may also be mentioned that 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:

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

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

Location

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

Table 2.9: Land Resources Monitoring Plan

Site No.	Monitoring indicators	Location	GPS(Decimal Degree)		Sampling Frequency	Methods/ Tools/ Techniques
			Northing	Easting		
1	Plot use, Soil fertility and nutrient, 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″	E-89°36′8.8″		

Site No.	Monitoring indicators	Location	GPS(Decimal Degree)		Sampling Frequency	Methods/ Tools/ Techniques
			Northing	Easting		
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″		

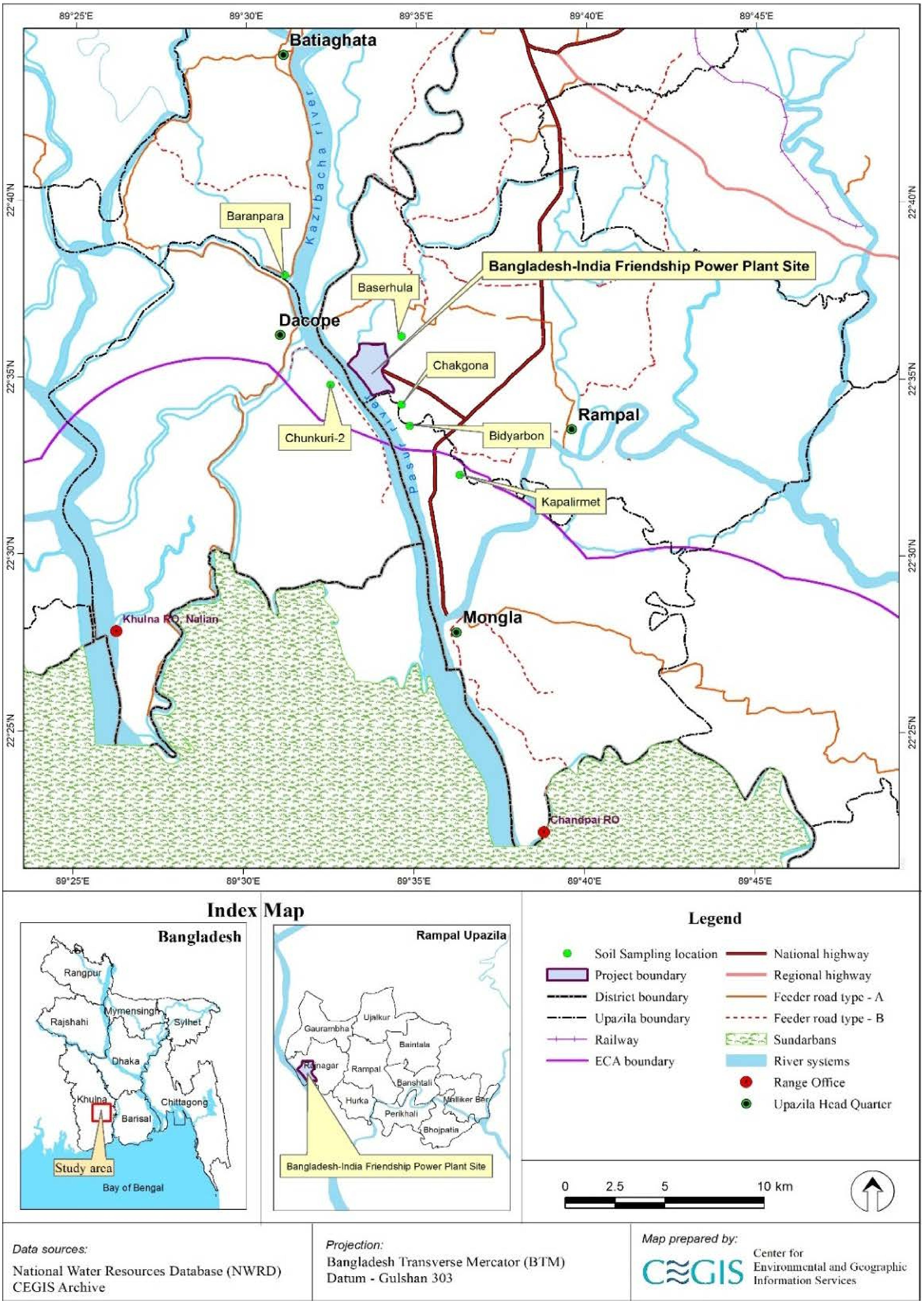


Figure 2.37: Land and Agricultural Resource Monitoring Locations

2.4.2 Process of Soil Samples Collection

Plot Selection

Monitoring plots were selected at the very beginning of this study. Expert's judgement along with plot owner's opinion was taken into consideration for this selection. Upazila Agriculture Officers of Batiaghata and Dacope of Khulna, Rampal and Mongla of Bagerhat District and Senior Scientific Officer of Soil Resource Development Institute (SRDI) of Khulna were communicated for collecting expert's judgement. Wind speed and wind direction were considered as potential local factor for the monitoring purpose. All the selected plots were characterized as medium high land (F_1), which are normally flooded in the range of 30-90 cm and remain inundated for more than two weeks to few months during the flood period.

Soil Sample Collection

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

Laboratory Analysis

Collected soil samples have been handed over to the SRDI, Dhaka for laboratory analysis. The analysis data and report are incorporated with this monitoring (35^{th} monitoring) report.

2.4.3 Status of soil quality of monitoring plots

Monitoring Plot-1 (Baranpara)

Top soil organic matter concentration increased to almost double after last year's drop. Total nitrogen concentration follows the similar trend. This might be an impact of good agricultural practice and use of organic fertilizer. Phosphorus concentration increased than the previous year while Sulphur concentration decreased. pH has increased in the monitoring plot while EC has decreased. All salinity related parameters (SAR, ESP and TSS) has dropped during this monitoring. Decrease in single valent cations (Sodium) might be a reason for this. Among the divalent cations, Calcium concentration decreased while Magnesium concentration increased after last year drop.

Among the micro nutrient's concentration, all the monitoring elements concentration decreased except zinc (Zn) which might be an impact of salinity decrease of that area. Lead and Cadmium concentration have also increased than the previous year but still are below the permissible limit (Pb-85 ppm and Cd-08 ppm) (**Figure 2.38-2.53**).

Monitoring Plot-2 (Chunkuri-2)

Top soil organic matter concentration increased after last year. Nitrogen and Sulphur concentration also increased whereas phosphorus concentration decreased. This might be due to applying high amount of organic fertilizer. Salinity of this monitoring plot was observed to be decreased during this monitoring. All salinity related parameters (EC, SAR, ESP, TSS) showed decreasing pattern. On the other hand, both mono (Sodium and Potassium) and di-valent (Calcium and Magnesium) cations concentration were reduced. This might a cause of decreasing salinity of this area. pH was also decreased during the monitoring period.

Moreover, all micro nutrients concentration (Mn, B, and Fe) were decreased except Zinc. Pb and Cd concentrations were also seen increased but stay within the permissible limit (**Figure 2.38-2.53**).

Monitoring Plot-3 (Kapalirmet)

This monitoring plot was used for fish cultivation during pre-monsoon and post monsoon period. During monsoon period this area completely goes under water. Decreasing salinity was common scenario of this monitoring plot. Among the base cations Sodium, Potassium and Calcium showed increasing trend while Magnesium showed decreasing trend.

Organic matter concentration reduced during this monitoring. Nitrogen and Sulphur concentration also reduced while Phosphorus concentration stayed almost similar. This might be a cause of regular leaching due to submergence. EC, SAR, ESP and TSS values dropped during the period. Both single and di-valent cations concentration also followed the similar trend. Micro nutrients concentration has decreased except Zinc concentration. Pb and Cd concentration also increased but stay within the permissible limit (**Figure 2.38-2.53)**.

Monitoring Plot-4 (Chakgona)

Organic matter has increased, so is other macro nutrients. which is an indication of soil health improvement due to use of organic fertilizer and reduced salinity during rainy season. Overall salinity of this area has decreased. EC, SAR and ESP also show the similar pattern. Mono valent cations (K, Na) showed similar trend while divalent cations (Ca and Mg) concentration has been increased. pH is almost similar to the previous year.

Decreasing trend of Fe, Mn and B concentration has been observed in the monitoring plot while Zn concentration increased. Pb and Cd concentration has also increased in this monitoring plot (**Figure 2.38-2.53)**.

Monitoring Plot-5 (Basherhula)

One part of this monitoring plot is exposed to river. So there is a good possibility of quick wash out and soil erosion during monsoon period. This scenario also indicates vulnerability to storm surge and salinity intrusion from riverside during extreme events. Organic matter concentration reduced than the previous year wet season monitoring, nitrogen concentration also follows the similar trend. But Phosphorus and Sulphur concentration has increased.

pH and salinity of the monitoring plot is decreasing than the previous monitoring year. All salinity related parameters (EC, SAR and ESP) follow the similar trend. This might be a cause of decreased monovalent cations (Sodium and potassium) and increased divalent cations (Ca and Mg) concentration. Among the micro nutrient concentration, manganese and zinc concentration has increased while boron and iron concentration has been decreased. Concentration of heavy metals also increased than the previous wet season monitoring year but still remains within the limit (**Figure 2.38-2.53)**.

Monitoring Plot-6 (Bidyarbon)

Organic matter, Nitrogen and Phosphorus concentration has increased while Sulfur concentration has decreased which might be due to the impact of using organic fertilizer and decreasing salinity. EC of this monitoring plot has decreased for couple of years. All salinity related parameters (SAR, ESP and TSS) also followed the similar trend. Among the base cations only Calcium concentration has increased. pH is almost similar to last year.

All the micro nutrients concentration reduced drastically. Manganese, Boron and Iron concertation has decreased to ten, seven and five times than previous yearly wet season monitoring. This might be an impact of reduced salinity and increase of organic fertilizer. Lead and Cadmium concentrations were found to be increased than the previous years, but still stayed below the permissible limit (**Figure 2.38-2.53**).

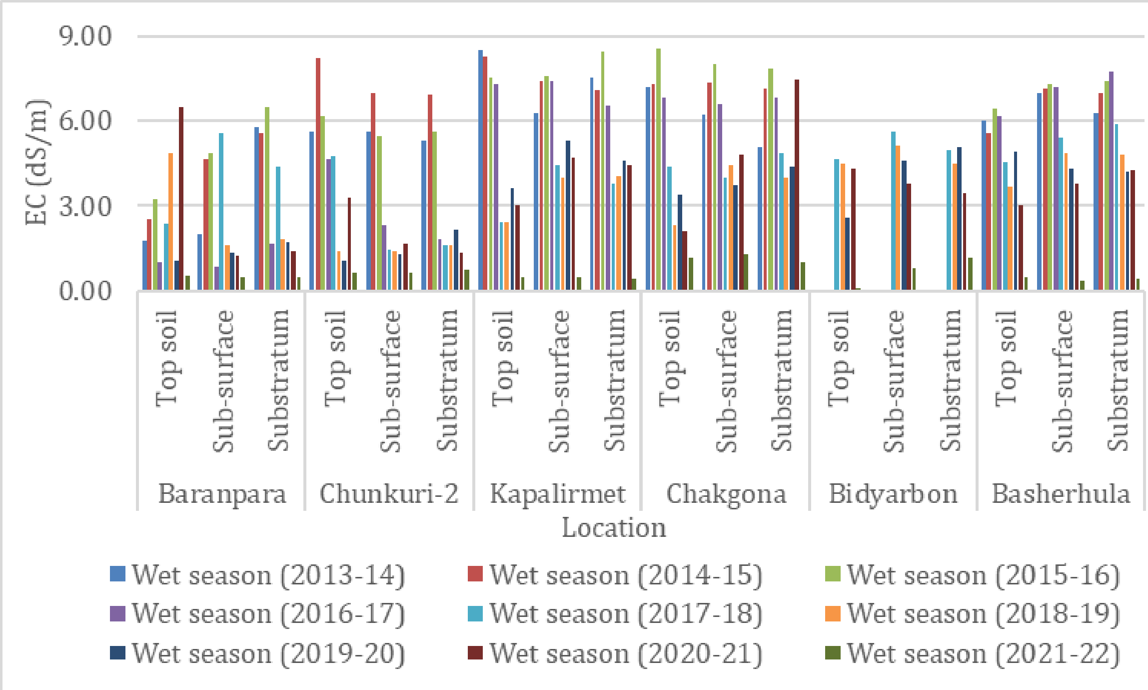


Figure 2.38: Changes of EC (dS/m) in wet seasons in sampling locations throughout the monitoring period

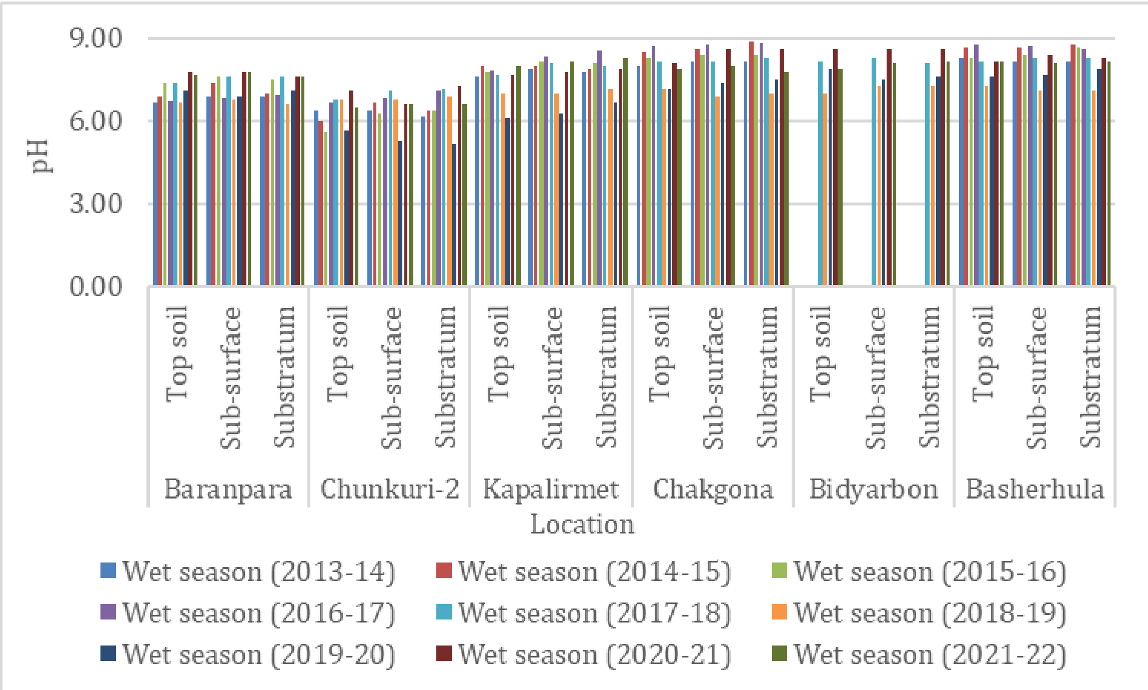


Figure 2.39: Changes of pH in wet seasons in sampling locations throughout the monitoring period

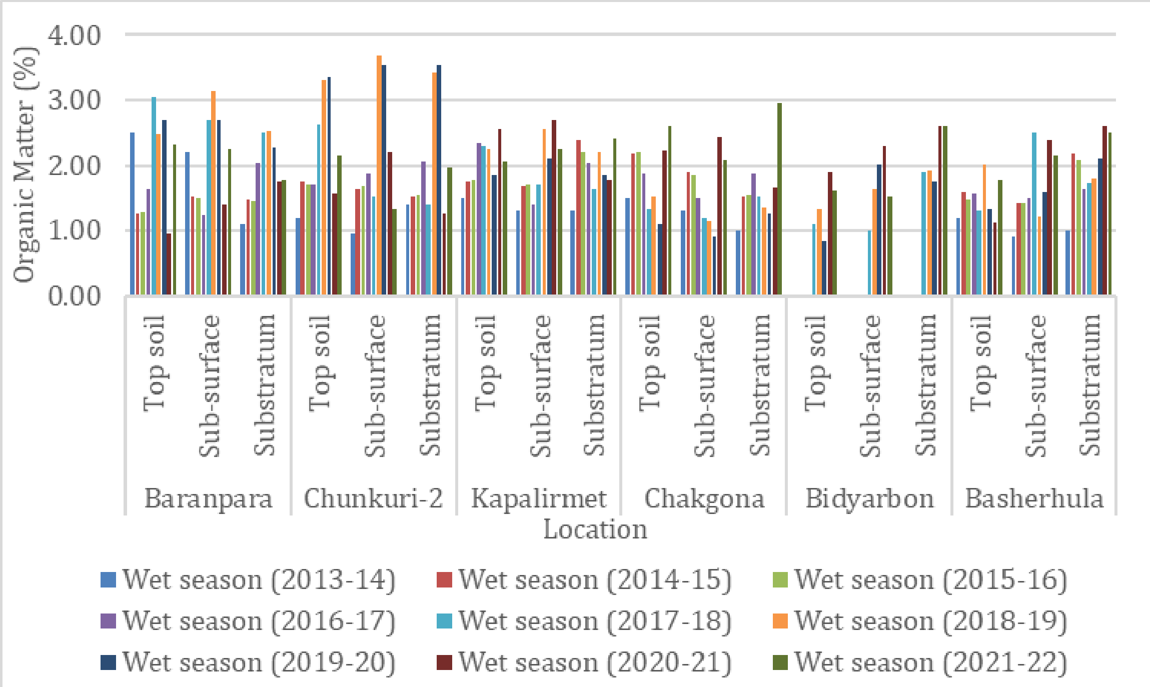


Figure 2.40: Changes of Organic matter (%) in wet seasons in sampling locations throughout the monitoring period

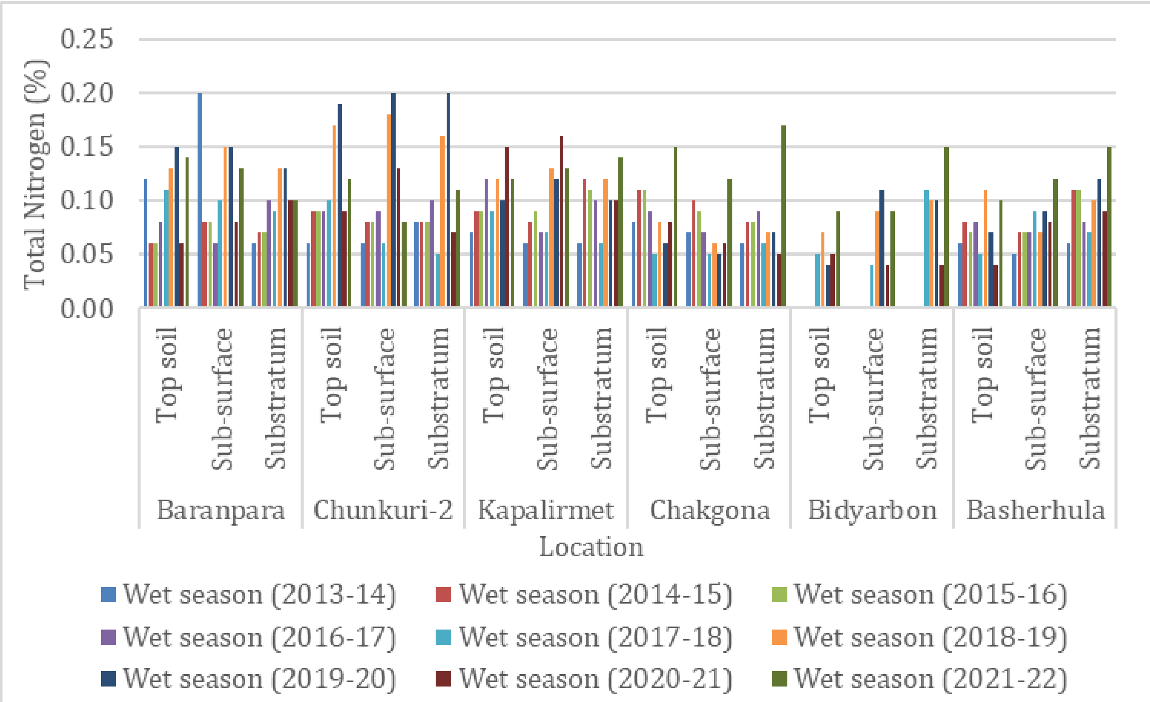


Figure 2.41: Changes of Nitrogen (%) in wet seasons in sampling locations throughout the monitoring period

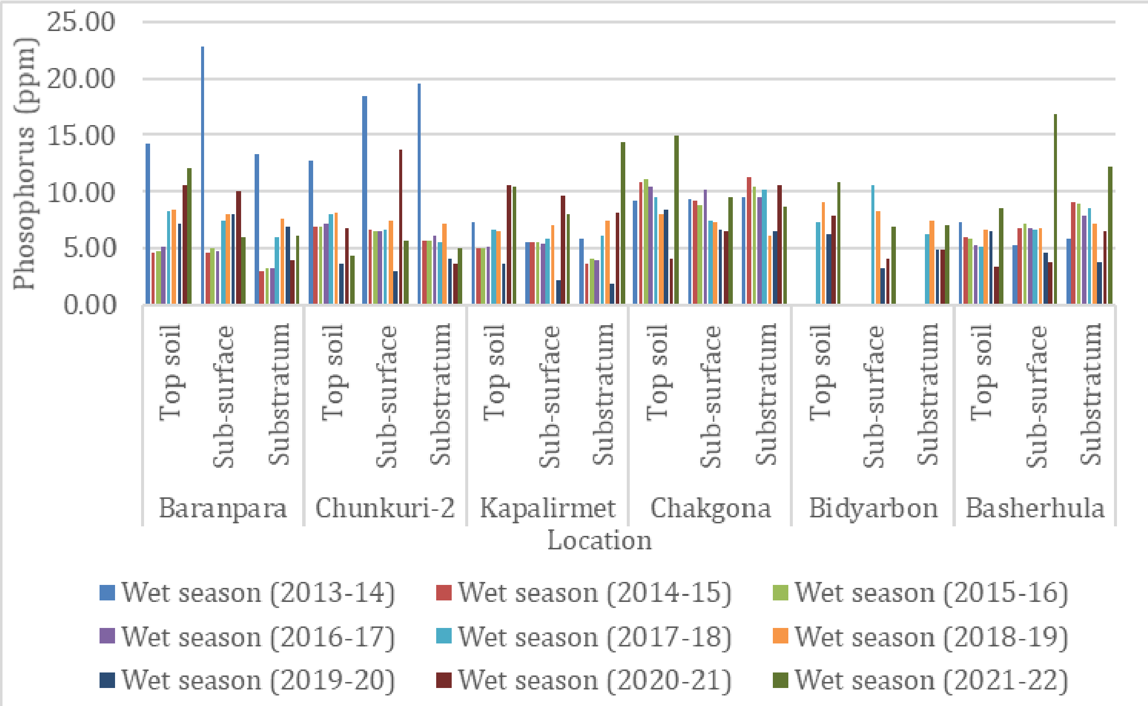


Figure 2.42: Changes of Phosphorus (ppm) in wet seasons in sampling locations throughout the monitoring period

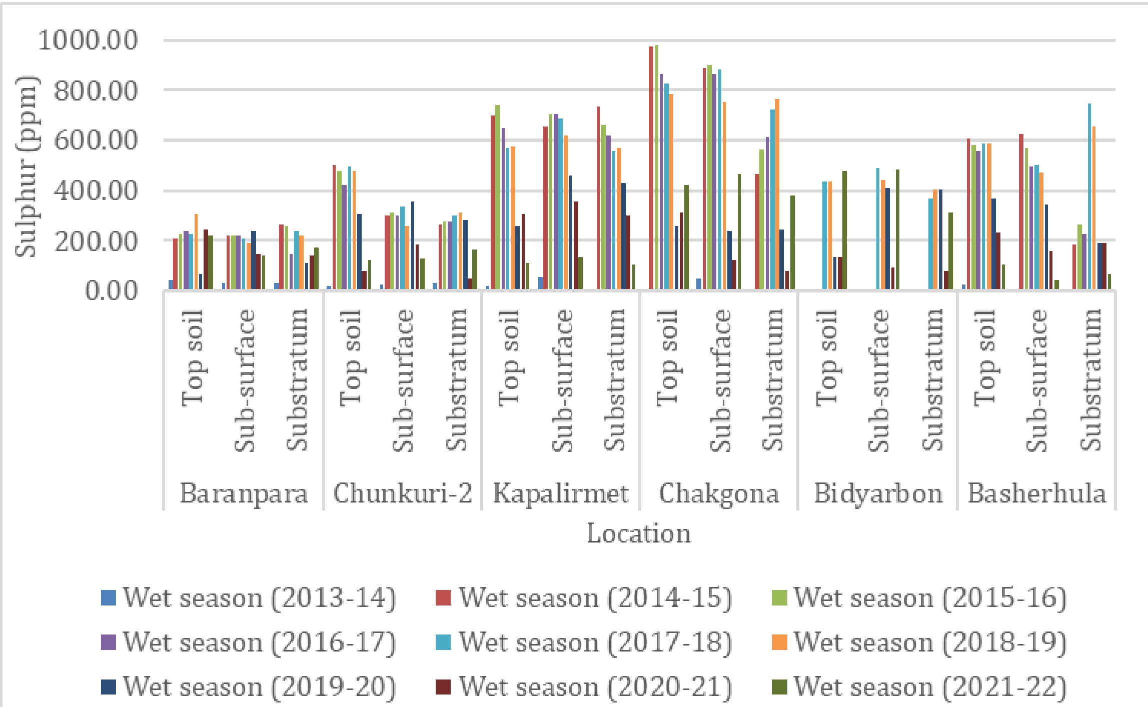


Figure 2.43: Changes of Sulfur (ppm) in wet seasons in sampling locations throughout the monitoring period

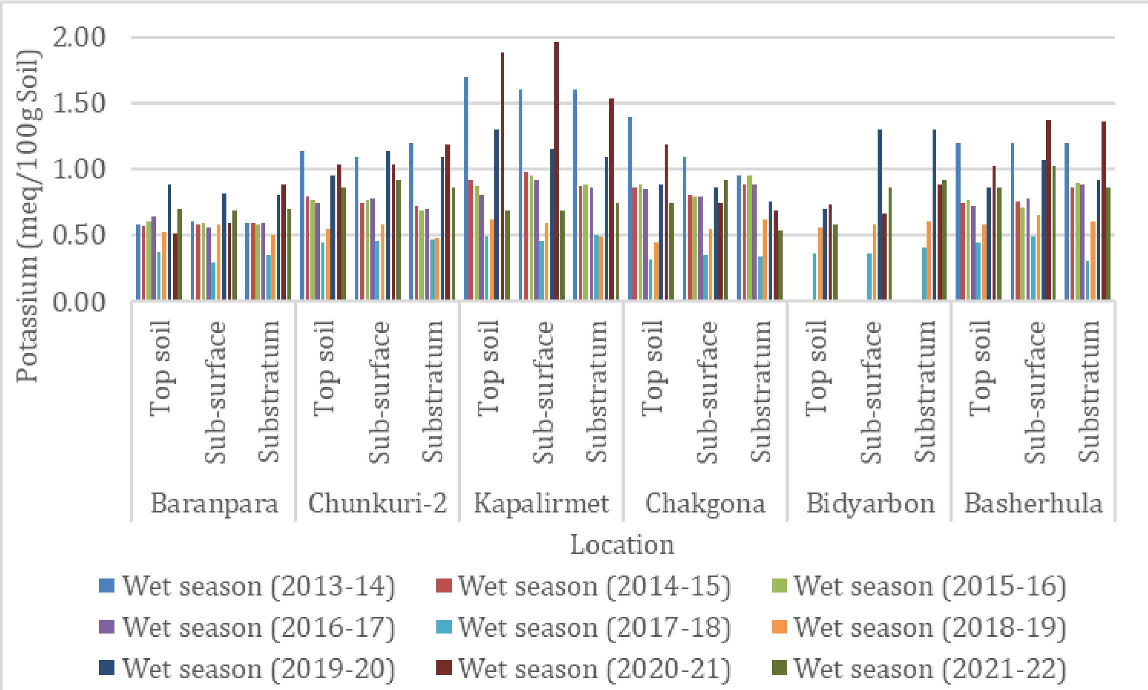


Figure 2.44: Changes of Potassium (meq/100g) in wet seasons in sampling locations throughout the monitoring period

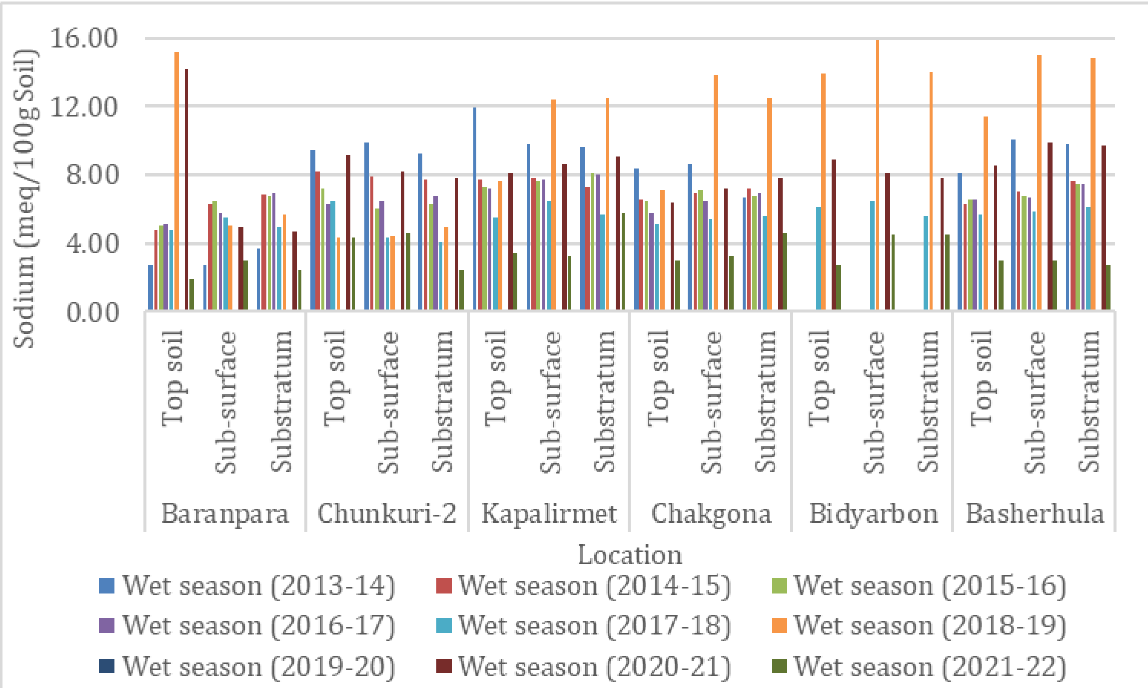


Figure 2.45: Changes of Sodium (meq/100g) in wet seasons in sampling locations throughout the monitoring period

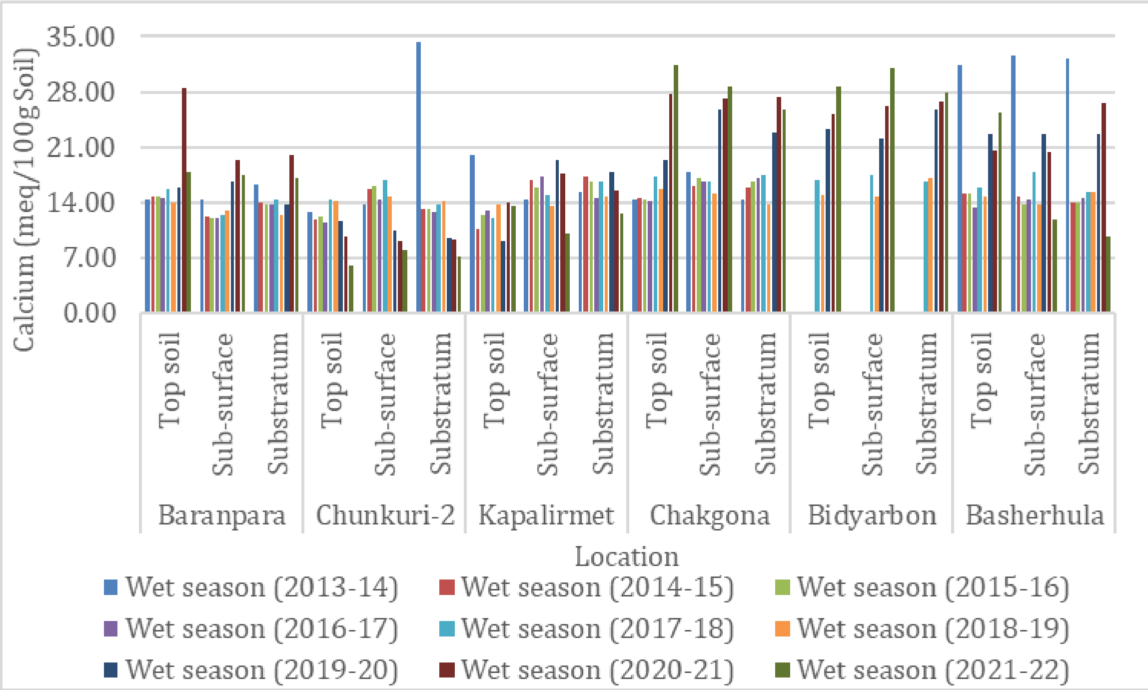


Figure 2.46: Changes of Calcium (meq/100g) in wet seasons in sampling locations throughout the monitoring period

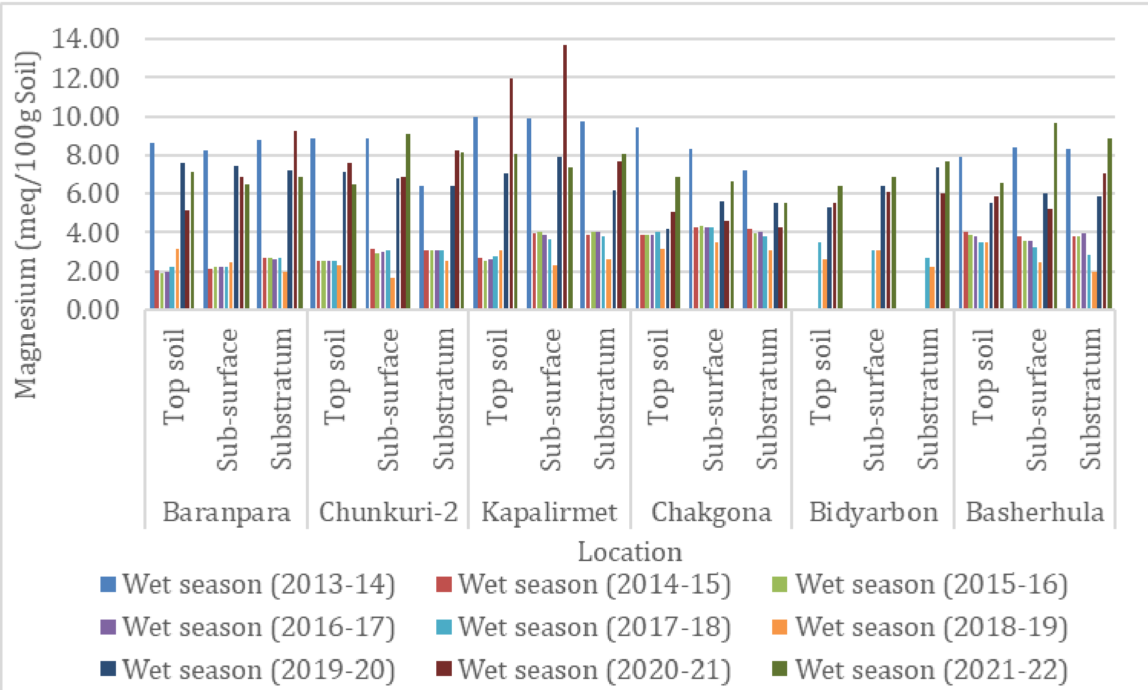


Figure 2.47: Changes of Magnesium (meq/100g) in wet seasons in sampling locations throughout the monitoring period

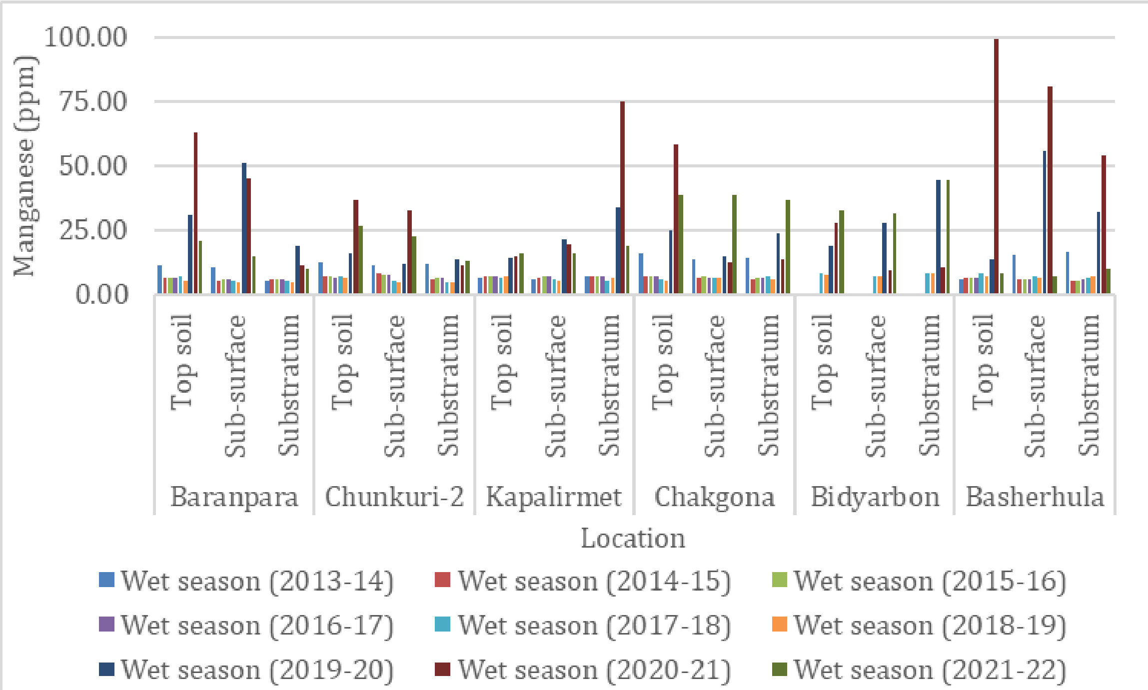


Figure 2.48: Changes of Manganese (ppm) in wet seasons in sampling locations throughout the monitoring period

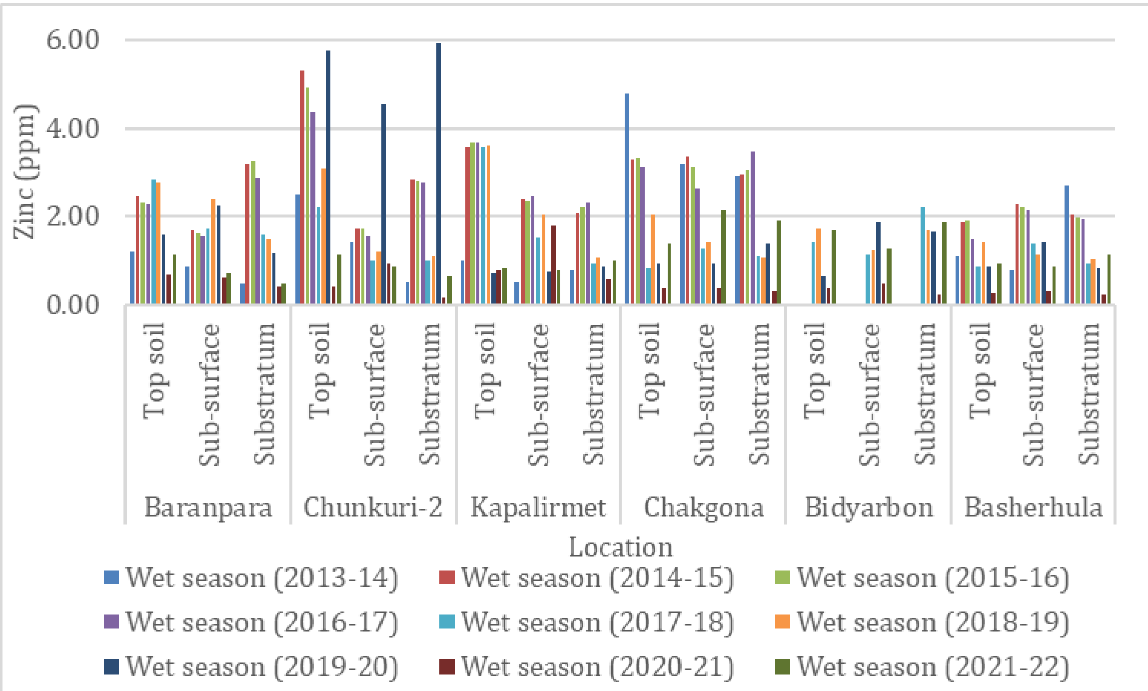


Figure 2.49: Changes of Zinc (ppm) in wet seasons in sampling locations throughout the monitoring period

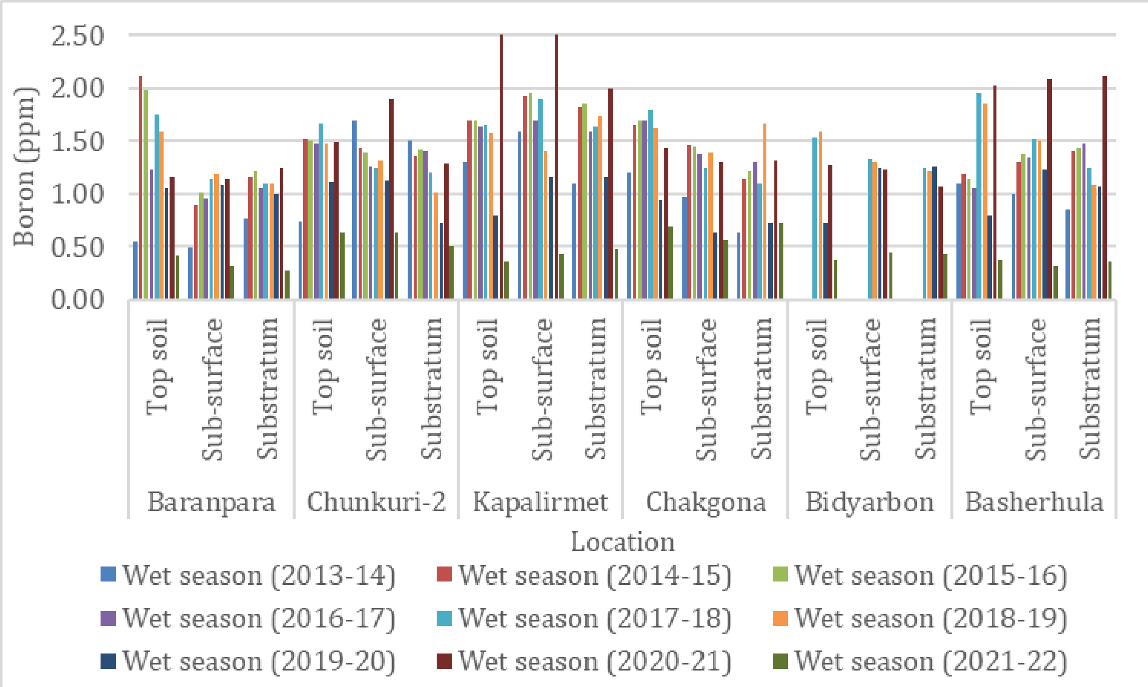


Figure 2.50: Changes of Boron (ppm) in wet seasons in sampling locations throughout the monitoring period

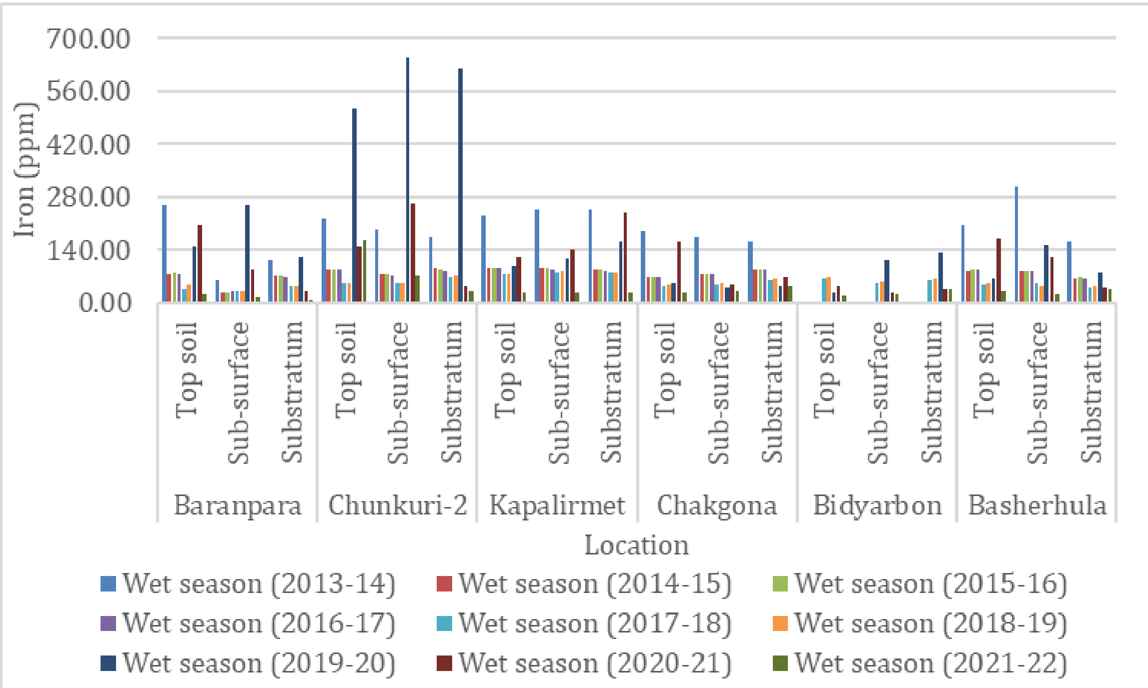


Figure 2.51: Changes of Iron (ppm) in wet seasons in sampling locations throughout the monitoring period

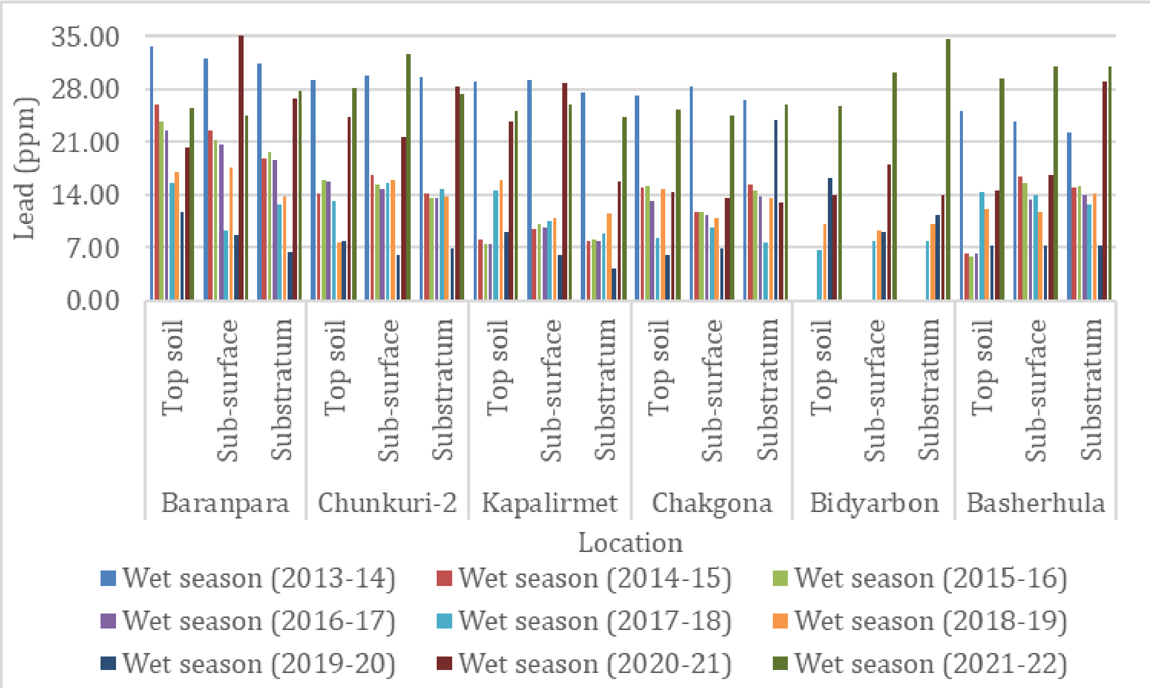


Figure 2.52: Changes of Lead (ppm) in wet seasons in sampling locations throughout the monitoring period

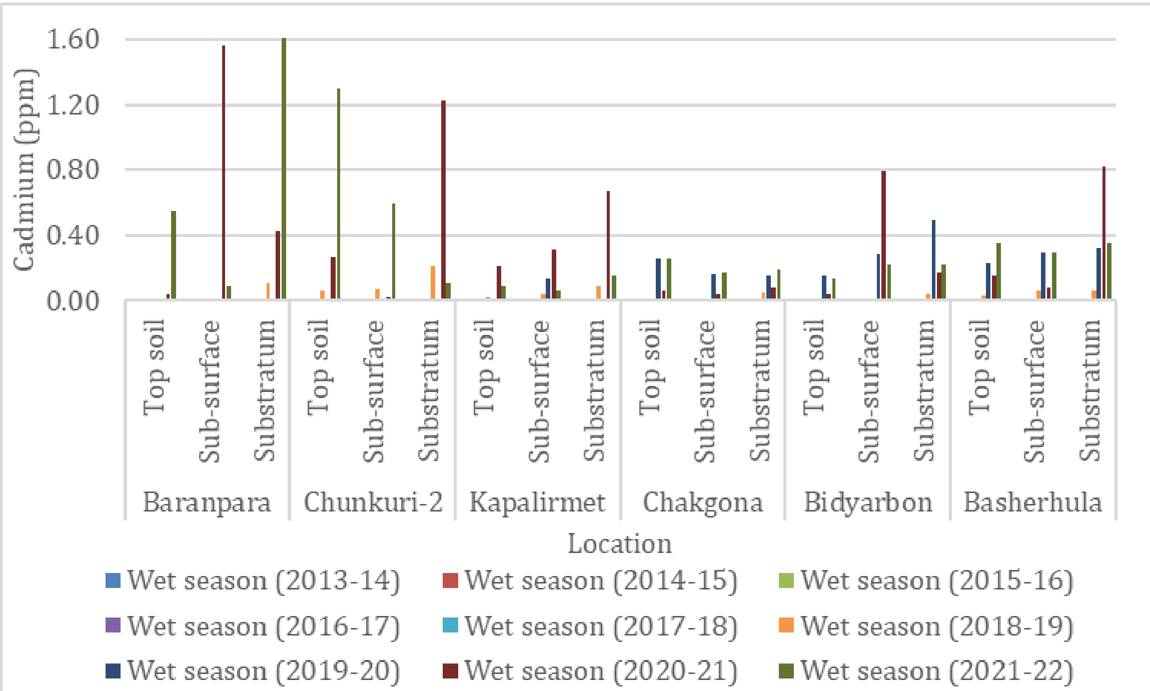


Figure 2.53: Changes of Cadmium (ppm) in wet seasons in sampling locations throughout the monitoring period

2.4.4 Agriculture Resources Monitoring

Monitoring of agriculture resources has been scheduled twice (April and October) a year as per the monitoring plan of the ToR. Next survey will be conducted in April, 2023 and report will be incorporated accordingly.

2.4.5 Livestock Resources Monitoring

The frequency of monitoring for livestock resources data collection has been considered twice in a year (April and October). The survey has already been conducted during the 35th quarterly monitoring period and report will be incorporated accordingly.

2.5 Water resources monitoring

The Passur River is one of the dynamic and significant 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 essential 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 Methodology

Time-series satellite images were used to assess the riverbank erosion and accretion. 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.

2.5.2 Collection and Processing of Images

Sentinel-1 Radarsat satellite images with 10m resolution covering the Passur River from Chalna to Hiron Point from July, 2022 to May, 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.

2.5.3 Delineation of Banklines

After collecting and processing 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 from July, 2022 to May, 2023.

2.5.4 Monitoring of Erosion & Accretion and Shifting of the Banklines

For monitoring the erosion and accretion at the project site, 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 July, 2022 to May, 2023 (**Figure 2.54).** However, the red colour (represents erosion) in a few locations along both banks during its passage from Chalna to Hiron Point, which may be considered insignificant.

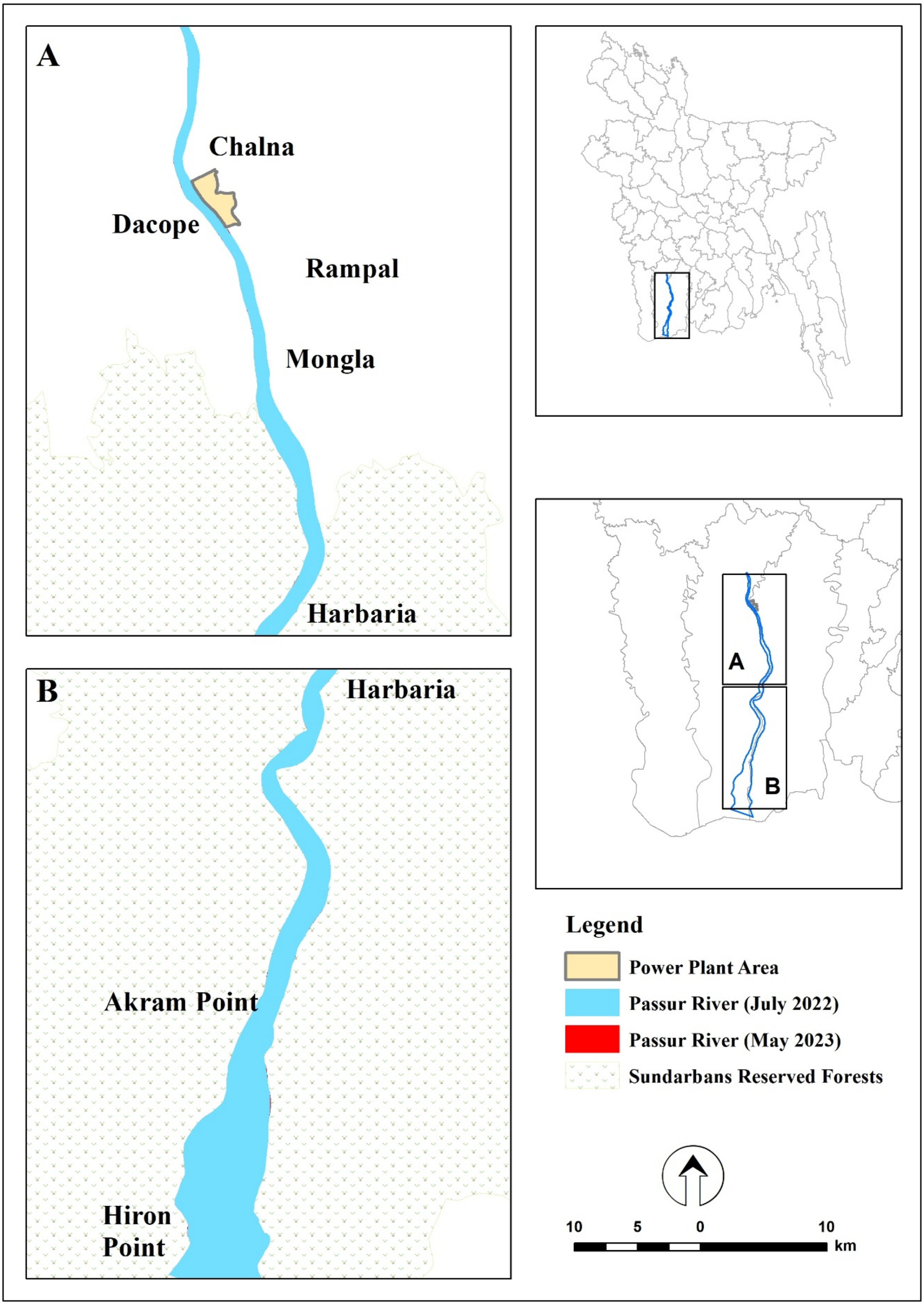


Figure 2.54: Riverbank erosion and accretion of the Passur River from July 2022 to May 2023

2.5.5 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 July 2022 to December 2022. Based on the relationship of the water level between Mongla Port and Hiron Point, the lag time and peak attenuation from Mongla Port to Rampal Jetty area were extrapolated.

Relation between Hiron Point and Mongla Port

For the assessment of lag time and peak attenuation between Hiron Point and Mongla Port, daily peak tidal water level was taken into consideration for the period from July 2022 to December 2022. 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 2.55**.

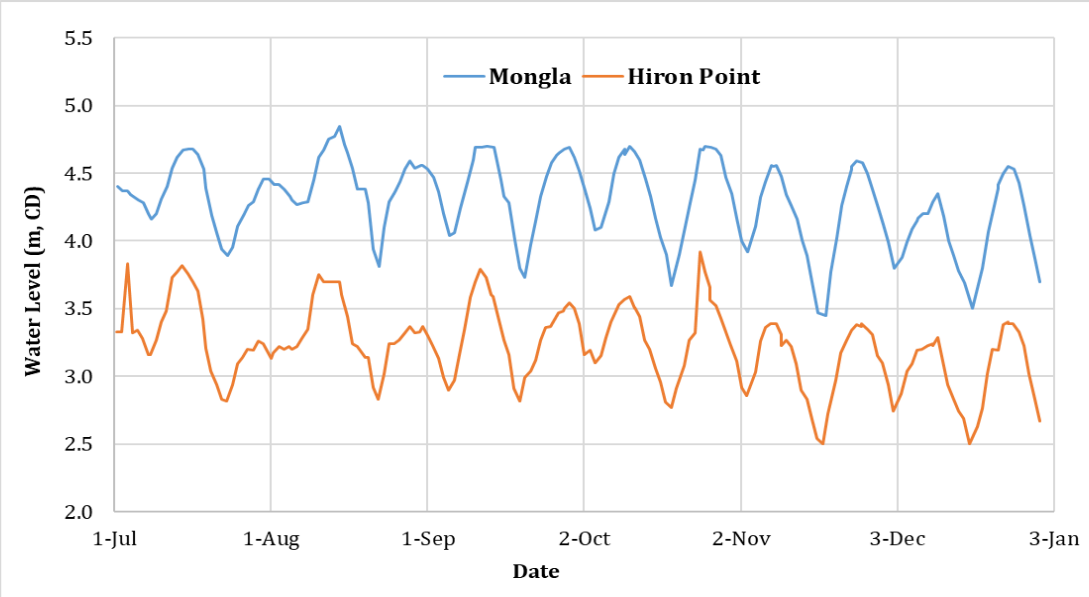


Figure 2.55: Peak water level at Hiron Point and Mongla Port for the period from July 2022 to December 2022

Moreover, maximum water level and corresponding time during full moon and no-moon were assessed to find out the lag time and peak attenuation between two stations (Mongla and Hiron Point) considering the distance between stations.

For the assessment of the lag time and peak attenuation between two stations for two different quarters for the second half of the year 2022, tidal water level data from July to September 2022 as well as October to December 2022 were analyzed respectively.

It was found that during no-moon period, peak water level of 3.76 m at Hiron Point at the beginning of the month of July 2022 travels through tide to the upstream at Mongla Port where its peak water level become 4.68 m on the same day (**Figure 2.56**). The peak attenuation between these two stations is 0.92 m. It was also found that the travelling time or lag time to reach this peak is around 1 hour 15 minutes.

Additionally, peak attenuation for the month of August 2022 and September 2022 are 1.15 and 1.00 respectively. While the lag time are 1 hour 15 minutes and 1 hour 30 minutes correspondingly for the month of August and September 2022 (**Figure 2.56**). The methodology is shown in **Figure 2.56**. It was measured that the distance between Hiron Point and Mongla Port is approximately 80 km. The average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from July to September 2022 is about 1 hour 20 minutes while the peak attenuation is nearly 1.02 m.

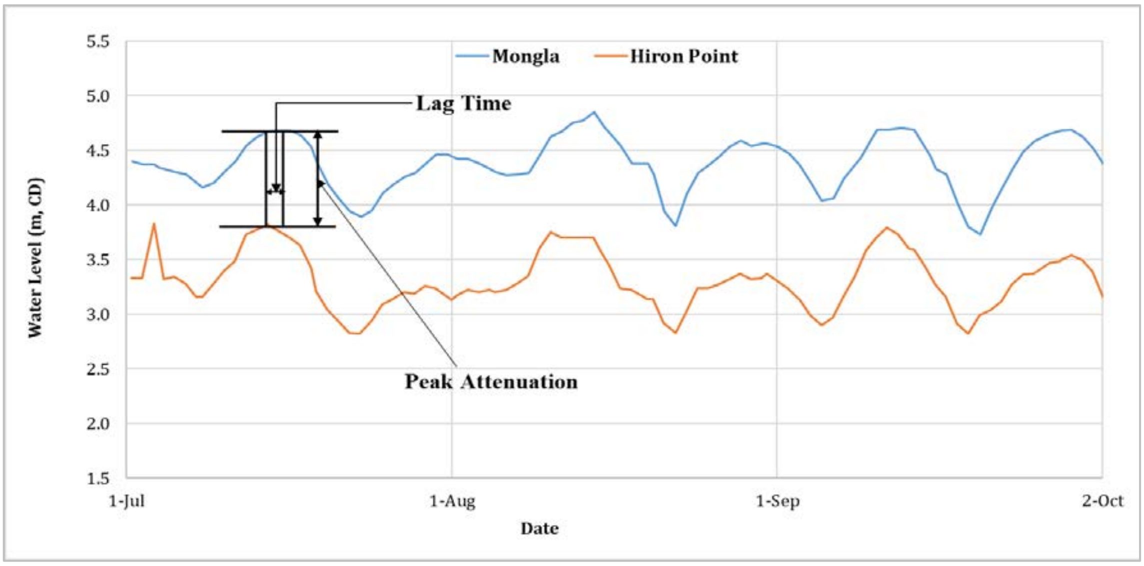


Figure 2.56: Process of calculation of lag time & peak attenuation during the period July-September 2022

Furthermore, analysis was done for the period of October to December 2022 (**Figure 2.57**). It was found that the peak attenuation during the month of October and November are 1.05 and 1.22 respectively while it is only 1.14 for the month of December 2022.

On the other hand, the lag time is same to reach peak water level from Hiron Point to Mongla Port for the month of October and November 2022 which is 1 hour. While it is 1 hour 35 minutes for the month of December 2022 (**Figure 2.57**). In addition, average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from October to December 2022 is about 1 hour 12 minutes while the peak attenuation is nearly 1.14 m.

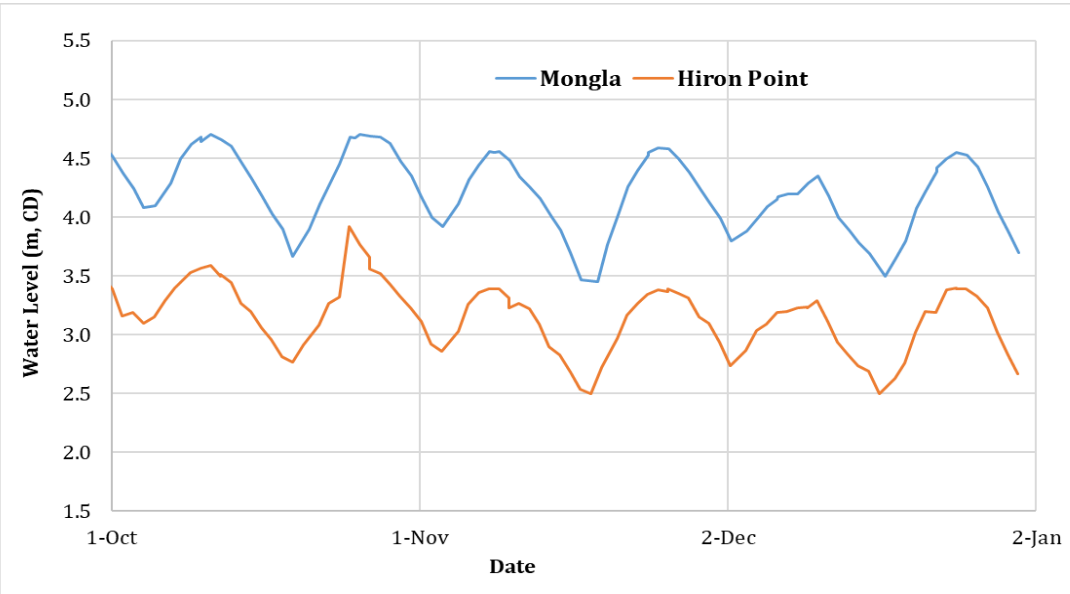


Figure 2.57: Peak water level at Hiron Point and Mongla Port for the period from October to December 2022

In summary, it was found that average travelling time to pass the peak water level through tide from Hiron Point to Mongla Port during the period from July to December 2022 is about 1 hour 16 minutes while the peak attenuation is nearly 1.08 m.

Relation between Hiron Point and Mongla Port was used to extrapolate the lag time and peak attenuation at Rampal Jetty area. The travelling distance from Mongla Port to Rampal Jetty area is 15 km. Based on the relation, it was estimated water level at certain peak at Hiron Point needs 1 hour 30 minutes to reach at Rampal Jetty area where peak attenuation is nearby 1.28 m.

2.6 Transportation Monitoring

2.6.1 Location of Traffic Survey

The traffic survey for this monitoring during the construction phase was conducted in between January 26, 2023 and January 28,2023 at three pre-selected locations. Weather was sunny on all the three days when the survey was conducted**.** The selected sites were Khudir Bottola and Gonai Bridge at Khulna Mongla Road and Taltola Bridge at Power Plant access road presented in the **Figure 2.58.**

2.6.2 Methodology

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

2.6.3 Traffic Volume Calculation

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

Table 2.10: Vehicle Conversion Factors

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

2.6.4 Results of Monitoring

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

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

Location	7:00 AM to 10:00AM	12:00 PM to 2:00PM	17:00 PM to 19:00PM
Khulna Mongla Road at Khudir Bottola	2353	1741	1990
Khulna Mongla Road at Gonai Bridge	860	612	756
Power Plant access road at Taltola Bridge	379	245	314

Source: Field Survey, January, 2023.

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.

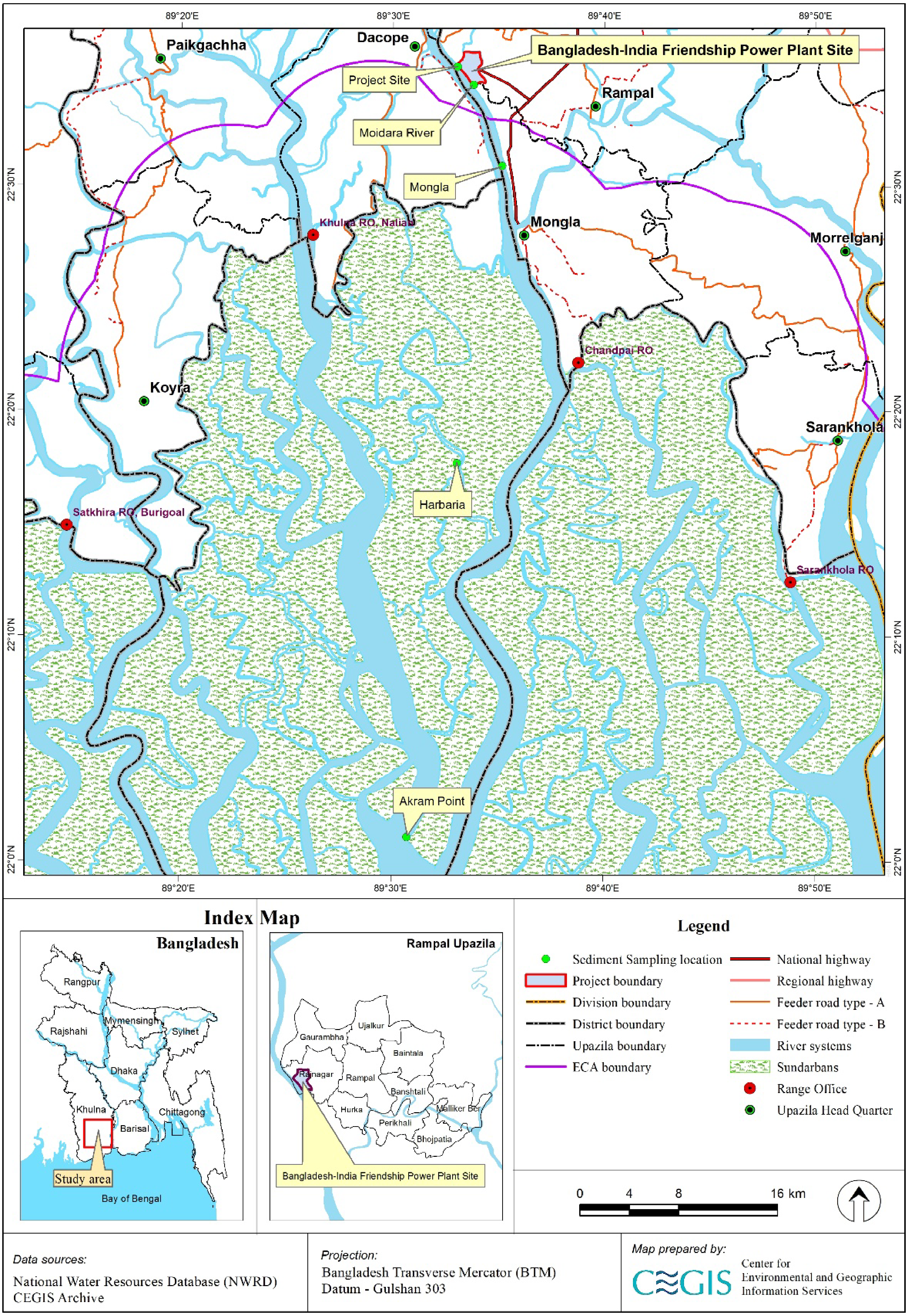


Figure 2.58: Locations of Traffic Survey

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 and also 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 34 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 35th quarterly period and a comparison with the earlier 34 quarters.

3.1.1 Methodology

Location of Monitoring Sites

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

Table 3.1: The Sampling Locations for Monitoring of Fisheries Resources

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

Selection of Parameters

According to ToR, five major components were selected for fisheries monitoring, such as fish habitat status, fish migration, fish diversity, shrimp/fish farm practices and fish production. Fish habitat status was monitored through investigating habitat suitability index in view of habitat classification based on length frequencies of different fish species, sensitivity of fish diversity and survival success of different life stages of fish to abiotic factors [(water quality, bed material, morphological aspects and biotic factors (food cover)]. On the other hand, 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. Moreover, 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 (up to 34th quarter monitoring), 35th quarter monitoring of session 2022-23 was conducted during the period from 29 January - 09 February, 2023. No fishing activities were observed at 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 (**Table 3.2**).

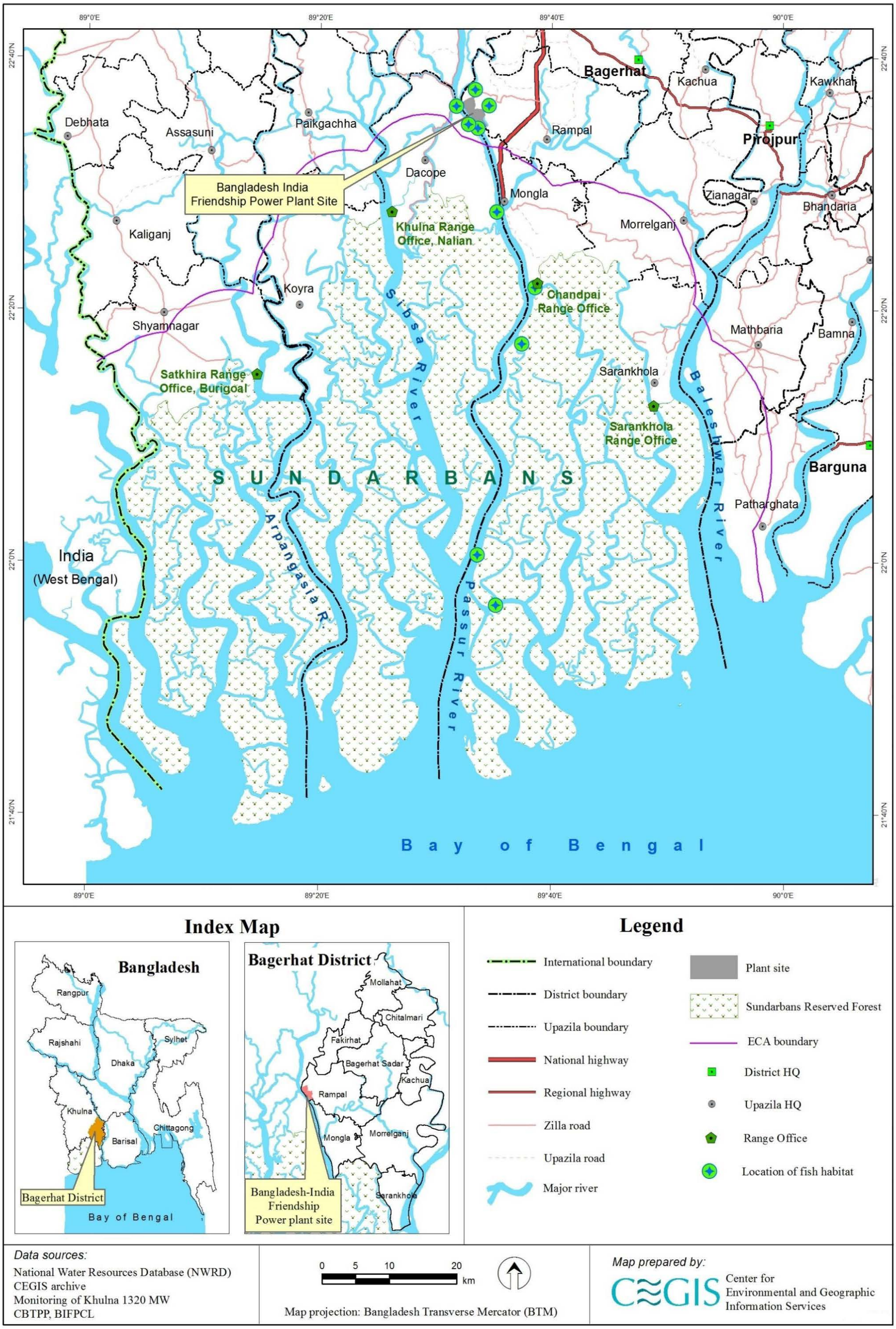


Figure 3.1: Fisheries Resources Monitoring Locations

Table 3.2: Classification of habitat use of 10 sampling sites

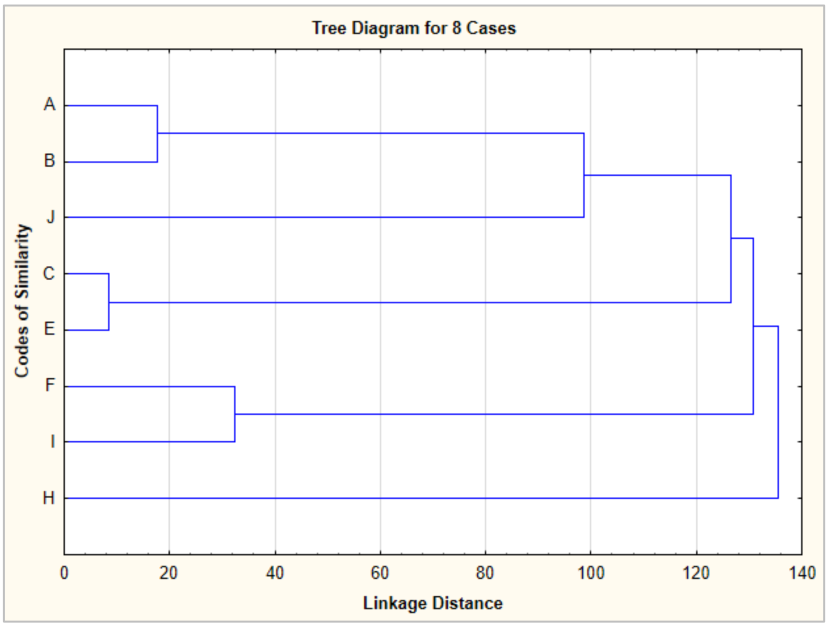
Monitoring Quarter	Type of Habitat Use
1st (April, 2014)	• Grazing Ground • Grazing and Breeding Ground
2nd (July, 2014)	• Grazing Ground • Spawning and Nursery Ground
3rd (October, 2014)	• Grazing Ground • Grazing and Breeding Ground • Spawning, Nursery and Grazing Ground
4th (January, 2015)	• Grazing Ground • Grazing and Breeding Ground • Spawning, Nursery and Grazing Ground
5th (April, 2015)	• Grazing Ground • Nursery Ground • Spawning and Nursery
6th (August, 2015)	• Grazing, Breeding Ground • Spawning, and Nursery Ground
7th (October, 2015)	• Grazing Ground, • Nursery Ground and • Growing and Feeding
8th (January, 2016)	• Nursery and Feeding Ground • Growing and Feeding
9th (April, 2016)	• Spawning and Nursery Ground • Feeding and Growing Ground
10th (July, 2016)	• Nursery Ground • Feeding and Breeding Ground
11th (October, 2016)	• Breeding and Spawning Ground • Feeding and Grazing Ground
12th (January, 2017)	• Grazing and Spawning Ground • Nursing Ground
13th (April, 2017)	• Grazing and Feeding Ground • Nursing Ground
14th (October, 2017)	• Grazing and Feeding Ground • Nursing Ground
15th (January, 2018)	• Grazing and Feeding Ground • Nursing Ground
16th (April, 2018)	• Feeding ground • Growing ground • Nursing ground
17th (July, 2018)	• Spawning and Nursery Ground • Nursery Ground with Feeding and Growing Capacity • Growing and Feeding Ground • Omni-ground
18th (November, 2018)	• Ground for Maturation • Omni-Ground: Nursery and Feeding Ground/Migratory Route; Ground for Maturation; Growing and Maturation Ground; Maturation Ground for Juveniles
19th (February, 2019)	• Ground for Feeding • Omni-Ground including Nursery Ground and Ground for Maturation

Monitoring Quarter	Type of Habitat Use
20^{th} (April, 2019)	• Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
21^{st} (July, 2019)	• Ground for Feeding and Maturation • Omni-Ground including Nursery Ground and Ground for Maturation
22^{nd} (November, 2019)	• Spawning and Nursery Ground • Omni-Ground including Feeding and Maturation Ground
23^{rd} (February, 2020)	• Nursery Ground • Spawning ground • Ground for maturation and feeding
25^{th} (July, 2020)	• Nursery Ground • Ground for maturation and feeding
26^{th} (November, 2020)	• Nursery Ground • Omni-Ground including Spawning and Nursery Ground, and Maturation Ground
27^{th} (January, 2021)	• Nursery Ground • Omni-Ground including Spawning and Nursery Ground, and Maturation Ground
28^{th} (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
31^{st} (February, 2022)	• Nursery Ground • Maturation and Feeding Ground
32^{nd} (May, 2022)	• Spawning and Nursery Ground • Maturation Ground
33^{rd} (July, 2022)	• Spawning and Nursery Ground • Feeding and Maturation Ground
34^{th} (October, 2022)	• Feeding Ground • Ground for Maturation

During the 35^{th} quarterly monitoring conducted in January-February of 2022-23 Session, the sampling sites were divided into two major classes as shown in **Figure-3.2**.

1. Spawning and Nursary Ground: The sampling sites, Chandpai (F), Mongla (H), Maidara (I) 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), Haldikhali (B), Charaputia (C) and Harbaria (E) were found to support mostly length groups of 10-20cm and >25cm of available fish species. Field findings revealed that the mentioned sampling sites were found to be used as maturation and feeding ground of observed fish species.

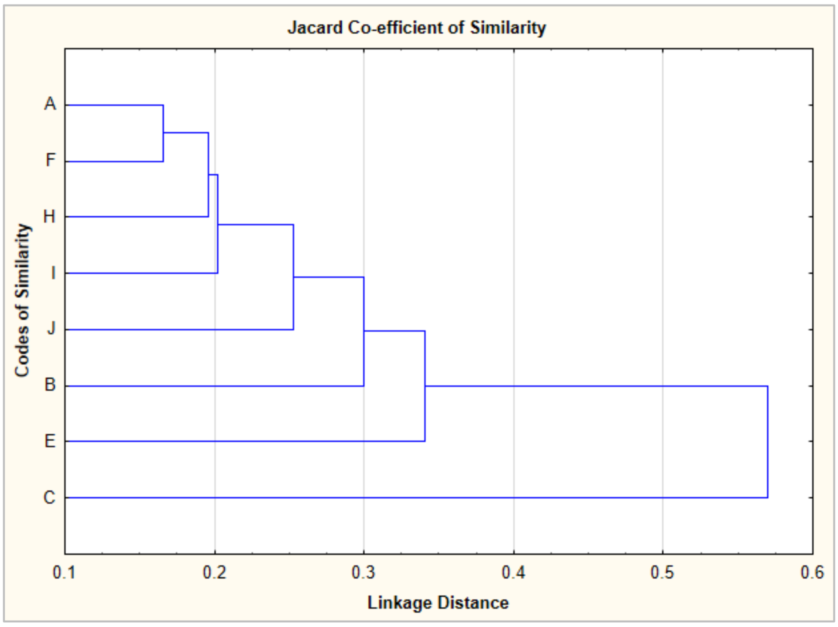


35th monitoring, October 2023

(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 2022-23, the JI value between Akram Point (A) 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 eight (08) sampling sites of available fishing.



35th monitoring, October 2023

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

Fish Diversity

<u>*Shannon-Weiner Index*</u>

In this monitoring year of 2022-23, species evenness also varies among the sampling sites. Highest Shannon-Weiner index was found at Charaputia (0.81) indicating most evenly distributed fish species. On the contrary, lowest evenness was found at Akram Point (0.39) (shown in **Table 3.5** and **Table 3.6**). 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 and gear used in shown in **Figure 3.4** and **Figure 3.9**.

<u>*Fish Species Richness (FSR)*</u>

Fish species richness was identified through Simpson's Index[5]. Considerable difference is noticed in the fish species richness (FSR) in different habitat classes (**Table 3.3** and **Table 3.4** and **Figure-3.5**). In this monitoring phase, species richness varies with the sampling sites. Maximum FSR was obtained at Chandpai Point (n=20), while very low FSR was recorded at Charaputia (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 *Chaka Chingri, Chali Chingri and Paisse*, Haldikhali was rich of *Galda,* Charaputia was rich assemblage of *Galda Chingri,* Harbaria was rich of *Galda* and *Gagra Tengra.*

Table 3.3: Site wise Rich Species Number (1st to 12th QM)

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

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

Table 3.4: Site wise Rich Species Number (13th to 35th QM)

Site	No. of Rich Species																					
	2017-18			2018-19				2019-20				2020-21				2021-22				2022-23		
	13th	14th	15th	16th	17th	18th	19th	20th	21th	22th	23th	25th	26th	27th	28th	29th	30th	31th	32nd	33rd	34th	35th
A	2	0	0	4	0	1	0	2	0	0	0	0	2	4	0	1	3	5	0	0	2	3
B	1	0	0	0	0	3	0	-	0	0	0	0	0	0	0	0	4	4	0	0	3	1
C	0	0	0	4	0	0	4	7	0	0	5	0	3	3	2	2	6	4	0	0	6	1
B	0	0	0	0	0	0	0	-	0	0	1	0	0	0	0	0	-	-	0	0	0	0
E	7	6	6	0	2	4	0	2	0	0	2	0	1	0	2	4	4	4	0	0	2	2
F	6	5	7	11	9	2	3	7	4	6	2	0	4	1	2	0	3	5	9	5	0	3
G	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	-	-	0	0	0	0
H	2	2	1	2	3	0	3	-	1	5	2	3	0	1	0	3	-	3	1	2	0	1
I	1	3	2	1	3	9	3	1	1	6	3	2	3	0	3	1	1	4	2	4	0	2
J	4	2	1	2	3	2	2	2	3	2	3	2	3	1	2	0	2	-	2	5	0	2

Source: CEGIS Field Survey, January, 2023

Table 3.5: Site Wise Species Diversity using Shannon–Weiner Index (1st to 13th QM)

Site	Species Number													Shannon-Weiner Index*												
	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th QM	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th QM
A	33	0	13	7	3	0	10	15	0	0	1	2	2	0.5	0	0.7	0.6	1	-	0.6	0.4	0	0	0	0.9	0.74
B	12	0	24	14	0	0	11	3	0	0	1	0	5	0.9	0	0.6	0.4	0	-	0.6	0.6	0	0	0	0	0.37
C	2	12	9	0	11	26	18	24	17	0	23	10	18	0.3	0.77	0.4	0	0.8	0.6	0.5	0.7	0.6	0	0.6	0.6	0.79

Site	Species Number													Shannon-Weiner Index*												
	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th QM	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM	13th QM
D	12	22	15	26	27	24	20	25	8	19	32	27	15	0.3	0.78	0.7	0.5	0.7	0.7	0.5	0.7	0.6	0.6	0.6	0.8	0.76
E	7	13	10	11	6	16	9	9	15	12	5	4	4	0.4	0.6	0.8	0.8	0.2	0.7	0.9	0.4	0.7	0.5	0.7	0.7	0.51
F	3	13	6	4	10	8	14	6	7	5	7	12	9	0.8	0.77	0.5	0.6	0.7	0.4	0.8	0.7	0.8	0.7	0.9	0.9	0.53
G	6	3	5	7	18	3	8	6	6	4	12	3	15	0.7	0.82	0.7	0.7	0.2	1	0.7	0.8	0.6	0.9	0.2	0.7	0.67

Table 3.6: Site Wise Species Diversity using Shannon–Weiner Index (14th to 35th QM)

Site	Species Number																					Shannon-Weiner Index																				
	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	21st QM	22nd QM	23rd QM	25th QM	26th QM	27th QM	28th QM	29th QM	30th QM	31st QM	32nd QM	33 QM	34 QM	35 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	33 QM	34 QM	35 QM
A	0	0	3	0	8	0	2	0	0	0	0	7	18	0	6	20	25	0	0	11	13	0	0	0.9	0	0.1	0	0.6	0	0	0	0	0.6	0.5	0	0.4	0.6	0.5	0	0	0.3	0.5
B	0	0	0	0	2	0	-	0	0	0	0	0	0	0	0	7	25	0	0	7	7	0	0	0	0	0.9	0	-	0	0	0	0	0	0	0	0	0.7	0.5	0	0	0.6	0.3
C	0	0	12	0	0	24	11	0	0	10	0	4	28	4	10	34	33	0	0	13	3	0	0	0.69	0	0	1.69	0.86	0	0	0.78	0	0.82	0.53	0.88	0.82	0.83	0.54	0	0	0.81	0.38
D	0	0	0	0	0	0	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	17	12	0	2	0	0	2	0	9	0	3	13	25	12	0	0	12	7	0	0	0	0.3	0.7	0	0.9	0	0	0.7	0	0.2	0	0.7	0.7	0.7	0.7	0	0	0.5	0.3

Species Number

Site	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	33 QM	34 QM	35 QM
F	6	17	0	0	0	13	22	19	11	11	0	12	7	20	0	10	13	19	6	-	20
G	81	29	21	16	19	0	26	0	0	0	0	0	0	0	0	0	0	0	0	-	0
H	112	13	3	18	2	13	-	5	11	10	11	0	3	0	9	1	11	13	8	-	12
I	3	13	12	10	17	11	8	9	11	12	6	16	0	18	1	1	12	4	11	-	12
J	4	5	10	14	11	21	12	14	9	8	15	11	12	4	0	8	0	10	13	-	7

Shannon-Weiner Index

Site	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	33 QM	34 QM	35 QM
F	0.85	0.81	0	0	0	1.44	0.74	0.5	0.81	0.56	0	0.70	0.18	0.37	0	0.68	0.59	0.84	0.91	0	0.46
G	0.6	0.7	0.7	0.8	0.3	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H	0.54	0.21	0.55	0.49	0	1.44	-	0.14	0.76	0.40	0.55	0	0.12	0	0.85	0	0.06	0.31	0.36	-	0.20
I	0.88	0.33	0.21	0.65	0.85	1.46	0.14	0.52	0.80	0.54	0.45	0.41	0	0.52	0	0	0.67	0.69	0.79	-	0.35
J	0.78	0.32	0.54	0.52	0.52	0.98	0.50	0.71	0.50	0.64	0.46	0.53	0.19	0.96	0	0.58	0	0.37	0.83	-	0.46

**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)*

Chota Baila (*Platycephalus indicus*)

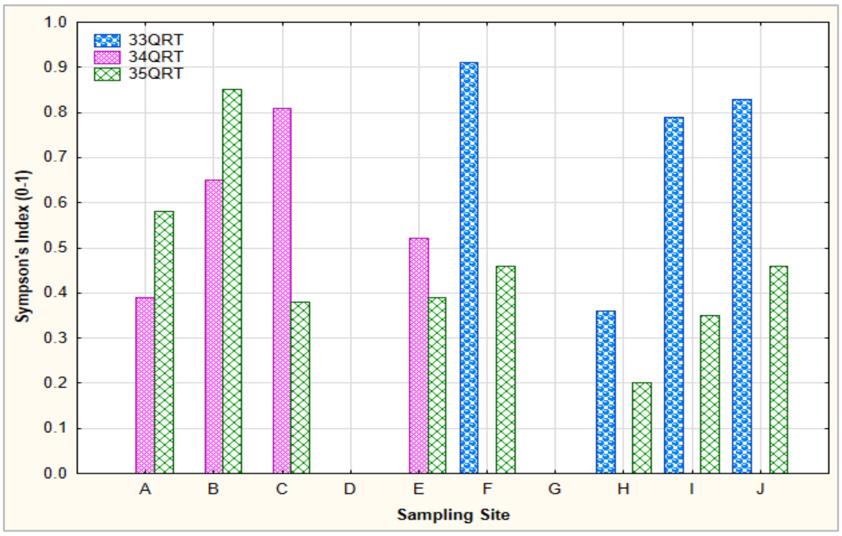
Poma (*Johnius coitor*)

Paissa (*Liza Persia*) and Chaka Chingri (*Fenneropenaeus indicus*)

Bhut Baila (*Butis melanostigma*)

Figure 3.4: In-situ catch observed in the sampling site

Source: CEGIS; January, 2023

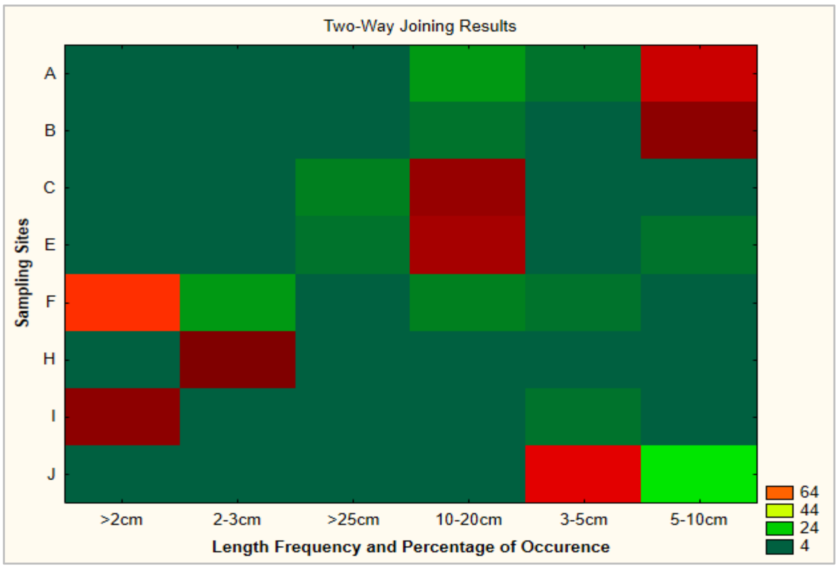


(FSR is identified though Simpson's Index)

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

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

Fish community structure was analyzed through counting the length-wise fish individuals (**Figure 3.6**). The following shows that Juvenile were dominant at Chandpai, Maidara and Mongla Point but adult age group were at Charaputia and harbaria Point.



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

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

Fish Migration

<u>*Migratory Species Diversity*</u>

Migratory species were identified by analyzing the common species available in the regular catch from the sampling sites. Fish species like Paisse, Kharolla, Amadi and Phesa attain the maximum abundance among the migratory fish species observed in the 35th quarter of monitoring. The relative abundance of the migratory species is given below in the **Figure 3.7**.

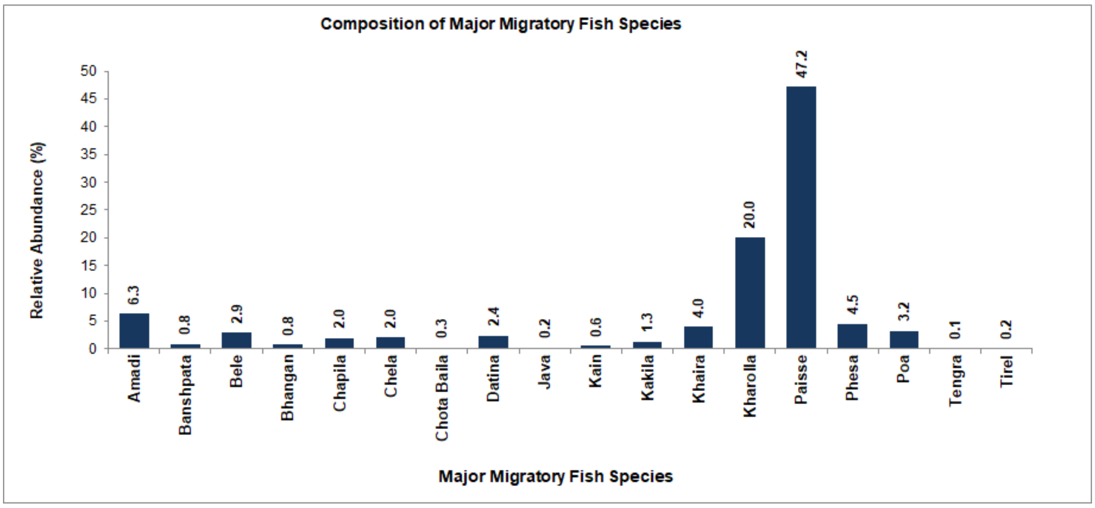


Figure 3.7: Relative abundance of major migratory fish species in sampling sites

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, Phesa were observed to migrate long distance (**Figure 3.8 and Table D.4 of Appendix-IV**).

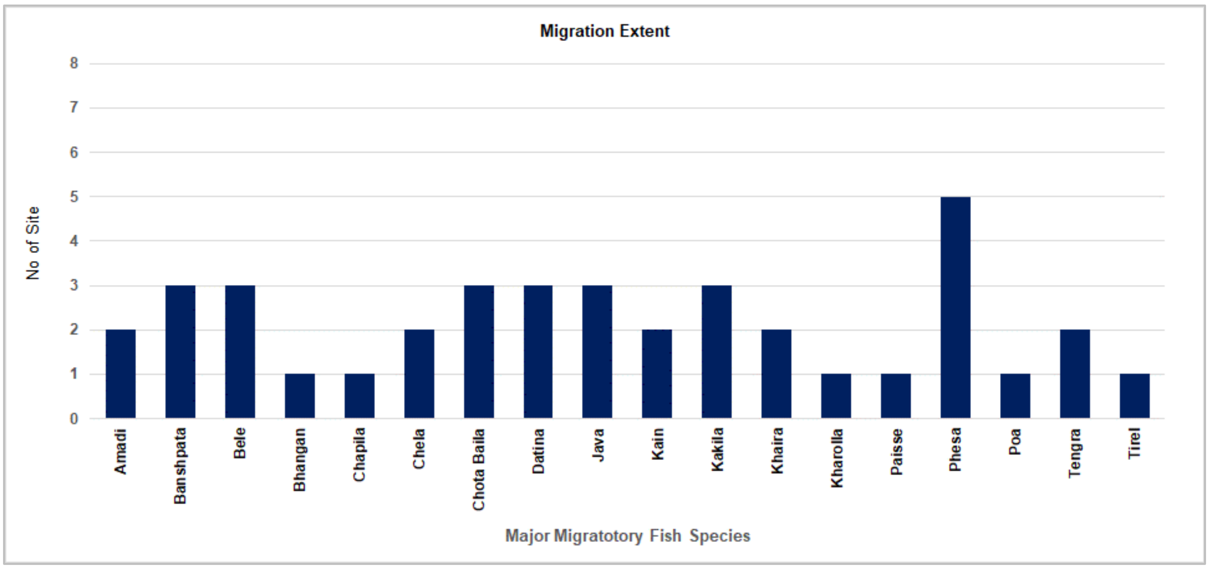


Figure 3.8: Migration extent of major migratory fish species in sampling sites

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 and Rajnagar gher (**Table 3. 7**).

Table 3.7: Stocking Pattern of Fish/Shrimp Farm

Name of shrimp farm	Name of species	Stocking Density (No/ha)	Stocking date
Rajnagar (42.09 ha)	Bagda	2851	January, 2023
	Paissa	1426	January, 2023
Kapashdanga-Muralia (115.7ha)	Bagda	9507	December, 2022
	Harina	6050	December, 2022
	Galda	43	December, 2022
	Paissa	8643	January, 2023
	Patari	7	January, 2023
Chunkuri-2 (6.07ha)	Kharolla	659	January, 2023

Name of shrimp farm	Name of species	Stocking Density (No/ha)	Stocking date
	Paissa	3295	January, 2023
	Bagda	1647	December, 2022
	Tilapiai	49	January, 2022
	Galda	329	December, 2022

Shrimp/Fish Growth Rate and Mortality

During the 35th quarter of monitoring, no growth rate was observed in the shrimp gher as this was the stoking period. (**Table 3.8** and **Table 3.9)**.

Table 3.8: Growth Rate and Mortality of Fish/Shrimp (1st to 17th 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	
	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)	Growth Rate	Mortality (%)
1	0.3	15-	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-	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
3	0.2	25-	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 3.9: Growth Rate and Mortality of Fish/Shrimp (18th to 35th QM)

Gher No.	18th QM		19th QM		20th QM		21th QM		22st QM		23nd QM		25rd QM		26th QM		27th QM		28th QM		29th QM		30th QM		31st QM		32st QM		33 QM		34th QM		35th 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 (%)
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	-	-
2	0.30	80	-	-	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	-	-
3	-	-	-	-	0.3	40	0.3	-	0.3		-	-	0.3	-	0.3	90	-	-	0.3	30	0.4		0.3	-	-	-	0.3	-	0.3	60	0.3	29	-	-

Source: CEGIS 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 (16.5 kg/haul) shown in **Table 3.10**. The highest production was observed at Akram Point followed by Harbaria (**Table 3.11**).

Table 3.10: Total Catch in Different Gears in the Sampling Sites

Site	Habitat	Gear Name/Type	Haul Duration (hr)	No of Haul	kg/haul
A	Passur River	Charpata Jal	12	2	12.75
		Charpata Jal	12	1	9.75
		Charpata Jal	12	1	16.5
B	Passur River	Borshi	6	20	0.08
		Khepla Jal	0.08	100	0.05
C	Passur River	Borshi	4	20	0.1
		Borshi	4	20	0.3
E	Passur River	Borshi	4	20	0.45
		Borshi	4	20	0.63
		Borshi	4	20	0.30
F	Passur River	Khepla Jal	0.08	30	0.03
H	Passur River	Tana jal	0.1	10	0.02
J	Passur River	Thela Jal	0.08	20	0.02
		Khepla Jal	0.08	15	0.01

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

Table 3.11: Total Catch in the Sampling Sites

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

Sampling Site	Total Catch (kg)																				
	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	322nd QM	33rd QM	34th QM	35th QM
A	-	-	17	-	16	-	0.4	-	-	-	-	30.5	3.5	-	1.1	27	30	-	-	81	51.7
B	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	13	14.5	-	-	0.4	20.5
C	-	-	1.50	-	-	93	17.5	-	-	4.6	-	18.9	33	12.7	5.85	23	20	-	-	1.1	8
D	-	-	-	-	-	-	-	-	-	1.35	-	-	-	-	0	-	-	-	-	-	-

Sampling Site	Total Catch (kg)																				
	14th QM	15thQM	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	322nd QM	33rd QM	34th QM	35th QM
E	1.5	2.56	-	0.1	2	-	0.5	-	-	1.17	-	2.07	-	47.5	11.34	52	4	-	-	5.7	27.5
F	0	-	-	-	-	-	-	-	-	-	-	0.6	-	2.3	-	-	-		0.6	-	0.8
G	10.5	37.67	3	4	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H	-	-	0.33	22	-	5	-	11.5	0.2	20	10.5	-	4	-	6.1	0.25	1	-	0.8	-	0.2
I	0.4	0.67	0.13	3	5	1.2	-	0.5	1.7	0.4	3.0	5	-	3.5	7.75	2.5	0.1	1.2	1.25	-	-
J	0.3	-	1	0.25	1.2	0.6	0.17	1.6	0.8	-	6.3	7.5	-	0.3	-	3.25	-	1.3	3.1	-	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*

Figure 3.9: Fishing gears observed during 35th quarterly monitoring

Culture Fish Production

The present study on shrimp/fish farm in the 35th quarter monitoring phase showed that fish production was observed only in the Rajnagar Gher **(Table D-5, Appendix-1)**. Fish production in the other two Ghers were not observed as it was stocking phase.

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.

Description of the selected homestead

The homestead in Rajnagar is located at 2.5 km. east from upper North-east boundary of the project site. This is situated inside the damp area as numerous small swamps exist inside and surround the homesteads. Water retention capacity of surface soil of this homestead is very low and for this reason very little number of grasses and other herbs are present. Land elevation of selected homestead at

Kalekarber village is comparatively flood free. This is located at about 1.8 km. east from Middle-east boundary of the project. Chalkghona village is located about 0.5 km south from south-east boundary of the project. The selected homestead of this village is close to Maidara River to it's north side and saline water shrimp farms to its south periphery. Presence of shallow ditches and peripheral waterbodies support to grow staple coverage of saline tolerant plant species. Borni village is located at about 3.0 km north from north-east boundary. Sampled homestead at Borni is situated at the middle part of the village. This homestead is also dominated by planted tree species and soil condition is similar to Rajnagar site. Vegetation of this homestead have been severely been damaged by past Cyclone Aila.

Species Composition of selected homestead vegetation

Homestead at Rajnagar

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

Homestead at Kalekarber dighi

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

Homestead at Chalkghona

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

Homestead at Barni

A total of 38 tree species have been recorded through quadrate sample survey of this homestead. Of which, Rendi Koroi *(Albizia saman)*, Mahagoni *(Swietenia mahagoni*), Taal *(Borassus flabellifer)*, Narikel *(Cocos nucifera),* Khejur *(Phoenix sylvestris)* are referable. The home owner has planted many fruit yielding trees which is now in growing form. Among this, Kotbel *(Limonia acidissima)*, Aam *(Mangifera indica)* and Safeda *(Manilkara zapota)* are common. Gewa *(Excoecaria agallocha)* was dominated at western part of this homestead now being less populated due to fell by the house owner. Tiger Fern *(Acrostichum aureum)* is a mangrove herb which presence at here also referable.

To determine the plant diversity, random quadrate vegetation survey has been conducted at selected homesteads during recent monitoring tier. A total of 36 plant species (excluding undergrowth) has been recorded from 16 number of surveyed sample quadrates which Shanon-Winner Diversity Index were 1.58. Details of the survey result is presented in **Table 3.12** below.

Species diversity of homestead plants followed less than the previous monitoring as some of the trees has been felled at studied homestea**.**

Table 3.12: Plant species composition of the sampled homesteads

Sl. No.	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		
1	*Acacia auriculiformis*	Akashmoni	Leguminosaea						1								1			2	**1.58**
2	*Accia arabica*	Babla	Leguminosaea														1			1	
3	*Acrostichum aureum*	Tiger Fern	Pteridaceae						2	3	4								3	12	
4	*Albizia richardiana*	Chambol	Fabaceae									1		4	3					8	
5	*Albizia saman*	Rain Tree	Fabaceae	1				2	4	2						2	1			12	
6	*Aphanamixis polystachya*	Rhyna	Meliaceae										1							1	
7	*Areca catechu*	Supari	Arecaceae						1	7			2							10	
8	*Azadirachta indica*	Neem	Meliaceae					3	2	1				3	5		2			16	
9	*Borassus flabellifer*	Taal	Arecaceae						1	2		3		1	1			1		9	
10	*Citrus grandis*	Jambura	Rutaceae														1			1	
11	*Cocos nucifera*	Narikel	Arecaceae	3	2	2	2	2	2	1	2	2	3	4	2	2	2	2		33	
12	*Diospyros pregrina*	Gaab	Ebenaceae													1	1			2	
13	*Eucalyptus globulus*	Eucalyptus	Myrtaceae					1												1	
14	*Euphorbia tithymaloides*	Rangchita	Euphorbiaceae	3	8	5	7												13	36	
15	*Ficus benjamina*	Lokkho Pakur	Moraceae					1		1										2	
16	*Ficus hispida*	Dumur	Moraceae											1				3		4	
17	*Heritiera fomes*	Sundari	Sterculiaceae							1										1	
18	*Ipomoea fistulosa*	Kolmilata	Convolvulaceae								10									10	
19	*Justicia adhatoda*	Bashok	Acanthaceae							1										1	
20	*Lannea coromandelica*	Jigar	Anacardiaceae	7	4						2				2	8				23	
21	*Lawsonia inermis*	Mehedi	Lythraceae				1									1				2	
22	*Mangifera indica*	Aam	Anacardiaceae						4		2					1				7	
23	*Manilkara zapota*	Safeda	Sapotaceae							1		1								2	
24	*Mimusops elengi*	Bokul	Sapotaceae										1							1	
25	*Moringa oleifera*	Sazna	Moringaceae					1							1			1		3	
26	*Musa sp*	Kola	Musaceae		5	1		2				6				3	2			19	
27	*Nypa fruticans*	Golpata	Arecaceae											3						3	

Sl. No.	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		
28	*Phoenix sylvestris*	Khejur	Arecaceae		2	3	4							2			1	3	1	16	
29	*Phyllanthus acidus*	Orboroi	Phyllanthaceae									1								1	
30	*Psidium guajava*	Peyara	Myrtaceae															1		1	
31	*Punica granatum*	Bedana	Lythraceae													2				2	
32	*Sonneratia apetala*	Kewra	Lythraceae				1													1	
33	*Swietenia mahagoni*	Mahagoni	Meliaceae					4		2	2	9	11	8			6	2		44	
34	*Syzygium cumini*	Jaam	Myrtaceae						1							4				5	
35	*Tamarindus indica*	Tentul	Fabaceae													1	1			2	
36	*Terminalia arjuna*	Arjun	Combretaceae													1				1	
37	*Terminalia catapa*	Kathbadam	Combretaceae														1			1	
38	*Ziziphus mauritiana*	Kul boroi	Rhamnaceae							1						1				2	

Note: Q=Quadrate

Species diversity of homestead plants followed more rich than the previous monitoring

Plant Health

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

Plant Diseases and symptoms in homestead vegetation

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

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

Number of diseases affected trees

Plant health has been drastically deteriorated at Rajnagar site. 3 species of indicator plants have been death at this site due to effects of land development by the silty saline sand from nearer khals. Besides, two Albizia saman and one Heritiera fomes has been logged by the homestead owners for extension of housing structures. Except this site, plant health status is more or less similar or unchanged. Here should be mentioned that, none of the plant health issues are revealed for the Project operation.

Following table **(Table 3.13**) represents the time series data on unhealthy plants in studied homesteads **Table 3.13.**

Figure 3.9: Overviews of the monitoring site of Rajnagar

Table 3.13: Proportion of healthy and unhealthy plants in studied homesteads

Ocation	Plant Name	Tot. No. of Plant	No. of Unhealthy Plant																													
			Apr, 2014	Jun, 2014	Oct 2014	Jan 2015	Apr 2015	Aug, 2015	Oct, 2015	Jan, 2015	Oct, 2016	Jan, 2017	Jan, 2018	Apr, 2018	Jul, 2018	Nov, 2018	Feb-19	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020	Nov, 2020	Jan, 2021	Apr, 2021	July, 2021	Nov, 2021	Feb, 2022	May, 2022	Jul, 2022	Dec, 2022	Feb, 2023
Rajnagar	*Cocos nucifera*	17*	NS	10	5	5	15	4	5	NS	3	4	6	6	9	4	4	3	2	3	10	3	7	11	10	10	10	3	1	2	4	5
	Phoenix sylvestris	25	NS	15	4	4	22	9	13	NS	10	2	5	4	7	6	8	9	5	3	4	4	5	2	12	2	3	2	2	1	7	3
	Manilkara zapota	1	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	Dead
	Albizia saman	2	NS	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2	-	2	Logged
	Excoecaria agallocha	55*	NS	-	1	1	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	10	-	-	-	-	12	3
	Mangifera indica	3	NS	1	-	-	2	-	-	NS	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	2	2	-	-	-	3	Dead
	Psidium guajava	2	NS	2	-	-	2	-	-	NS	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	Dead
Borni	*Cocos nucifera*	10	7	3	-	-	3	1	2	NS	1	2	3	1	2		1	1	1	2	1	-	-	-	-	-	-	1	-	-	1	Logged
	Phoenix sylvestris	12	-	5	4	4	3	1	4	NS	4	3	4	2	1		-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
	Borassus flabellifer	6	3	1	-	-	-	-	-	NS	-	-	-	-	-	1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	Mangifera indica	6	3	3	1	1	4	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-
	Excoecaria agallocha	18	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	3	-		3	1	-	-
	Swietenia mehogani	11	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Areca catechu	10	-	6	2	2	8	2	2	NS	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Manilkara zapota	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
	Psidium guajava	2	2	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kalekarber Dighi	*Cocos nucifera*	56	35	5	1	1	2	2	3	NS	1	1	-	6	3	-	1	3	1	7	4	2	-	-	-	2	-	-	-	-	1	-
	Phoenix sylvestris	10	-	3	-	-	1	-	1	NS	3	-	3	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	1	-
	Mangifera indica	5	1	1	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1
	Manilkara zapota	2	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Borassus flabellifer	8	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Zizyphus sp	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-

Ocation	Plant Name	Tot. No. of Plant	No. of Unhealthy Plant																													
			Apr, 2014	Jun, 2014	Oct 2014	Jan 2015	Apr 2015	Aug, 2015	Oct, 2015	Jan, 2015	Oct, 2016	Jan, 2017	Jan, 2018	Apr, 2018	Jul, 2018	Nov, 2018	Feb-19	Apr, 2019	Jul, 2019	Nov, 2019	Feb, 2020	Jul, 2020	Nov, 2020	Jan, 2021	Apr, 2021	July, 2021	Nov, 2021	Feb, 2022	May, 2022	Jul, 2022	Dec, 2022	Feb, 2023
	Psidium guajava	8	-	-	-	-	-	-	-	NS	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tamarindus indica	2	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chalkghona	*Cocos nucifera*	39	25	19	5	5	34	20	-	NS	2	2	4	5	3	-	3	4	2	4	3	5	-	-	-	-	-	-	-	-	2	-
	Phoenix sylvestris	24	-	10	1	1	6	5	1	NS	1	-	5	2	3	-	-	1	2	2	1	3	-	1	3	2	1	1	-	-	2	-
	Albizia saman	3	-	-	-	-	1	-	-	NS	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Excoecaria agallocha	36	-	-	1	1	-	-	-	NS	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-	-	1	-	-**	1
	Manilkara zapota	1	-	-	-	-	-	-	-	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Psidium guajava	17	1	7	-	-	-	-	-	NS	-	-	-	-	-	1	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
	Mangifera indica	7	2	1	-	-	-	-	-	NS	-	1	-	1	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
	Borassus flabellifer	2	-	-	-	-	-	-	-	NS	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Note: NS = Not Surveyed *=1 Cocos and 45 Excoecaria have been cut*

***19 Excoecaria have been cut*

Vegetation canopy status

Species representation in different canopy layers of homestead vegetation

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

Estimated Canopy cover in homestead vegetation of sampling sites

Canopy cover has been deteriorating at three sites out of four. Canopy cover has drastically reduced at Rajnagar site as most of the trees has been died in this settlement platform due to land filling by sand. In the case of other sites, the canopy cover found lower than previous monitoring because of the home owners pruned the large trees and monocots. **Table 3.14** represents the canopy status of different monitoring sites.

Table 3.14: 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

Location	% of canopy cover			
	Rajnagar	Borni	Kalekarber	Chalkghona
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

Note: NS = Not Surveyed

Bird Habitat

Local birds and their nesting behaviour

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

Bird species and number of Bird nests in sampling sites

None of the sites found any bird nest in this monitoring tier. However, **Table 3.15** represent the bird nest monitoring datasheet over the monitoring periods .

Table 3.15: 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
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	-	-	-	-	-	-	-	-

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
	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	-	-	-	-	-	-	-	-
	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	-	-	-	-	-	-	-	-

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
	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	-	-	-	-	-	-	-	-
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	-	-	-	-	-	-	-	-

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
	C	-	-	-	-	-	-	-	-
Dec, 2022	R	-	-	-	-	-	-	-	10
	B	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-
Feb 2023	R	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-
	K	-	-	-	-	-	-	-	-
	C	-	-	-	-	-	-	-	-
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 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 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 Digraz Kheyaghat to Maidara to Chalna Ghat) through boat transact during full tide. The transect length was 14.5km and survey time was 2hr14 minutes during midd to ebb tide. A total of 8 dolphins have been recorded. Of which 6 were recorded within the Maidara River and 2 within the Passur River reaches. The encounter rate is 0.34 individual/km/hr which is higher than previous monitoring tier. **Figure 3.11** represents the survey transact and location of dolphin occurrence within the river channel.

Dolphin occurrence in Shella Gang and Bhadra Khal

Dolphin occurrence has monitored within 6.91 km length of Dhanmari Khal. The transect length was 13.54 and actual survey duration was 60 minutesA total of 13 dolphins were recorded and the encounter rate was 0.52 individual/km/hour. The encounter rate is higher than previous monitoring. The distribution of dolphin occurrence at Dhangmari Khal is presented in **Figure 3.12**.

Eight Dolphins were also sighted in Shella Gang while 8.14 km transact survey conducted from Chandpai to Joymonirgol Thota to Food Silo to Jhongra Forest Patrol Post to Joymonirgol Thota (**Figure 3.13**). The occurrence rate was 0.91 individual/km/hour. The survey duration was 60 minutes.

17 dolphins have been recorded at Bhadra Khal during 54 min survey time and the 3.15 km inner reach from Bhadra Patrol Post. The encounter rate was 6.37 individuals/km/hr. The encounter rate was higher than the previous monitoring. This increasing trend of dolphin occurrence due to banning the fishing activities within the Bhadra Khal by BFD. The distribution of dolphin occurrence at Bhadra Khal is presented in **Figure 3.14**.

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 3.16.**

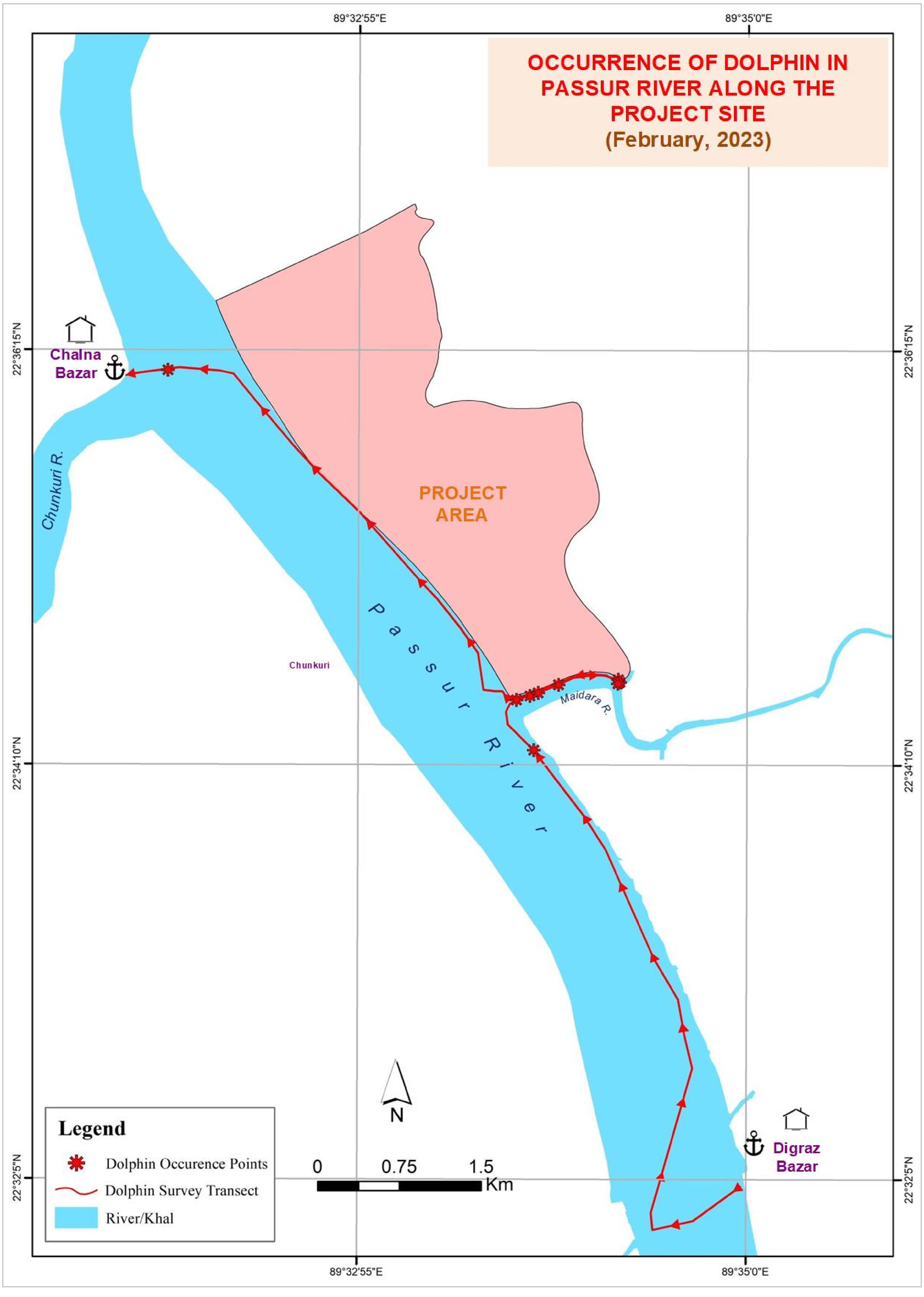


Figure 3.10: Occurrence of dolphins in Passur and Maidara River along the project site

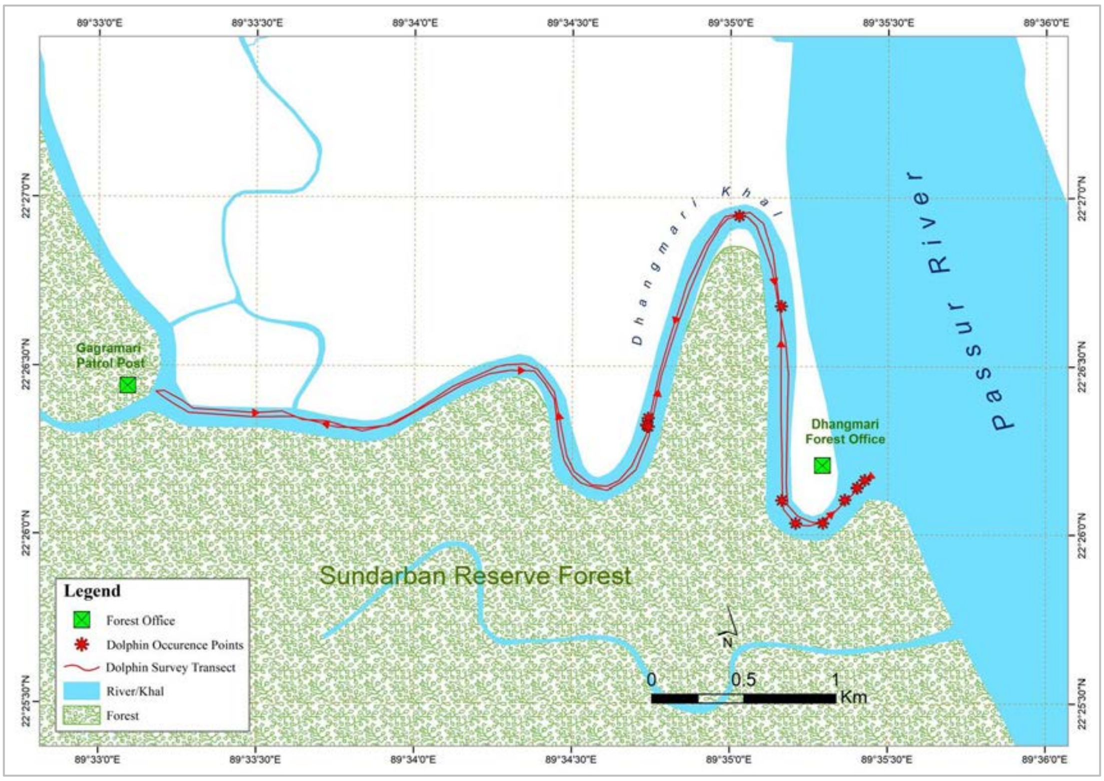


Figure 3.11: Location of dolphin occurrences in Dhangmari Khal

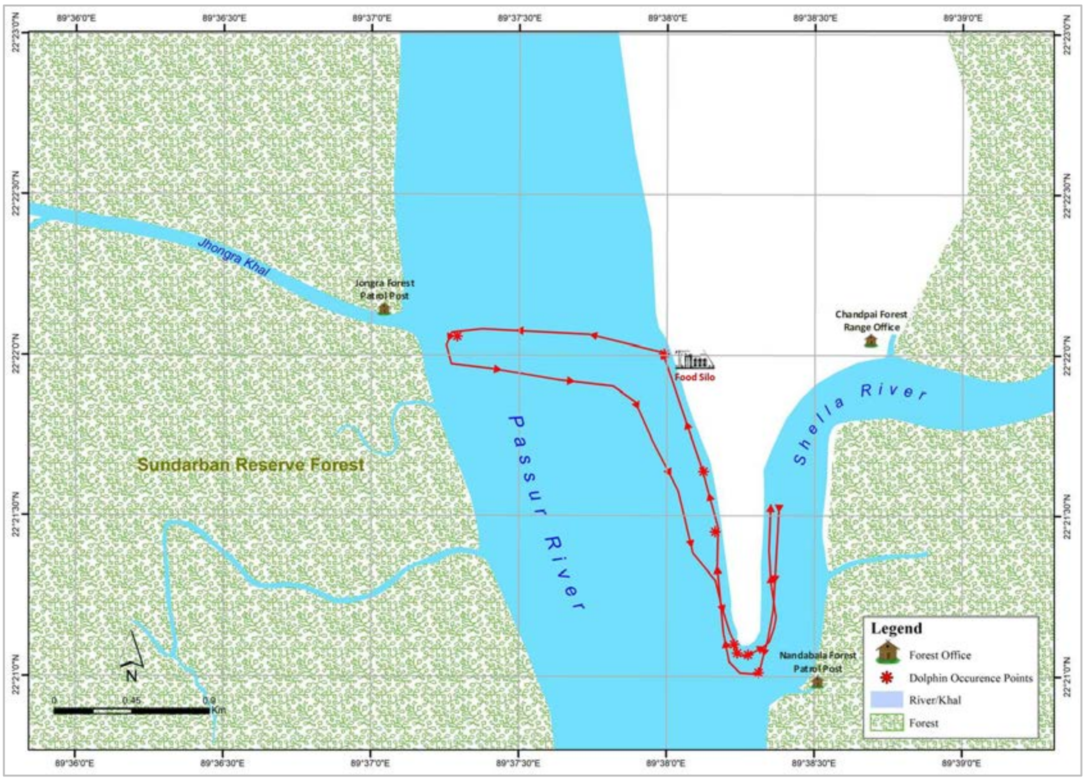


Figure 3.12: Location of dolphin occurrences in Chandpai

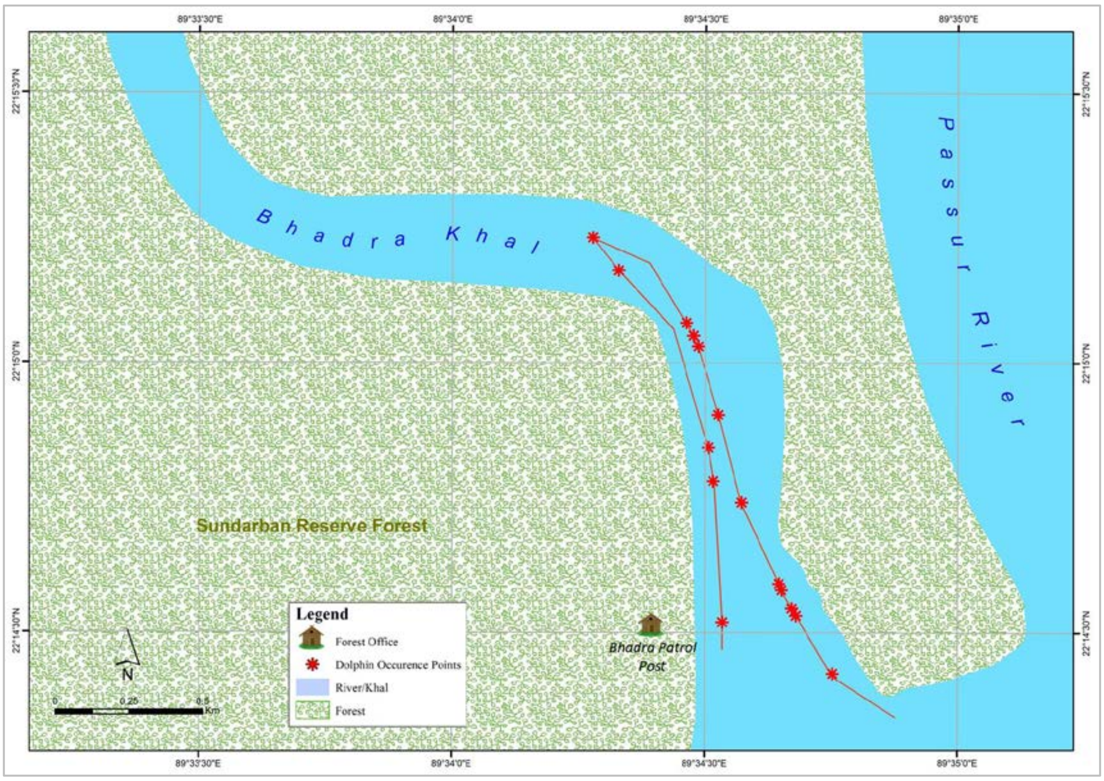


Figure 3.13: Location of dolphin occurrence in Bhadra Khal

Table 3.16: 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
	NT	Y	Y	N	NS	Y	NS
Jan-2018	FT	Y	NS	Y	N	NS	NS

Monitoring Tier	Tidal Condition	Passur River at Project Site	Karamjal	Harbaria	Akram Point	Maidara River	Shella River at Chandpai
	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
Note: FT=Flood Tide, NT=Neap Tide, NS=Not Surveyed; Occurrence Status: Y = Occurred, N = Not occurred							

3.2.5 Status of benthos and planktons in river systems

Benthos and plankton sample have been collected from 7 different locations of Passur and Maidara rivers during different tidal conditions. Detail status of benthos and planktons from recent survey is presented in following sections.

Species Composition of Benthos

Three types of benthos have detected from two sampled sites. **Table 3.17** shows the benthic species composition and abundance at different sampling locations.

Table 3.17: Species composition and abundance of Benthos in different monitoring locations

Sl. No.	Type/Species Name	Abundance (No./Liter)						
		JS	MR	MP	HB	AP	KB	KD
1	Mysis stage of shrimp larvae	-	-	-	-	-	15	-
2	Placobdella ornata	-	-	24	-	-	-	-
3	Snail	-	-	16	-	-	-	-

Note: AP=Akrampoint, HB=Harbaria, JS=Passur River at Project Jetty Site, KB=Kalekarber Dighi, KD=Koigardaskathi Pukur, MD=Moidara River, MP=Mongla-Passur Confluence; Sample analysed in Laboratory of Environmental Science Discipline, Khulna University

Species Composition of Planktons:

Phytoplankton: A total of 41 phytoplankton species were recorded from the 5 locations of river water and two locations of inland freshwater pond.

10 phytoplankton species has been recorded from Passur and Maidara River. Out of which, *Leptocylindrus danicus* is highly abundant in Passur River at Jetty site. *Closteriopsis longissimi, Coscinodiscus granii Gough and Aphanizomenon flos-aquae* are abundant both of the river water.

The lentic aquatic ecosystem supports lower population and species diversity in this monitoring tier. Both of the sampling ponds recorded 8 phytoplankton species each. *Aphanizomenon flos-aquae, Planktothrix sp., Pleurosigma angulatum, Scytonema sp.* etc are the dominant species. Species composition and abundance of Phytoplankton in different monitoring locations have been listed in following Table (**Table 3.18**).

Table 3.18: Species composition and abundance of Phytoplankton in different monitoring locations

Sl. No.	Species Name	Abundance (No./Liter)						
		JS	MR	MP	HB	AP	KB	KD
1	*Alexandrium catenella*					96		
2	*Aphanizomenon flos-aquae*	65	113	156			76	49
3	*Aphanocapsa sp.*			47			48	
4	*Carteria sp.*				104			
5	*Closteriopsis sp.*				117			
6	*Coscinodiscus centralis*			190				76
7	*Coscinodiscus excentricus*	184			110			
8	*Coscinodiscus granii Gough*	307	32		124	304		
9	*Coscinodiscus sp.*		48					
10	*Cylindrotheca sp.*	64						
11	*Cymatopleura sp.*				56			
12	*Eucampia sp.*		42					58
13	*excentricus Coscinodiscus*					88		
14	*Fragilariopsis oceanica*		112					
15	*Gloeotrichia sp.*				32			
16	*Guinardia sp.*		38					
17	*Homoeothrix sp.*	84						
18	*Leptocylindrus*		154	266				
19	*Leptocylindrus danicus*	414			67			

Sl. No.	Species Name	Abundance (No./Liter)						
		JS	MR	MP	HB	AP	KB	KD
20	*Microcystis sp.*							35
21	*Nitzschia lorenziana*	72						
22	*Nitzschia sp.*				40			
23	*Oscillatoria princeps*							56
24	*Oscillatoria sp.*			75				
25	*Pandorina sp.*						38	
26	*phanizomenon flos-aquae*					85		
27	*Planktothrix sp.*						64	38
28	*Pleurosigma angulatum*					72	56	84
29	*Pleurosigma morphotype*	110				76		
30	*Pleurosigma sp.*				73			
31	*Proboscia alata*		68	88				
32	*Proboscia sp.*							65
33	*Radiofilum sp.*				45			
34	*Raphidiopsis mediterranea skuja*		76	86	56	144	56	
35	*Scytonema sp.*						65	
36	*Thalassionema sp.*					80		
37	*Thalassiosira lacustris*				56			
38	*Thalassiosira sp.*	72						
39	*Thalassiosira weissflogii*		34					
40	*Tropidoneis sp.*						44	
41	*Ulnaria sp.*	191						
No. of Species in each site		**10**	**10**	**7**	**12**	**8**	**8**	**8**

Note: AP=Akrampoint, HB=Harbaria, JS=Passur River at Project Jetty Site, KB=Kalekarber Dighi, KD=Koigardaskathi Pukur, MD=Moidara River, MP=Mongla-Passur Confluence

Sample analysed in Laboratory of Environmental Science Discipline, Khulna University

Zooplankton: Three Zooplankton species has been identified from the Passur River systems at Project Jetty Site, Moidara River, Harbaria and Akram Point. Of which Calanus sp. recorded highest population size of all. Species compositions of zooplankton in different monitoring locations have been presented in following Table (**Table 3.19**).

Table 3.19: Species composition and abundance of zooplanktons

Sl. No.	Type/Species Name	Abundance (No./Liter)						
		JS	MR	MP	HB	AP	KB	KD
1	*Brachionus rubens*	25	-	-	-	38	-	-
2	*Brachionus calyciflorus*	-	25	-	-		-	34
3	*Calanus sp.*				32	43		

*Note: AP=Akrampoint, HB=*Harbaria, JS=Passur River at Project Jetty Site, KB=Kalekarber Dighi, KD=Koigardaskathi Pukur, MD=Moidara River, MP=Mongla-Passur Confluence; Sample analysed in Laboratory of Environmental *Science Discipline, Khulna University*

3.3 Sundarbans Forest Health monitoring

3.3.1 Background

Forest health monitoring (FHM) is concerned with the ecosystem's wellbeing. To make decisions about how to sustainably manage, preserve, and conserve forests, data from the monitoring of forest functions and cover can be employed. Our country's woodlands play a crucial role in the scenery. The goal of the Forest Health Monitoring program is to identify the current state, any changes, and any trends in the indicators of forest condition over a given period of time. In order to address forest health issues that jeopardize the sustainability of forest ecosystems, the Forest Health Monitoring program analyzes data from a range of sources, including ground plots (i.e., long-term monitoring plots), aerial surveys, and other biotic and abiotic data sources. One of the popular methods for assessing the health of forests According to Beets and Whitehead (1996), bio-indicators are growth trends throughout time and how they relate to the leaf area index. When all other factors are equal, stands with a high leaf area index will produce higher biomass and total volume per ha than stands with a low leaf area (Beets et al. 2008). Another reliable measure of the health of a forest is the amount of lichen. Lichens frequently develop on trees and plants and take in nutrients from the air. Lichens are incredibly sensitive to air pollution, especially sulfur dioxide, fluoride, and ammonia, therefore whether they are present or not is a sign of how healthy the forest is. Mangrove trees are able to adapt to anaerobic and waterlogged environments by growing more pneumatophores, which increases the surface area available for gas exchange. The ecological stability of the mangrove forest ecosystem is greatly influenced by crab. According to Lee (1989), crab burrows can efficiently remove nitrogen from the aquatic ecosystem in the form of gaseous nitrogen (N2) and nitrous oxide (N2O), and they can also increase the amount of oxygen in the soil layer. Another crucial metric for assessing the health of a forest is the soil quality (USDA Forest Service, 2007). Measurements of the soil's physical, chemical, and biological composition at various depths are typically required for an evaluation of soil quality. Another bio-indicator of a healthy forest is the variety of plant species present. Finding out if there is a mixture of plant species of various sizes and ages that results in forest "layers" that serve as habitat for several species is one way to evaluate this variety (Greenleaf Forestry and Wood Products Inc. 2010). A robust regeneration capability in a forest is also a bio-indicator of monitoring forest health. A study of these bio-indicators will be conducted in the Sundarbans Reserve Forest (SRF) in light of the installation of the Rampal Power Plant. CEGIS team has been periodically monitoring the Sundarbans Reserve Forest health to oversee the probable impacts of Rampal Thermal Coal Power Plant Project under implementation. Conducting monitoring program at five locations namely Sutarkhali, Karamjal, Harbaria, Akram point and Hiron Point at Sundarbans Reserve Forest (SRF). The Sundarbans forest health is being monitored quarterly as per monitoring schedule and thirty fourth (35^{th}) surveys were conducted at Five locations. Due to the first subplot of Hiron Point's sandy soil's heavy silting and constant washout from the forest floor, a new subplot has been taken into account to evaluate the area's genuine status.

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 3.15**). 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 3.19**). The sites have been selected considering the distance from the proposed Project site, wind directions, coal transportation route, river systems and vegetation types. New plot has been taken at hiron point and the 1^{st} plot is abandoned as maximum portions of the plot is eroded by river.

Table 3.20: 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

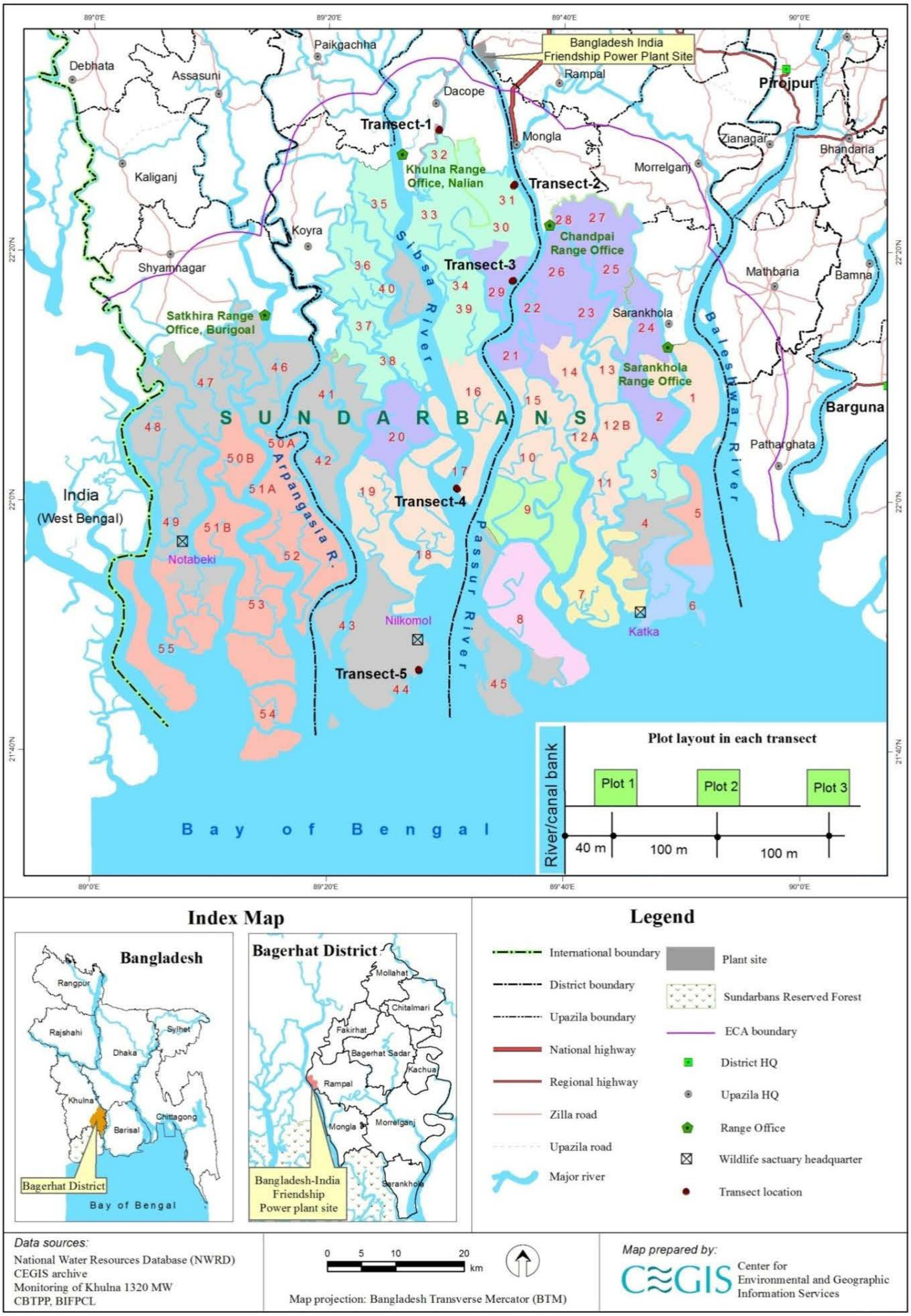


Figure 3.14: Location Map of Sundarbans Forest Health Monitoring Plots (PSP)

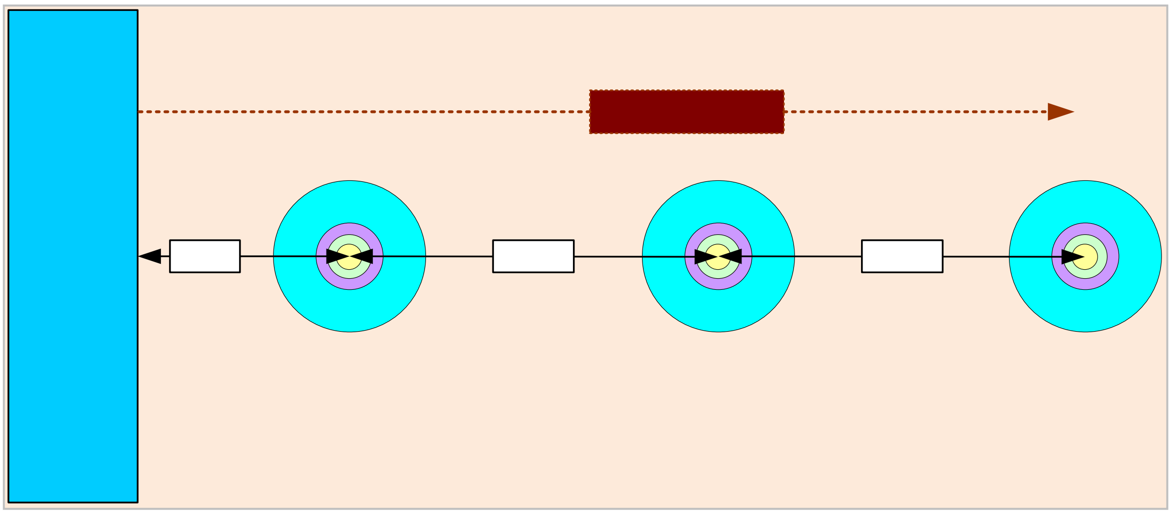


Figure 3.15: Layout of the subplots and transect line perpendicular from ecotone (river or canal bank

3.3.3 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 3.16**). 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 3.17**)

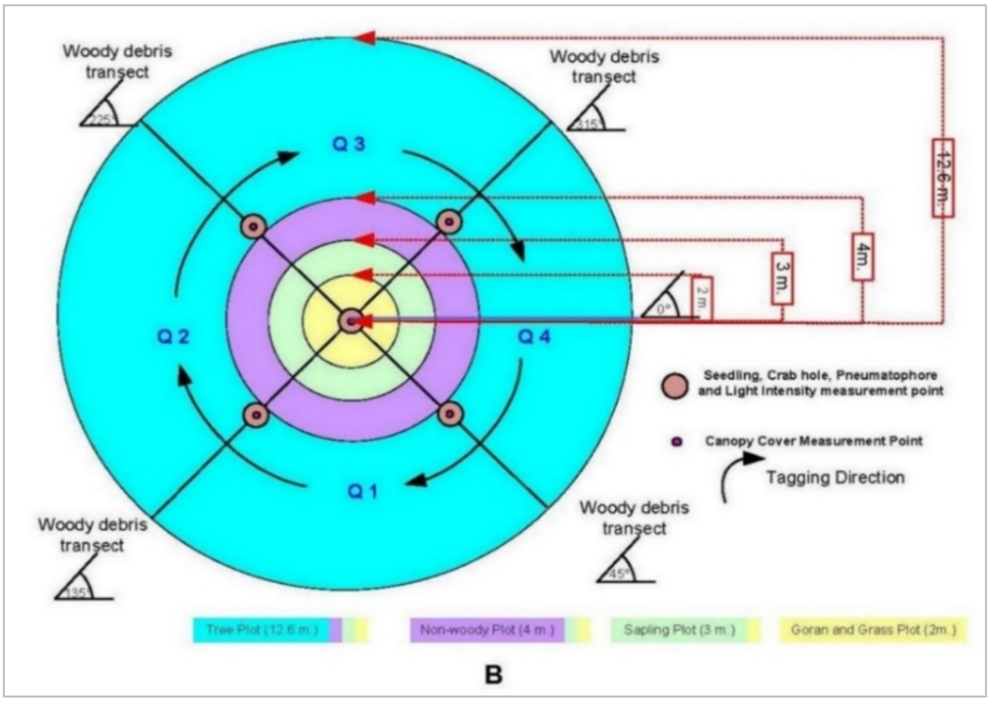


Figure 3.16: Layout of the Survey Activities in each Subplot

3.3.4 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 identificationLeaf phenology and phonological behaviour

Tree Growth

The tag number of trees (DBH ≥ 5cm and lean angle greater than 45º) 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 3.18**).

Figure 3.17: Team members measuring tree DBH and Height in 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 seedling has 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 3.19**). 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). In this monitoring report, LAI was calculated as follows:

Leaf Area Index (LAI) = loge (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)

Figure 3.18: Team member taking canopy cover and light intensity using Densitometer and Lux meter

Woody debris

Woody debris is defined as any dead woody materials (twigs, branches, or stems of trees or shrubs) that have fallen and lie up to a height of 2 meters above the forest floor. Dead trees that lean at an angle > 450 from true vertical were also counted (Donato, et al., 2009). The planar intersect technique involves counting intersections of woody pieces with a vertical sampling plane (transect) (Harmon et al., 1996) followed (Donato, et al., 2009). A survey tape was stretched from the subplot center for 10 meters in each of the 4 cardinal directions, oriented at 45° angles from the main transect line. A compass was used to run the transect tape on a straight line. Woody debris intersecting the transected plane was recorded, up to a height of 2 meters above the forest floor.

Woody debris was categorized into 4 size classes (**Table 3.20**): Small, Medium, Large, and Extra-Large. An aluminum down-wood gauge (Fuel Gauge) was used to determine the size class of each piece encountered.

Table 3.21: Classification of Wooden Debris

SI. No.	Classes	Size (in cm)
1	Small	0.0-0.6
2	Medium	0.6-2.5
3	Large	2.5-7.6
4	Extra-Large (Sound & Rotten)	≥ 7.6

Small, medium, and large pieces were tallied as the number of pieces that crossed the transect tape. For Extra-large pieces, the actual diameter over which the transect line was crossed, was measured and the decay status was also recorded as sound (machete bounces off or only sinks slightly when struck) or rotten (machete sinks deeply and wood is crumbly with significant loss). 205. Each of the transect lines was made into sub-sections and these sub-sections start from the distal end of the transect (meter 12.62). Small pieces were only tallied for 2 meters of the transect (from meter 12.62 to meter 10.62). Medium pieces were only tallied for 5 meters of the transect (from meter 12.62 to meter 7.62) and the large and extra-large pieces were measured along the 12.62-meter transect.

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)

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

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

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. 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 × (ρ) 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).

Statistical analysis

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 phenological events such as leaf emergence, leaf shedding, flowering and fruiting and fruit/ propagule dropping time may have affected by Air pollution. Hence, Phenological 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 (**Figure 3.20** and **Figure 3.21**).

Figure 3.19: Flowering at Sundari at Akram point

Figure 3.20: Fruiting at Amoor at Sutarkhali

Pest and diseases identification

Tree diseases can also be utilized as a bio-indicator of the health of the forest. The main factors contributing to the population reduction of the tree species Avicennia spp., Rhizophora spp., Heritiera spp., Pandanus spp., Phoenix spp., and Acanthus spp. have been discovered by researchers (Rahman et al. 2010). Leaf blight, dieback, stump and collar rot, trunk gall, root rot, leaf blight, leaf necrosis, and powdery mildew are a few significant diseases of Sundarban mangroves (Rahman et al. 2010). The 'top dying' of Sundari, however, was noted in all of the PSPs in the current investigation. The "top dying' disease affected between 30 and 40 percent of Sundari trees. Pest and disease type of the Sundarbans mangrove forest was investigated through literature review, which was then verified in the field through visual observation (**Figure 3.22** and **Figure 3.23**).

Figure 3.21: Dying branches on one side of crownat Karamjol

Figure 3.22: Spots or bumps on Passur leaves at Harbaria

3.3.5 Monitoring Result and discussion of SRF Health

Seedling Density

According to the most recent monitoring report, it has been discovered that the number of seedlings per hectare, which is set at 1000, has fluctuated across all monitoring locations (as depicted in **Figure 3.24**). The highest density of seedlings was recorded during the 5th and 6th years in all plots compared to the baseline period. However, the monitoring results of this period have revealed that the number of seedlings at all points was lower than the previous year. This may be attributed to unfavorable conditions and high natural stresses that have limited the growth of the seedlings.

The recruitment of new seedlings relies on regeneration and survival rates, which, in turn, depend on canopy cover, soil chemistry, and other factors such as pH, salinity, and organic matter. Seedlings tend to perish at an early stage in natural forests due to competition for nutrients and light intensity. Upon analyzing the data, it has been observed that canopy coverage and leaf area index are lower in Akram point, making it difficult for shade-loving trees to survive in such conditions. In addition to silvicultural competition, seedlings at Akram point also face natural stresses due to their proximity to the sea.

In the Sundarbans, most mangroves' seeds disperse during the rainy season and settle on the forest floor. As a result, seedlings are usually more abundant after the rainy season, from monsoon to post-monsoon, compared to other seasons. Nevertheless, an analysis of variance (ANOVA) test has revealed that the density of seedlings at 1000/ha varies significantly ($P<0.05$) throughout the year and across all five Permanent Sample Plots (PSPs).

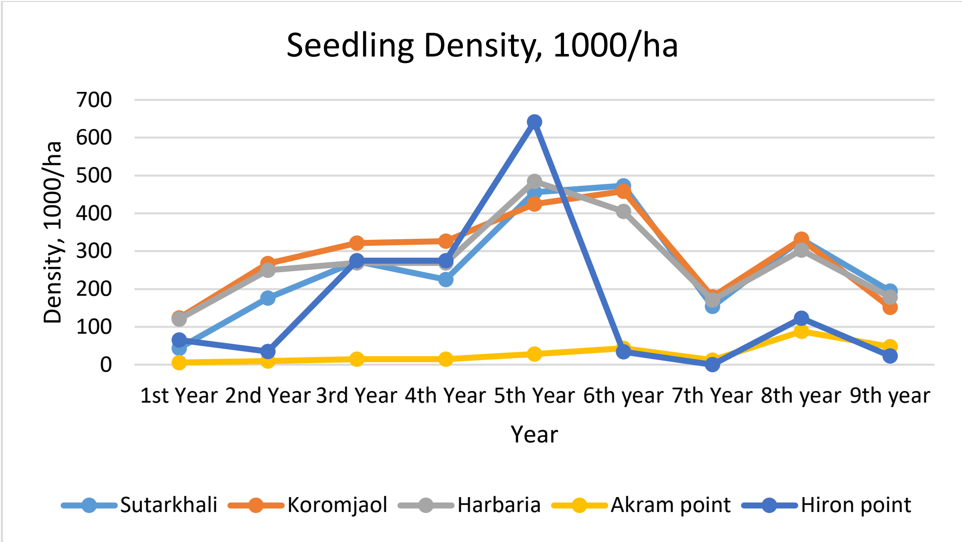


Figure 3.23: Mean seedlings density among the yearly surveys in five PSPs

Pneumatophore density

Similar to seedlings, the density of pneumatophores also exhibits seasonal variability, as illustrated in **Figure 3.25**. The provided data shows the density of pneumatophores in five different locations over a period of nine years. Pneumatophores are specialized structures that emerge from the roots of certain plants, such as mangroves, and facilitate gas exchange between the roots and the atmosphere. In the first year, Sutarkhali had a pneumatophore density of 194,185, which increased to 425,766 in the second year and continued to grow until it reached a peak of 481,685 in the fourth year. However, the density declined slightly in the following years and was at 342,501 in the ninth year.

Koromjaol had a pneumatophore density of 576,733 in the first year, which increased to 660,145 in the second year and reached a peak of 670,237 in the third year. However, the density declined in the following years, and in the ninth year, it was at 201,454. Harbaria had a pneumatophore density of 212,497 in the first year, which increased to 291,676 in the second year and continued to grow until it reached a peak of 375,939 in the third year. However, the density declined in the following years, and in the ninth year, it was at 297,513.

Akram point had a pneumatophore density of 68,080 in the first year, which increased to 134,143 in the second year and reached a peak of 193,585 in the seventh year. However, the density declined in the following years, and in the ninth year, it was at 92,451. Hiron point had a pneumatophore density of 145,605 in the first year, which increased to 198,406 in the second year and reached a peak of 317,803 in the third year. However, the density declined in the following years, and in the seventh year, it was at 0 due to the lack of data. The density increased again in the eighth and ninth years, reaching 161,374 and 156,184, respectively.

Overall, the data indicates that the pneumatophore density in these five locations has fluctuated over time, with some experiencing growth and others experiencing decline. Moreover, the number of pneumatophores may also vary due to the elevation of the forest floor from the mean sea level (MSL). Pneumatophores primarily serve the function of exchanging gas with the atmosphere during tidal inundation. Thus, highly elevated plots with minimal inundation may have a lower number of pneumatophores. It should be noted that the number of pneumatophores varies during counting periods as they are submerged underwater during tidal inundation. As it is challenging to reach the monitoring station at a specific time during each monitoring period due to weather conditions and tide variations, pneumatophore density may fluctuate.

The ANOVA results indicate that there is a significant difference ($P<0.05$) in pneumatophore density between the five plots. Sutarkhali, a site with high species richness and silty and muddy soil, has the most abundant pneumatophore growth, while Akram point, a seashore site with sandy soil, has the least abundant pneumatophores during the 9th-year monitoring period.

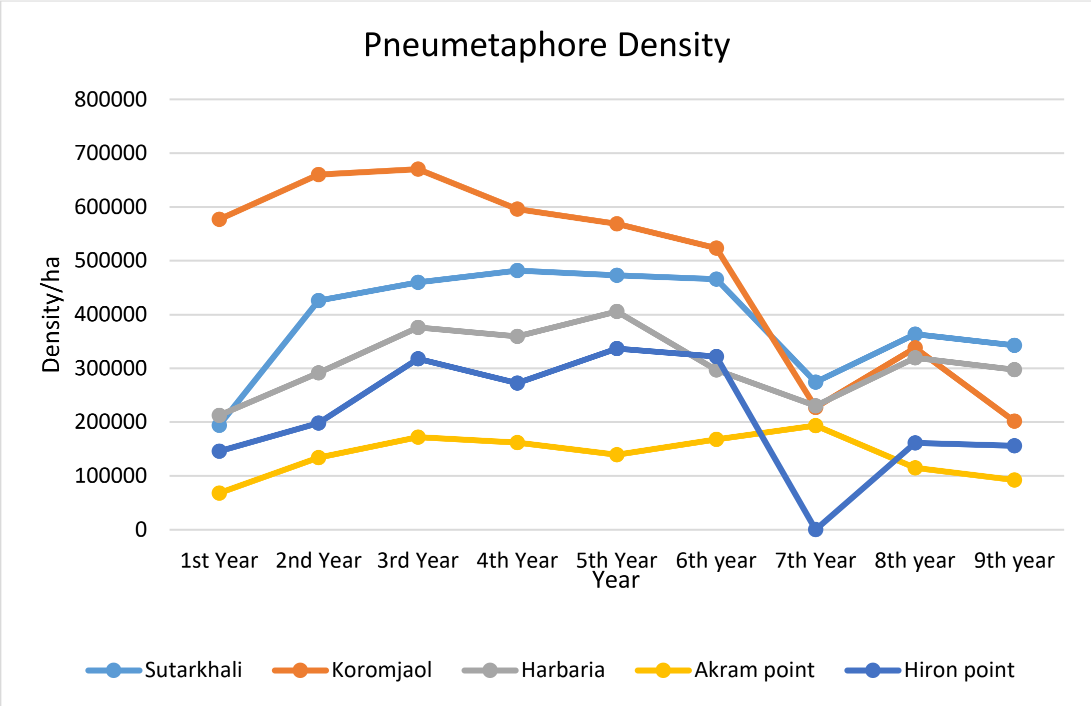


Figure 3.24: Mean Pneumatophores Density among the yearly surveys in five PSPs

Crab hole density

Crab holes are important indicators of crab activity in a given area. The density of crab holes can provide information about the availability of crabs in a particular location (**Figure 3.26)**. In this context, the average crab hole density has been found to be highest at Akram point compared to the other four monitoring sites. The sandy clay loam forest floor at Akram point is conducive to crab activity, as crabs are known to prefer this type of habitat for digging their burrows. Therefore, the high crab hole density at Akram point is likely due to the favorable habitat conditions for crabs.

On the other hand, Hironpoint has the lowest crab hole density among the five monitoring sites. This may be attributed to the fact that the first subplot in this area is always carpeted by sandy soil, which could disturb crab activity and cause them to dig their holes deeper inside the forest floor where it is not being disturbed by the sand. This could result in lower crab hole density in the first subplot of Hironpoint.

The ANOVA results show that there is a significant difference in crab hole density between the five monitoring plots, which means that the density of crab holes varies significantly depending on the location. However, there is no significant difference in crab hole density from year to year within each plot. This indicates that the density of crab holes remains relatively stable over time, despite potential variations due to tidal inundation and changes in forest floor conditions.

In summary, the density of crab holes can provide valuable information about crab activity and availability in a particular area, and the factors that influence crab hole density can vary depending on location and environmental conditions.

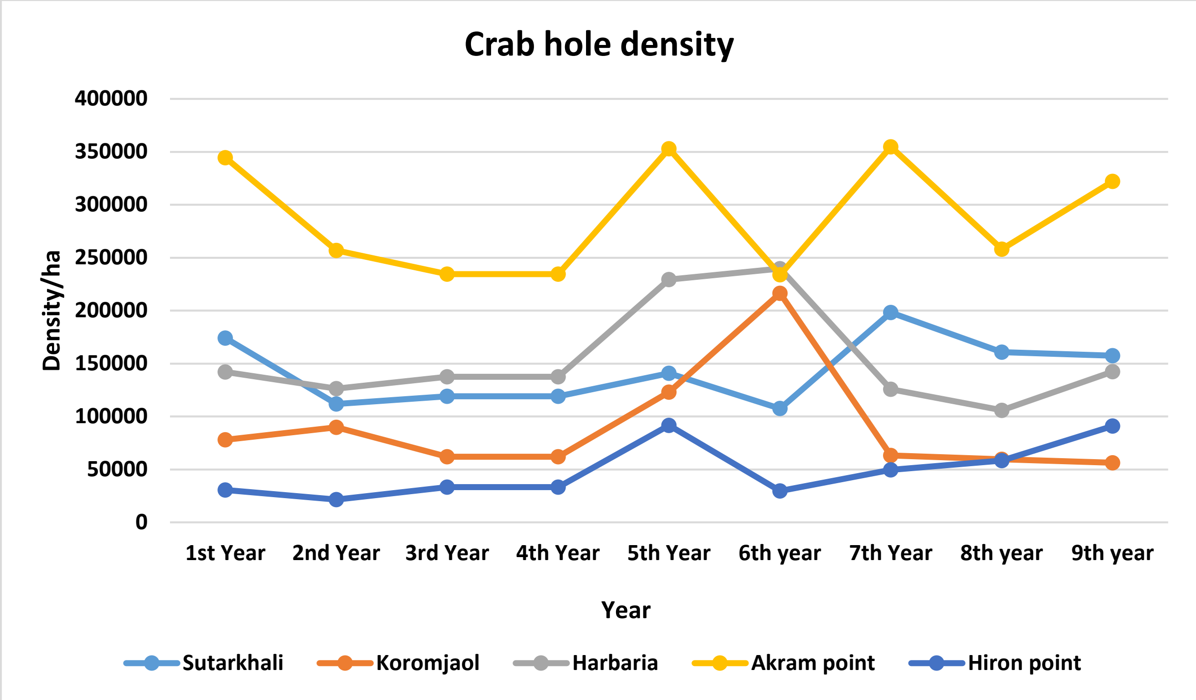


Figure 3.25: Mean Crabhole Density among the yearly surveys in five PSPs

Canopy Coverage (%)

Over the past 9 years, there has been no significant variation in the percentage of canopy cover across all monitoring plots ($p>0.05$). Canopy cover is an important indicator of the probability of successful natural regeneration, as it plays a critical role in determining the distribution of light, shade, and rainfall on the forest floor (Utschig, 1995). Information about canopy cover is essential for evaluating forest health and provides valuable insights into the long-term stability of a forest, as well as its susceptibility to wind-related damage. Additionally, canopy cover has been identified as a key indicator of wildlife habitat quality and provides a useful descriptor of forest stand structure (Crookston and Stage, 1999).

In this study, it has been observed that the canopy cover percentage in the monitoring plots has not varied significantly over the past 9 years, indicating that the forest is in good shape (**Figure 3.27**). Although canopy cover can vary seasonally and due to natural stresses, such as pest and disease attacks, but the forest has a high adaptive capacity to regain its cover. A healthy forest should have greater than 60% canopy coverage, and all of the monitoring sites in this study meet this criterion, which is a positive sign for the overall health of the forest.

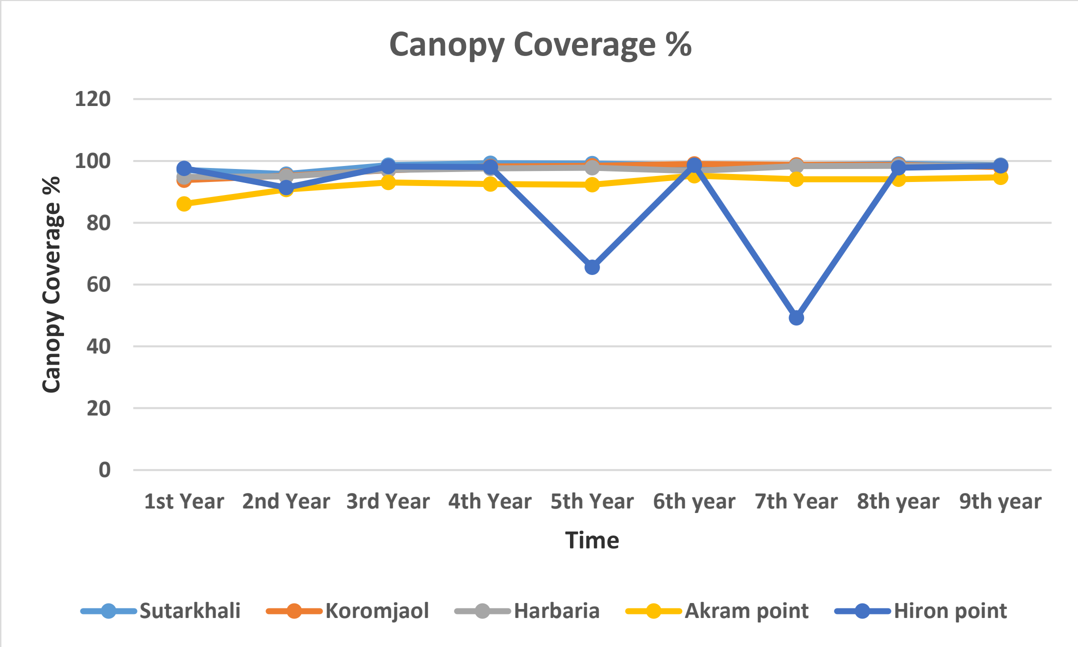


Figure 3.26: Mean Canopy coverage % among the yearly surveys in five PSPs

Leaf area index(LAI)

The leaf area index (LAI) is a crucial parameter that affects the rate of daily net canopy photosynthesis, which in turn influences the exchange of atmospheric CO_2. It provides a complete understanding of how much light passes through the canopy. In the case of a multi-layer canopy, the LAI of the upper layer is vital for the amount of light received by the lower layer. Additionally, the LAI serves as an indicator of radiation, precipitation interception, energy conversion, and water balance.

The ratio of under-canopy to open-canopy light intensity is an essential measure for determining the LAI. The lower the ratio, the greater the LAI, and therefore the higher the net canopy photosynthesis. The ANOVA results suggest that the light intensity values do not vary significantly year over year in all monitoring plots. However, there is a significant difference in LAI values between the plots ($P<0.05$) **(Figure 3.28)**. The Karamjol site, with high species diversity and a multi-layered stand structure, has the highest LAI, while the Akram point site, with a low diversity Gewa-dominated stand, has the lowest LAI. This difference in LAI values between the plots can be attributed to the differences in their species composition and forest structure.

The LAI is crucial for determining the forest's overall health, productivity, and resilience to climate change. By assessing LAI values in different monitoring plots, we can identify areas where forest management practices may be needed to maintain or enhance the forest's productivity and health. Additionally, the LAI is an important indicator of forest diversity, which is critical for supporting various wildlife habitats and maintaining the overall ecological balance of the forest ecosystem.

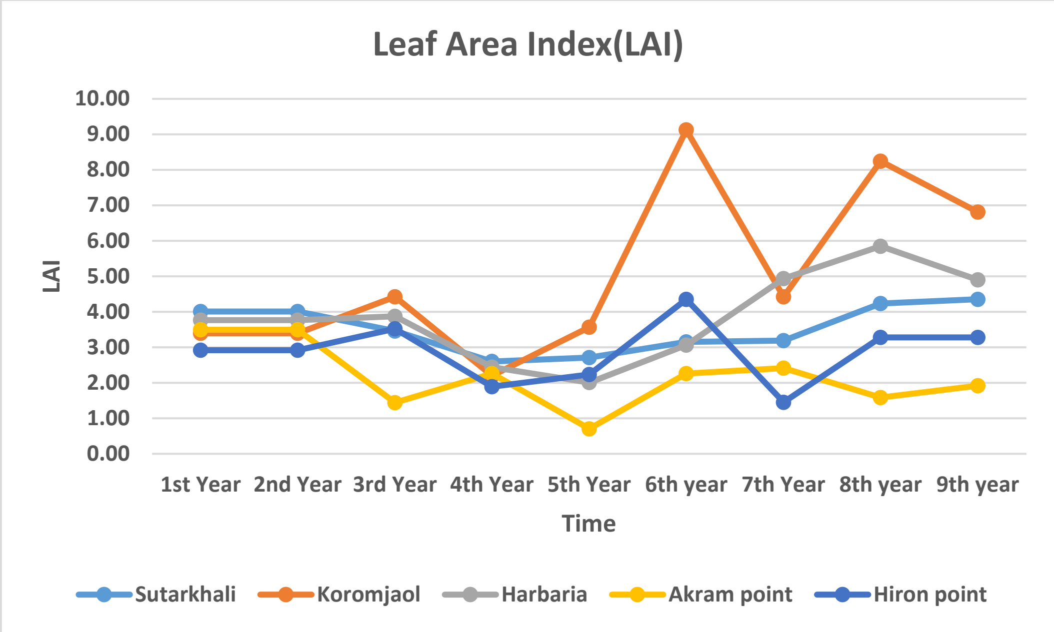


Figure 3.27: Mean LAI % among the yearly surveys in five PSPs

Wood Debris

The data represents the amount and size of wood debris found during two different monitoring periods in five different locations. In each monitoring period, the researchers recorded the amount and size of wood debris found in each area, as well as whether the wood was sound or rotten.

In the 35th monitoring period, Sutarkhali had 123 small, 26 medium, and 4 large pieces of wood debris that were all sound. In comparison, in the 31st monitoring period, Sutarkhali had 208 small, 25 medium, and 4 large pieces of wood debris, with only 1 of them being rotten.

Similarly, in Karamjol, Harbaria, Akram Point, and Hiron Point, there were differences in the amounts and types of wood debris found between the two monitoring periods. In general, there were more small and medium-sized pieces of wood debris in the 31st monitoring period, while the 35th monitoring period had more large-sized wood debris. There were also more instances of rotten wood in the 35th monitoring period in some areas, such as in Harbaria. The variation in wood debris between the two monitoring periods could be caused by a variety of factors, including environmental conditions, human activities, natural disturbances, or differences in the monitoring methodology. Changes in weather patterns, water levels, and other environmental factors could affect the amount and distribution of wood debris in the study area. Human activities such as logging or reforestation could also impact the amount of wood debris. Natural disturbances, such as storms or insect outbreaks, could also contribute to changes in wood debris levels (**Table 3.21**).

Table 3.22: Number of wood debris found in two different monitoring periods

35th Monitoring					
	Small	**Medium**	**Large**	**Sound**	**Rotten**
Sutarkhali	123	26	4	0	0
Karamjol	197	51	11	0	2
Harbaria	198	64	7	1	12
Akram Point	141	26	11	1	7
Hiron Point	184	81	22	0	20

31st Monitoring					
	Small	**Medium**	**Large**	**Sound**	**Rotten**
Sutarkhali	208	25	4	0	1
Karamjol	141	64	21	2	2
Harbaria	72	48	25	4	3
Akram Point	148	29	7	1	7
Hiron Point	174	87	38	6	2

According to the below graph (**Figure 3.29**), the mean carbon density from wood debris slightly varied between the two monitoring periods for some locations. For instance, Sutarkhali had a mean carbon density from wood debris of 0.8 during the 35th monitoring period, which increased slightly to 0.9 during the 31st monitoring period. Harbaria, on the other hand, had a mean carbon density from wood debris of 1.3 during the 35th monitoring period, which decreased to 1.1 during the 31st monitoring period.

The data also shows that during both monitoring periods, Hiron point had the highest mean carbon density from wood debris, while Sutarkhali had the lowest. In general, the mean carbon density from wood debris was higher during the 31st monitoring period compared to the 35th monitoring period for most of the locations.

However, Based on the results of the independent t-test, there is no significant difference between the mean carbon density at the two locations, as the p-value is greater than 0.05. The changes in mean carbon density from wood debris between the two monitoring periods suggests that factors such as weather conditions, human activities, and changes in vegetation could be influencing the rate of wood debris decomposition and the subsequent release of carbon dioxide.

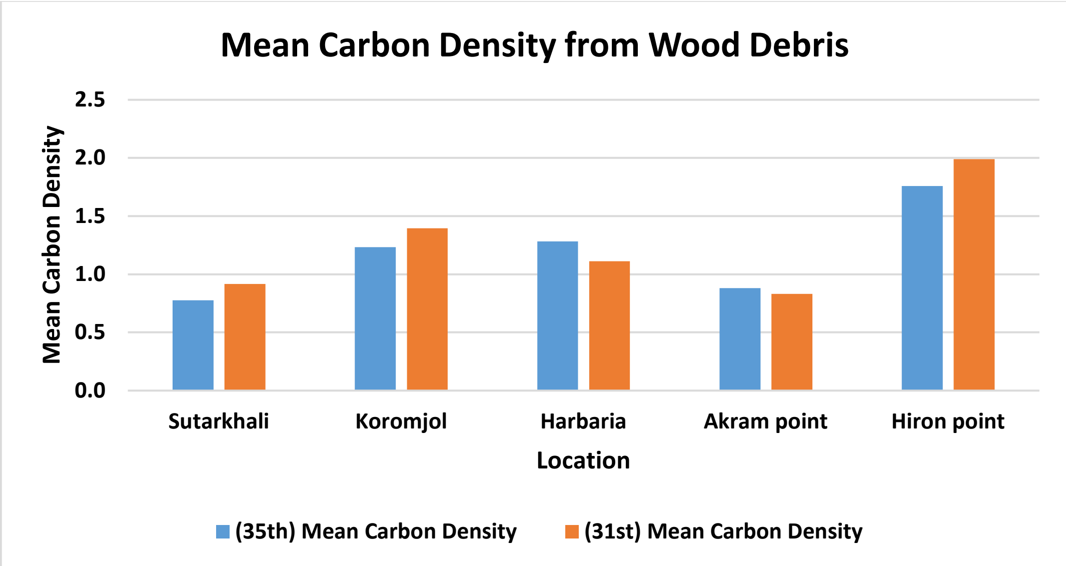


Figure 3.28: Mean carbon density variation in two different monitoring periods in five PSPs

Floral diversity, species richness and species evenness

Floral diversity and species richness are key factors that influence the productivity, stability, nutrient dynamics, and invisibility of ecosystems. Furthermore, species evenness serves as an indicator of the degree of homogeneity within a community. Upon careful analysis, it has been observed that Karamjol boasts a higher floral diversity and species richness in comparison to Harbaria, Akram Point, and Sutar Khali (as demonstrated in **Table 3.22**). Remarkably, the diversity index reveals that, except for Karamjol, all the other plots have experienced a decrease in species diversity and species richness from their baseline conditions.

Notably, the low species richness observed in Akram Point is indicative of its ecological instability relative to the other sites. This can be attributed to the natural stresses that Akram Point faces due to its proximity to the sea. Such environmental conditions are known to exert significant pressure on the flora, thereby resulting in lower species richness. How due to unfavorable weather condition species information cannot be obtained in hiron point in the baseline monitoring period.

Table 3.23: 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	0.55	0.40	0.50
Karamjol	2	0.79	1.19
Harbaria	0.93	0.52	0.89
Akram Point	0.75	0.68	0.36
Hiron Point	0.36	0.26	0.50

Carbon density

The given data represents the baseline and present status of five different locations, namely Sutar Khali, Karamjol, Harbaria, Akram Pont and Hiron point (**Table 3.23**). The data shows that there has been an increase in the amount of carbon stored in all the locations in the present status compared to the baseline status.

For example, in Sutar Khali, the baseline amount of carbon was 111.72 Mg/ha per plot, and it increased to 140.2 Mg/ha per plot in the present status. Similarly, in Karamjol, the baseline amount of carbon was 118.09 Mg/ha per plot, and it increased to 106.6 Mg/ha per plot in the present status.

The data also differentiates between the two types of carbon, ABC, and BGC. ABC represents the active carbon fraction, which is readily available to support plant growth, while BGC represents the slow-decomposing carbon fraction, which is resistant to decay and remains in the soil for a more extended period.

In most of the locations, the present status shows an increase in both ABC and BGC compared to the baseline status. For example, in Sutar Khali, the baseline ABC was 70.51 Mg/ha per plot, and it increased to 88.9 Mg/ha per plot in the present status, while the baseline BGC was 41.21 Mg/ha per plot, and it increased to 51.3 Mg/ha per plot in the present status.

In conclusion, the given data shows that there has been an overall increase in the amount of carbon stored in the soil in all the locations, which is a positive sign for the ecosystem's health.

This may due to the deposition of sediment can increase the soil's organic matter content and promote the growth of mangroves, which can lead to an increase in the amount of carbon stored in the soil. Moreover, changes in the growth and productivity of mangroves van change the biomass and lead to variations in the amount of carbon stored in the soil.

Table 3.24: Mean carbon density in Baseline and Present condition of the four monitoring sites

Baseline Status

Carbon density	Sutar Khali	Karamjol	Harbaria	Akram Pont
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

Carbon density	Sutar Khali	Karamjol	Harbaria	Akram Pont	Hiron point
ABC Mg/ha per plot	88.9	69.5	84.2	63.2	59.1
BGC Mg/ha per plot	51.3	37.1	46.6	36.9	33.8
Total carbon	140.2	106.6	130.8	100.1	92.9

Phenological Behavior

From the last visit, Phenological behavior of major mangrove species was summarized in **Table 3.24**

Table 3.25: 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												
Passur												
	Flowering											
Sundari												
Gewa												
Amor												
Hetal												
Goran												
Kakra												
Passur												
	Fruiting											

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

Source: CEGIS field visit, January 2023

Pest and diseases status

The following **Table 3.25** summarise the observation of disease among the monitoring plots from last visit.

Table 3.26: Observation of disease among the monitoring plots

Sl. No.	Symptoms of disease or damage	Species name	Number
1	Tree has ragged leaves with holes	Sundari,Passur,Gewa,Goran,Amor	05,01,02,01,01
2	Black or brown leaves	Hetal,Sundari,Goran,Gewa,Amor	06,03,01,02,01
3	Spots or bumps on leaves	Passur,Shundari,Goran,Gewa	02,03,02,02
4	Twisted or mail formed leaves	Sundari,Amor,Gewa	01,02,01
5	Leaves changing colour before fall	Sundari	05
6	Branch decay	Sundari,Passur	04,01
7	Peeling or broken bark or holes in the bark	Gewa,Sundari	03,02
8	Dying branches on one side of crown	Sundari ,Hetal,Urmai	04,06,01
9	Canker	Passur,Sundar	01,01
10	Gull	Passur	01
11	Hollows	Sundari,Passur,Gewa,Amor,Goran	03,02,02,01,01
12	Fungi	Passur,Sundari	01,03
13	Green or brown spots		

Source: CEGIS field visit, January 2023

According to the above data, the majority of trees have hollows in their bark and ragged, discolored, or holey leaves. The most afflicted tree, nevertheless, is the sundari, which exhibits all pest and disease signs.

4. Social Environment

4.1 Introduction

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

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

4.1.1 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 and the project area. The consultations were held at the MSTPP office and Niramoy Medical Center, whereas relevant project officials provided their feedback based on the checklist. In addition, physical observation and informal interviews were held with the workers and local people. The informal interview was carried out at Zero Point, Kapasdanga, Barni, Gaurambha, Rajnagar, and Borodurgapur; 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 in construction activity is decreasing with the completion or close to completion of the construction activities, and the authority is now concentrating for the operation of the plant for which permanent and temporary technical employees is required. It is estimated that about 5% to 10% local labors are working (during this monitoring phase) at the project site only for non-technical construction activities i.e. cleaning, cooking assistance and other support services etc. According to the statement of local people, more than 100 local laborers are regularly worked at the project site as temporary workers, in which higher number of labors are comprised in Gaurambha union. However, at present, the proportion of local and Indian employees is 231:18 in BIFPCL office. The plant is waiting for its production where more technical workforce will be required for its operation which is rarely found the study area, but it could generate the scope of employment in national context.

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 may have commitment with some others who is highly deserving and most vulnerable family member. On the other hand, the project authority said that they recruit the local employees on the basis of the birth certificates, authorized by respective local chairman and following all their procedures of recruitment. The MSTPP will also influence for generating further industrial development in the project surrounding areas after the operation of this power plant, which will enhance the local employment opportunity. In the meantime, MSTPP is committed for the skill development of the PAPs by generating semi-skilled and skilled labors in the study area. Before, starting the Covid 19 Pandemic Situation in 2020, the project authority initiated some trainings for skill development of the local people and provide some necessary logistics for their development which was halted due to covid 19 pandemic. The authority will take similar types of initiatives after starting the operational flow of the project while they have suggested to the consulting firm for seeking and identifying potential sectors for training considering local needs and potentiality.

Figure 4.1: Discussion with local stakeholders

In addition, scope of small business opportunities for local people have 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. Also, about 300 non-motorized vehicle drivers are so far registered to get access in the approach road of the power plant for providing necessary communication support.

Working Environment

The PMU regularly monitors the safety issues for ensuring safe and secured working environment for all the workers. The tri-party coordination meeting with BIFPCL, BHEL, and other sub-construction companies was held with a regular interval 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. All the workers have sufficient toolbox training, and the PMU strictly monitors the issue that without getting a pass from the safety exam, no new laborers will work at the project site. BIFPCL authority checked up all the important health issues of newly recruited workers and include them under a health insurance program. The Niramoy Medical Center of the MSTPP conducted and facilitated all these activities. This medical center provides all kinds of available medical supports including medicine, diagnosis, general operation, ICU bed with oxygen support, private ambulance service, physiotherapy etc for the workers.

Physical condition of the labor sheds is moderate. There have some issues of improper cleanliness in the toilet and residence of the labor sheds which have limited/no scope of further improvement as the works of residential workers almost ending. The residential labors of the sheds complaint against their daily food menu and cooking quality. In addition, use of harmful asbestos and improper management of construction debris is found in the construction sites which is health hazardous for the construction workers.

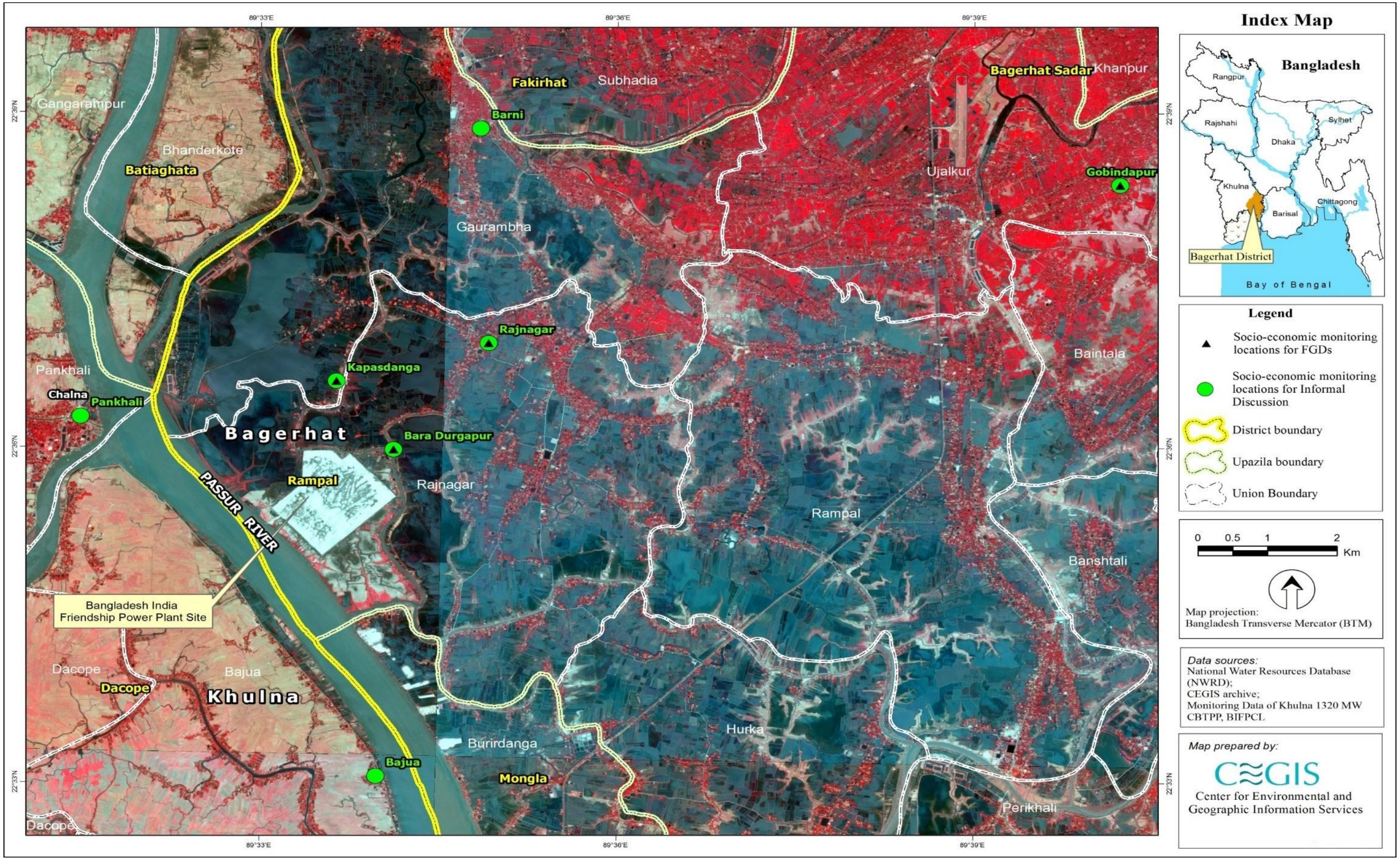


Figure 4.2: Socio-Economic Environment Monitoring Location

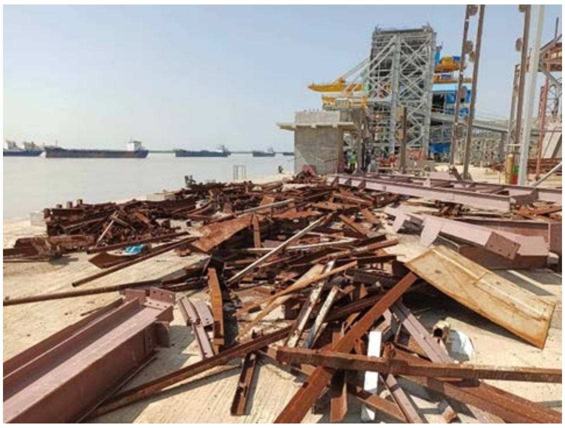


Figure 4.3: Unsafe asbestos management

Figure 4.4: Improper management of construction debris

Community Health and Safety

During this quarter of monitoring, local community did not raise any grievance regarding degradation of their health and safety due to the project. Noise problem, and waste water discharge problem at the trial period of the plant is not yet recorded in this monitoring phase. For ensuring better environmental quality in the project area, and it surrounding villages, the project authority planned for trees plantation in the project site. In line with this, 84000 trees were planted in the project area and periphery up to 2 years back, and some scattered plantation for 3000+ trees is recently observed in the township area of proposed project.

The authority has a MoU with Forest Department, Bagerhat for plantation of additional 3 lac trees in the project area premises for which about BDT 3 crore will be required and this amount is not yet sanctioned from the project authority. Also, the dredged material disposal activity is initiated to the designated plantation site, therefore the plantation activities has been delayed so far. However, in this monitoring phase, the authority is highly concentrated on the operation of the plant which also delayed the plantation activity.

Also, it has been noted that the authority did not prepare any dredged material disposal plan for the maintenance dredging. So, improper management of the dredged material will affect the health and livelihood of local people and BIFPCL employees as well as environmental components in near future. Blowing sand of the dredged material will affect the biodiversity of the surrounding wetlands, loss the crops and vegetable production, increase respiratory diseases for the BIFPCL employees and local community. Therefore, a comprehensive dredged material management plan is required for successfully continuing the maintenance dredging.

Corporate social responsibility (CSR)

The BIFPCL is committed to continue supporting/development activities under the CSR however, in last six months no such activities were initiated except to installation ROs for ensuring safe drinking water for the surrounding communities. The BIFPCL official stated that they have a plan to restart the skill development training for the local people, and in this regard, they requested to the consultants of the monitoring firm to suggest the potential sectors for training as per the requirements and potentiality of the local people.

The outdoor medical facilities and campaign is well accepted to the local community but this service has been temporarily halted at the beginning of the covid -19 pandemic situation and still continuing. In the meantime, the authority initiated boat camps and mobile camps to the surrounding unions during Covid-19 pandemic period which was stopped in later, because of unavailability of doctors, and lack of maintaining protocal of the Covid -19 for all.

RO System Installation

Five (5) RO system were previously installed as 2 in the Rajnagar, 2 in Gaurambha and 1 in Burirdanga Union and all of those are functional. Additional 6 ROs are under construction as 2 in Hurka Union, 3 in Burirdanga Uniona and 1 in Mongla Paurashava for ensuring safe drinking water for the local community. The MSTPP authority installed these ROs while local people with the involvement of respective union chairman operates the ROs. The maintenance activity will be initiated by the project authority up to 1 year of it installation.

Source: Field Survey, January, 2023.

Figure 4.5: RO treatment and filtering system installation in the study area

Medical Facilities

Medical campaign is one of the major program under the CSR of MSTPP. From November 2022 to January 2023, a total of 1,386 patients were treated under three types of medical facilities (OPD, laboratory tests and physiotherapy services) from the Niramoy medical center which is smaller in patient's number, and types of services than the last quarter monitoring report. From the Covid 19 pandemic, regular medical camp for the communities has been halted because of the safety issue which is not yet restarted. However, the authority initiated mobile medical camps and boat camps for providing medical support to the local community during this emergency period on special request of the local administration and government agencies which was also halted by June, 2022. Detail of the medical facilities provided over last three months are given in the following **Figure 4.6**.

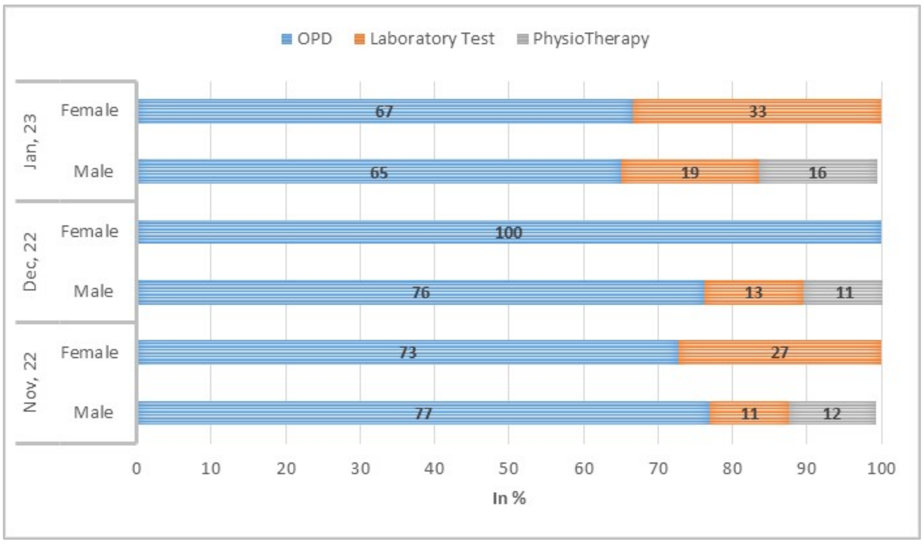


Figure 4.6: Medical Campaign from November 2022 to January 2023

Award Giving Ceremony of Freedom Fighters

Rampal Upazila Administration arranged an award giving ceremony for the freedom fighters and the family members of martyr freedom fighters at 16 December 2022 which was sponsored by the BIFPCL. The Upazila Nirbahi Officer, Upazila Chairman, Coast Guard Officials, local elites and freedom fighters with their family members attended the program (**Figure 4.7**).

Source: Field Survey, January, 2023.

Figure 4.7: Award giving ceremony of freedom fighters and family members

4.1.3 Autonomous Development due to MSTPP

The proposed project insists for autonomous development in the project area and the surrounding area. Babur Bari bazaar and DBBL agent banking facilities are already developed in the approach road and close adjacent. Some village road connectivity was observed with the approach road of MSTPP. Also, road communication of the project surrounding villages have been improved and almost all those village connecting roads are concrete of which about 75% were kutcha before initiating this project. These facilities are helpful to the local people and they are getting sufficient benefits of these services.

Also, some plots adjacent to the MSTPP approach road have already purchased for using industrial and commercial activities that might be change the urban development trend and employment status in the study area.

4.1.4 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. 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;

c. It is required to installed a grievance box in the main gate of the project office and establish a grievance redress committee (GRC) to monitor and solve the problem (especially during selecting beneficiaries for providing any services from the MSTTP) of localities regarding the aspect of construction activities of MSTTP;

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

e. 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;

f. 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.

g. Plantation program should be re-initiated to complete the targeted volume of the plantation before initiating the full phase of operational activities and it is under the condition of DoE for ensuring greenery effect; CSR activities should be performed primarily among the PAPs on equitable manner. This should be audited by a third party monitoring team;

h. Local people are becoming aware about the new entrepreneurship development in this area; in this regard, training on entrepreneurship development should be arranged under the CSR activities;

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

j. River water should be used for dust suppression activities and ground water use should be prohibited in this regard;

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

l. Mindset of local people have been changed and people are more positive about the project. To increase more awareness, it is required to arrange some consciousness program in which they can be more aware about how this power plant will be operated and how this project will be beneficial for the local people;

m. It is required to arrange program at local schools, colleges and UP offices about the operation and impact of the power plant to disseminate the progress of the project and create more awareness about the MSTPP;

n. Installation of the ROs for ensuring safe and quality drinking in different location of the project surrounding is well accepted to the villagers, but it should have sufficient need assessment for selecting the installation location;

o. Medical camp should be restart for the local community which is a good and authentic source of medical facilities in the project surrounding villages.

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). Providing an operational translation of local laws, international standards and company codes, the report will demonstrate the actions required to ensure that all operations along the supply chain, from the production of the raw material to the production of the electricity that are consistent and comply with DoE conditions and also Environmental Management Plan (EMP) requirements stated in the EIA report. The Major milestones during this quarter were as follows:

- Synchronized with National Grid on 15.08.22
- Trial operation done up to 416 MW.
- Unit-1 was shut down due to non-availability of coal. Coal under supply, expect arrival by 07 Feb'23
- Plant has now under operation again as coal supply has returned into normal situation.

However, an E&S team from CEGIS recently visited to the plant on 6th to 9th February, 2023 for a routine inspection and to acquire 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 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. Unlike the 34thenvironmental compliance monitoring report this quarterly report will focus on waste generation and its management in and around of the main plant and labour shed. It is noted that during 34th field visit we identified and requested to the respective authorities to take necessary measures for a set of anomalies regarding waste generation and its proper management. During 35th 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:

- Plenty of Asbestos fibre were observed in the plant premises specially at the boiler and ESP plant site. Taking consideration of asbestos issue, BIFPCL has already issued a letter to BHEL to take necessary step on this issue.
- The lavatory waste sewerage facility at labour shed is inadequate that may cause 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 may pose significant threat for the aquatic ecosystem for the nearby waterbodies.

- Current Dredged material disposal practice seems unsustainable and harmful for the environment and the adjacent biodiversity. Proper dredged material disposal plan is highly recommended.
- Coal Conveyor belt from jetty area to 1st Transfer Point (About 20 to 25 m) found 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. 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-1997 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	• Monthly and quarterly air quality monitoring in and around the project sites is being conducted and checked with ECR, 2005 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.	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. • As winter season will be drier, dust suppression activities should be

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Construction materials must be covered to protect from wind action • Spray water regularly for suppressing fugitive dust • Dust particle generated from access road must be controlled by spraying water during dry season. • Stock piles of construction materials must be covered in order to protect from wind action. • An appropriate freeboard must be maintained in trucks hauling construction materials.	• Continuous water spraying on the dusty road was noticed. BHEL has contracted a company for 3 years for this job. • 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		monitored on a regular basis for maintaining the air quality within standard limit. • Face musk should be use wear throughout the workplace.
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:	• Surface water is regularly monitored. Most of the time the discharge water quality has been recorded within the standard limit (ECR, 1997) • Construction waste water discharge 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.	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
		• Arrange weekly consultation session among the workers through plant site managers. The duration of consultation is one 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.	• 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 (1m3) RO water processing plant. It is also complying ECR 1997(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 basestripping 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	• 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)	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 deterioration. • 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

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• Location of spoil stock pile ought to be located in safe area and protected from wind and rain action. • No spoil store on River bank/slope • Construction wastes must be reused or recycled as and where possible • Burning of waste material should be restricted • Quality housekeeping practice must be maintained by regular inspection and checking. • 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	• 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 • 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 731 different colored waste containers (EMP_ January, 23) 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.		regarding source segregation of the waste • Awareness raising programs regarding waste recycle and reuse should be introduced. • 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 and compensation plan if the Project needs any land acquisition addressing compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies. • Resettlement of the PAPs • Cash for compensation of land (CCL) before resettlement formal agreement with the	• Compensation has been given to the rightful owners of the land as per the laws of Bangladesh e.g., 'Acquisition and Requisition of Immovable Property Ordinance, 1982 started in 2011 • Compensation was paid by the local DC office as per law of the land.	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

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		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 • 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	• Local DC office facilitates to obtain house of the PAPs (settlers of the project area) in cluster villages provided by the GoB. • Almost 32 affected families are now having their houses at Foyla cluster villages. • BIFPCL is giving priority to affected people in project employment or trained them as much possible. • 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.		affected peoples from local DC office but this is not done yet.
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;	• BIFPCL are recruiting the local people especially PAPs with the help of local government (UP Chairman and members). • In January, 2023 Total manpower at site was 3600 nos. Out of this, Bangladeshi manpower was 2950 nos • Previously an NGO "SAMAHAR" was engaged by BPDB to give livelihood training for the affected people.	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

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/ Measures already Implemented	Compliance Status	Recommended Action
		• For the increased movement of people and heavy vehicles, the road networks must be developed. • Keep provision of sanitary toilet, one toilet for 10 persons.	• Provisions has been kept for health facilities to the labors as well as for the communities. • 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.		• Health and financial support should be available for the labour in case of COVID and other health effects.
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. • No GHG inventories were prepared yet. • 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. • GHGs inventory checklist may be prepared.

Table 5.2: Monitoring of Labor and Working Condition

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
1	Working Conditions and Management of Worker Relationship	• Preparation of Human Resources Policies and Procedures for Direct workers; • Defined Working condition and Terms of Employment for direct worker; • Sustainably equivalent terms and condition for migrant workers; • Compliance to national law of forming workers' organization; • No discrimination and equal opportunity for all; • Grievance Redress Mechanism.	• BIFPCL is 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. • 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	Mostly Complied	• Create fund to support the labour and his families in case of any fatalities • CEGIS team strongly and repeatedly recommended to the authority for Community GRM but still not done. The grievance box may be fixed just at the outside of the main entrance.
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.	Complied	• Complied but this should be continued strictly till the end of the pandemic. • Awareness work should be continued regarding the local cultural values, STD, redressing of workers grievances, insurance

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
			• Workers get the safety clearance before initiating any work like – routine checkup of the work places and administrative clearance is being Implemented		policy related facilities and also contract clauses of the job to get maximum benefit.
3	Safety at site	• Installation/Construction of Safety Fence around the Project area • Use of Personnel Protective Equipment's (i.e., safety vest, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.); • Safety trainings for workers (i.e., fire control, working at height, working in heat, first aid etc.); • Practice of Tool box meeting, safety talks • Safe Storage of Hazardous Chemicals (e.g., fuel, flammable chemical, toxic chemicals, etc.); • Maintaining Material Safety Data Sheet (MSDS); • Provision of Health care facilities such as doctor, hospital etc. available at/nearby the Plant construction site; • Availability of First Aid at work place; • Preparation and Follow of Emergency Response Plan (ERP); • Adequate fire precautions in place (e. g., fire extinguishers, escape routes etc.);	• 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 were observed. Fire-fighting system: Fire extinguisher - Foam type-23 no's, Soda type -Nil, DCP type-231nos and CO2 type- 186 no's have been kept at different places of sites in December, 2022. • In addition to this, two nos of fire fighting vehicle, two nos ambulance with doctors are also available at sites. • Induction trainings and awareness program were given to **767 no's** of participants work force during month of Jan, 2023. • 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 issuesis being given. • The OHAS Company named Cholamandalam has been looking into the occupational safety system of this project.	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
		• 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	• 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. • Substantial warning sign, speed limit and convex mirror have been displayed at the strategic locations.		
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

Sl. No.	Potential Impacts	EMP measures as proposed in the EIA	Actual measures already Implemented	Compliance Status	Recommended Action
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. • Grievance mechanism available for the workers that usually address the safety issues. • No labour association identified yet to look after workers 'well-being issues	Mostly Complied	• Establish and Freedom of Association, Rights & scope of bargaining should be open for the workers. • Take care about the ultimate payment of the labors from the sub-contractor or local contractor. It should not be lower than the national standard fixed by the PWD for the labors.

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; • Maintaining open communication channel with the local community.	• Social liaison officer is working for maintaining relation with local communities especially the CSR activities. • BIFPCL regularly display the progress of the development through their website (https://www.bifpcl.com/) and 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	Mostly complied	Recommend and advise in each quarterly meeting to initiate the community GRM procedure so that the local community could easily state any grievance properly. But this issue has yet to be done.

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
			Redress Mechanism (CGRM) has yet to be in action. It should be started as soon as possible.		
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 be in action. It should be started as soon as possible.	Complied	• Advise to Maintain and limit the frequent access of the project workers to the local community during this COVID pandemic • 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.
4	Community Health and Risk	• Provision of providing health service facilities to community if the Project poses any health risk like	• Continued the medical facilities (consisting medical officer, medical assistant, office assistant) at Plant site for checkup the	Complied	BIFPCL may introduce awareness program for STD and other transmitted

Sl. No	Potential Impacts	Proposed EMP	Actual measures already Implemented	Compliance Status	Recommended Action
		sexually transmitted disease, contract disease, vector-borne diseases; • Implement all pollution mitigation measures to ensure safeguarding to community.	communicable diseases of the workers and staffs; • Office medical centres of BIFPCL Total 382 patients have taken treatment, Pathology test has done 110 and Physiotherapy has given 90 patients in January, 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.		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 initiate skill development trainings on electronics, driving, health and hazard safety, fittings, welding etc.	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
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. • A 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 might be used for spreading the project right information • The proponent should aware and clarify about the project the local people to stopover any rumor.

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

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/Measures already Implemented	Compliance Status	Recommended Action
1	Rainfall runoff from the construction site would cause deterioration of aquatic ecosystem.	• Installation of proper runoff drains; • Use of sediment fences, traps and basins for trapping the sediment, if required.	• Permanent drainage system (Under BHEL) to discharge waste water from the project 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 1997 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. • Operation of ETP should be quick to treat the waste water and other effluent before discharging in the nearby river.
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;	• 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 in this quarter. • 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	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.

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/Measures already Implemented	Compliance Status	Recommended Action
		• Using shade (directed downwards) around the outdoor lights; • Provision of cut-off time to switch off unnecessary lights at night; • Initiate Green plantation; • No plantation of non-native species; • Retaining top soil for future habitat restoration; No degradation of sensitive habitat.	plantation has done by the side of township area and another 2000 will be done soon. • Another 150,000 saplings supposed to be planted ASAP by Bagerhat Social Forest Division. • 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 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	• 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.	Complied	• Initiatives should be taken for excavation of silted reach of Maidara River to protect the rainfall runoff washout. • Proper protective measures must be taken to take care of Dolphin community

Sl No	Potential Impacts	EMP measures as proposed in the EIA	Actual condition/Measures already Implemented	Compliance Status	Recommended Action
		River for maintaining tidal flow dynamics	Selected coal suppliers ensured the appropriate vessels with minimum sound for the coal transportation to avoid the disturbance to 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. Now the mechanical and electrical works are in progress.	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	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
		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. • **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. BIFPCL has also installed the Continuous Monitoring Station (CMS) at the Chimney area and will be operation after completion of the chimney construction. 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	• BIFPCL has taken appropriate mitigation measures conforming EMP and technical specification of main Plant at each of the stages of Project Development.	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
	MW Coal based Thermal Power Plant Project activities.	Proper safeguard measures for the safety of the workers were found satisfactory. Proper PPEs and scaffolding structures were observed during the site visit.	
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 are being followed and will be followed through best practices and according to the EMPs of EIA Report.	Being Complied.
9	Construction works shall be restricted to daytime hours so as to avoid/mitigate the disturbance of local lives as well as implementation schedules of the works shall be notified in advance to nearby residents.	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 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 but Proper Waste management around the labour shed must be ensured as soon as possible.

Sl. No	Condition of DoE	Compliance Status	Remarks
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 so that no habitat of any flora and fauna would be endangered or destructed.	Quarterly monitoring activities are being carried out to examine the potential impacts on habitat of flora and fauna. No significant changes are yet recorded. Moreover, monthly environmental monitoring has been performed for noticing any harmful air pollutant emission or waste discharge form the project area.	Being Complied
14	All the required mitigation measures suggested in the EIA report along with the emergency response plan are to be strictly implemented and kept operative / functioning on a continuous basis.	The 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.	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
		• 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.	
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 *Air pollution control Rules, 2022* 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 were observed as blocked situation 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. 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.

Sl. No	Condition of DoE	Compliance Status	Remarks
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 near the jetty area. 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 35^{th} field visit by CEGIS team it is observed 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 is almost finished and the sheeting work is at finishing stage.	Being complied
22	The entire coal stockyard should be covered with water sprinkler provided with automated moisture sensor to control self-combustion.	All these stipulations have been included in the technical specification of Main Plant EPC contract package, Section V, B4 of Technical Specification. Out of 4 coal stockyards, construction of 1 stockyard is fully completed and 50% of anther stackyard has completed. Automated moisture sensor has observed to protect 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	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

Sl. No	Condition of DoE	Compliance Status	Remarks
	provision of small ash dyke that will not exceed 25 (twenty-five) acres of land to store residual ash.		
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. **<u>Status:</u>** • 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). **<u>Status:</u>** • Bottom Ash Intermediate Silo structural erection completed. FA Pipe rack and piping work under progress.	Compliance action initiated
27	Resettlement and rehabilitation of the displaced population (including those who do not own land) should be done properly.	Land has been acquired as per the legal procedure of GoB. However, BPDB wrote to Ministry for suitable resettlement and rehabilitation as per DoE requirement. BPDB prepared an assessment (Livelihood Restoration Plan) regarding the rehabilitees (including those who do not own land) for this Power Plant. As per the recommendation of the LRP, a NGO “SAMAHAR” has completed their assigned tasks regarding this issue. This monitoring	Compliance action continued

Sl. No	Condition of DoE	Compliance Status	Remarks
		has recorded that DC office has rehabilitated around 32 families at Foyla and 17 families at Koigardaskati.	
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 34th and 35th 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 practice.
30	As described in the report environmental monitoring should be strictly followed and monitoring report should be shared with DoE to ensure the environmental management properly.	BIFPCL has engaged CEGIS as a third-party independent entity for conducting environmental monitoring on a quarterly basis in February 2014. Accordingly, each quarterly monitoring report has been prepared, submitted and shared with DoE, which are also available at BIFPCL web site.	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
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 Headquarters of the Department of Environment simultaneously.	All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5). However, air, water, soil and biological components are regularly monitored as per recommendation of EMP. Each of the monitored environmental data has been incorporated in the Monitoring report and displayed on the BIFPCL website at present.	Compliance action initiated.

Sl. No	Condition of DoE	Compliance Status	Remarks
35	There should be regularly disclosure of the report through workshops and websites and responses should be taken care accordingly.	CEGIS 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. BIFPCL has ensured three (3) more device will be installed around the Power Plant. Moreover Continuous Online monitoring System has already been installed at the Chimney area and will be operative after completion of the Chimney. 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 during operation 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	Joint Venture Company (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

Sl. No	Condition of DoE	Compliance Status	Remarks
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. Two (02) RO plant has already been constructed by project proponent to fullfill the demand of potable fresh water and construction purpose. Moreover a 1200 ft deep tube well has been 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.	Being complied but sometimes ground water is being withdrawn only for supplying 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	Environmental Monitoring Reports as per specific format provided in the EIA Report made available by BIFPCL and submitted to DoE	Being Complied

Sl. No	Condition of DoE	Compliance Status	Remarks
	District Office, Khulna Divisional Office and Headquarters on a monthly basis during the construction period of the Project.	Bagerhat District Office, Khulna Divisional Office and Headquarters accordingly.	
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 March, 2023. The COVID restriction has been withdrawal by Gov. with the decreasing infection which also implemented for the MSTPP construction site. During 35th 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 some 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.	Complied at present COVID-19 PPE (Specially Face-mask) usage should be ensured
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 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.	Being Complied.

Sl. No	Condition of DoE	Compliance Status	Remarks
		Center for 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. 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. are being conducted by the BIFPCL authority as a continuous process at the plant site. As a part of CSR, medical center of BIFPCL has provided the following medical facilities in January, 2023. o Total 382 patients have taken treatment, o 110 patients have taken Pathology test 90 patients have received the Physiotherapy	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),	At present, the Plant is in construction phase. Some of the required parameter from DoE are ready, some are under ready and some will be ready before operation phage.	Compliance action initiated

Sl. No	Condition of DoE	Compliance Status	Remarks
	'closed-loop' Flue Gas Desulfurization (FGD), Low NOx Burner, online air and water quality monitoring system and other pollution control equipment and obtaining Environmental Clearance Certificate, the proponent shall not start operation of the Project.	**<u>Current status:</u>** • **Chimney:** Shell construction completed in Apr'21 (270 m+5 m = 275 Meter). Flue liner erection completed and ready for Boiler light up (pic attached). • **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. A Continuous monitoring station (CMS) has already installed and will be in operation phase after completion of the chimney. **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 being 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 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.	So far, no issue has been reported or noticed under Coal Transportation for the Proposed 2x660 MW Maitree Super Thermal Power Plant Project.	Suggested to comply as and when required.
5	Proper and adequate mitigation measures shall be ensured throughout the operation period of the Project	The project proponent has included all the mitigation measures in their BID document of Coal Transportation. However, BIFPCL has monitored 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.	Suggested to comply at operation stage.

Sl. No.	Conditions	Compliance status	Remarks
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 35th field visit the following anomalies were identified: • During the visit inside the labour shed plenty of household waste were found on the road in an unmanaged situation. • Lack of waste bin and lack of proper initiative of source segregation of the organic waste has made the labour shed unhygienic • Unused bath-tub with dirty water has noticed where waste garbage and polybags were floating. • Lack of lavatory/toilet waste drainage and sewerage facilities that has been causing waste accumulation and malodorous stench. CEGIS advised to take immediate step to clean the labour camp and other waste related issues to make the environment healthy. But during 35thfield 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. Adequate no. of toilets has been made at every location at sites & labour colony	Partially Complied Waste management issue needs to take as top priority.

Sl. No.	Conditions	Compliance status	Remarks
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 so far including the Jetty has been followed 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 did not find any significant changes of the habitat of flora and fauna of the project influenced Passur river and Sundarbans ecosystem.	Being Complied
10	All the required mitigation measures Suggested in the EIA report along with the emergency response plan are to be Strictly implemented and kept operative/functioning on a continuous basis.	The proponent is giving top priorities to occupational health and safety issues. 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. EHS team of BIFPCL, BHEL and Cholamandalam are compelling to ensure the safety mitigation measures as per EIA and EHS guideline. Moreover, Periodic training has been made as mandatory for the workers. BIFPCL has been working hard to build awareness about Covid-19 among workers and office support staff. Thermal scanning of workers is being done at regular frequency for checking COVID symptom.	Being complied
11	To control dust, spraying of water over the earthen materials should be carried out from time to time	Periodic air quality monitoring in and around the project sites is being conducted and checked it with ECR, 2005 standard. BHEL has contracted with an external company for three years (renewable) who are continuously spraying water as per schedule by three	Being Complied The anomalies identified in the compliance status should be mitigate ASAP

Sl. No.	Conditions	Compliance status	Remarks
		(03) water tankers to suppress fugitive dust from the plant premises. At jetty site the following issues were identified: • 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.
15	Construction material should be properly disposed of after the construction work is over.	Lots of construction materials and waste were observed by the side of the River in the jetty area.	Partially complied Good housekeeping practice has strongly recommended. The slurry should remove

Sl. No.	Conditions	Compliance status	Remarks
		Coal-water slurry is deposited in around the jetty area and TP that was found very unhealthy and dangerous.	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 for the pre-construction and construction phase. Accordingly, each quarterly monitoring report has been submitted and shared with DoE, which are also available at BIFPCL web site. However, a third party monitor is not yet engaged for coal transportation activities.	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.	No third party monitor has yet been engaged for coal transportation activities.	Not 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.	CEGIS as third-party independent entity has been preparing the baseline condition of the 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. A third party monitor need to be engaged during the coal transportation ASAP.	Compliance action initiated.
19	Air, water, soil, biological and social data should be monitored regularly with a network monitoring system with a view to assess the natural quality of the Sundarbans and other fragile ecosystem and report of monitoring results should be submitted to Bagerhat District Office, Khulna Divisional Office and Headquarters of the Department of Environment simultaneously.	The network monitoring system will be installed as a part of the project construction for online monitoring and it will run at the time in operation phase. All these stipulations have been included in the technical specification of Main Plant EPC contract package. (Section-V, Clause No B0 6.19.13.2 and Clause No. B0 6.19.13.5). Steam and water quality analysis system has already been developed. For air quality monitoring DoE has already installed one device to monitor	Being Complied.

Sl. No.	Conditions	Compliance status	Remarks
		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. Three more device are to be installed soon. BIFPCL has also installed the Continuous Monitoring Station (CMS) at the Chimney area and will be operation after completion of the chimney construction 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.	54600 tons of coal has been transported by 43 barges for the commissioning. Proponent confirmed that the vessel was covered and most of the work conducted during day time. No spillage and ship breakage incident has been reported. Noise level was found 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 enable identification of substances harmful to the marine environment.	No anomalies were identified during the coal transportation so far as reported by the proponent. This should be strictly monitored by the project authority.	Being complied and suggested to follow this throughout the project cycle.

Sl. No.	Conditions	Compliance status	Remarks
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 for the construction activities 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, 2014.	Being Complied
30	The following records must be kept in respect of any samples required to be collected for the purposes of environmental monitoring activities: a) the date(s) on which the sample was taken; b) the time(s) at which the sample was collected;	The Monitoring report for construction activities by CEGIS are maintaining all the records as suggested.	Being Complied

Sl. No.	Conditions	Compliance status	Remarks
	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 for 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. BIFPCL has adopted 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 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	Complied at Present.

Sl. No.	Conditions	Compliance status	Remarks
		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.	Being complied
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

Air quality monitoring station near BIFPCL office

Air quality monitoring station at Chimney area

Part of drainage system is being constructed

Construction debris

Unsafe working environmnet near the crusher area

Construction debris the crusher area

Installation activities of Flue can for 2nd unit

Installation activities of Flue can for 2nd unit

Ash pond area

Dreged material dumped near the Ash pond area

References

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Sukumar, R., Dattaraja, H. S., Suresh H. S. et al. 1992. "Long-term monitoring of vegetation in a tropical deciduous forest in Mudumalai, southern India," Current Science, 62:608–616, Tareq M S., Rahaman S M., Rikta Y S., Islam S M N., Sultana M S 2013; Seasonal Variations in Water Quality of the Ganges and Brahmaputra River, Bangladesh; Jahangirnagar University Environmental Bulletin, Vol.2; pages (71-82)

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

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

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

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

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

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

Appendices

Appendix I: Checklist of Monitoring Environmental Compliances

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

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Generation of Noise within the BIFPCL's Plant premises	• Conduct noise survey around and inside the site boundary • Reducing Noise and Vibrations to country's ambient standards, and occupational health and safety standards • Introducing vehicle speed limit and speed limit monitoring system • Green Plantation around the Project boundary • Switching off/ throttling down of machines/equipment's/generators which are not in use			
2	Dust Generation from Land development activities and other construction works	• Conducting dust monitoring and visual inspection around the site boundary • No use of earthen and undeveloped roads by vehicles related to the Project use • Installation of water spraying system to control fugitive dusts • Introducing vehicle speed limit and speed limit monitoring system • If yes, do they monitor vehicle speed regularly?			
3	Water Quality	• Fencing the construction site by drum sheet or Tarjja of any other fencing • Arrangement of runoff drainage for reducing any water logging • Location of backfilling stockpile in safe area and protected from wind and rain action • No storing of backfilling materials/spoil stored on river bank/slope • No disposal of waste and wastewater to river or canal.			
4	Waste Management System	• Provision of onsite waste management system			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
5	Compensation and Resettlement	• Prepare Proper resettlement action plant and compensation plan if the Project needs any land acquisition addressing compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies • Resettlement of the PAPs • cash for compensation of land (CCL) before resettlement • formal agreement with the affected people prior to migration/resettlement • Sufficient standing crop compensation • Compensation for shift able structures? • Retention of salvageable materials? • Compensation for loss of trading income? • one-time moving assistance • grant to cover loss of regular wage income • Has a resettlement plan been developed which includes compensation, restoration, livelihood, living standards etc. based on proper socio-economic studies? • Provide/take extra care/caution for the disadvantaged/vulnerable group(s) (i.e., women, children, ethnic minorities, indigenous people etc.) • Provision of monitoring the compensation and resettlement process			
6	Livelihood and living	• Does the Project pose any threat to the livelihood/living standards of the local people? • If yes, are adequate steps taken to reduce the impacts? • Has the company developed any policy which prioritizes the local laborers in employment opportunities? • Is there any possibility that large vehicle related to the Project will cause traffic induced disturbance/s to the local dwellers? • If yes, are there any mitigative steps taken to decrease the disturbance/s? • Has the road network been developed after the Project being proposed and during the construction phase?			

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
		• Are there separate water and sanitation facilities for the construction workers in the Project area?			
7	Green House Gas Controlling Measures	• Use of efficient generator in the construction activities • Regular maintenance of vehicles, generator and machinery in accordance with manufacturer's specifications • Use of approved pollution control devices fitted in the equipment's and machineries • Switching off and throttling down the machines/equipment's/generators which are not in use			

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

(Labor and Working Condition)

Basic Data

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

Checklist for Labor and Working Condition

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Working Conditions and Management of Worker Relationship	• Preparation of Human Resources Policies and Procedures for Direct workers • Defined Working condition and Terms of Employment for direct worker • Sustainably equivalent terms and condition for migrant workers • Compliance to national law of forming workers' organization • No discrimination and equal opportunity for all • Measures for diminishing past discrimination • Grievance Mechanism			
	Protecting Workforce	• The client will not employ children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. • No Force Labor			
2	Safety at site	• Installation/Construction of Safety Fence around the Project area • Use of Personnel Protective Equipment (i.e. safety suit, safety goggles, ear plug, safety shoes, gloves, dust mask, etc.) • Safety trainings for workers (i.e. fire control, working at height, working in heat, first aid etc.) • Practice of Tool box meeting, safety talks, • Safe Storage of Hazardous Chemicals (e.g. fuel, flammable chemical, toxic chemicals, etc.) • Maintaining Material Safety Data Sheet (MSDS) • Provision of Health care facilities such as doctor, hospital etc. available at/nearby the plant construction site • Availability of First Aid at work place • Preparation and Follow of Emergency Response Plan			

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

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

(Community Health, Safety and Security)

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

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

(Biodiversity and Sustainable Management of Living Natural Resources)

Sl No	Potential Impacts	Proposed EMP	Actual Implementation	Recommended Action	Compliance Status
1	Runoff (contain mostly sediment load) from newly developed land falls into nearby river and channel.	• Installation of proper run on/runoff drains • Use of sediment fences, traps and basins for trapping the sediment, if required			
2	Disturbance to nearby ecosystem due to different construction activities	• No cutting/ felling of trees along the river bank • Implementation of on-site waste and air quality management plan • Limiting soil extraction activities limited within the defined area • Limiting the vegetation clearance and base stripping process within the Project boundary • Safety fence around the construction site • Limiting the use of night light • Using shade (directed downwards) around the outdoor lights • Provision of cut-off time to switch off unnecessary lights at night • Initiate Green plantation • No plantation of non-native species • Retaining top soil for future habitat restoration • No degradation of critical habitat?			
3	Occupation of river, inter-tidal areas and wetlands	• No encroachment of inter-tidal flood plain area • No disturbance to Dolphin community • Monitoring of Ecosystem Health and Monitoring of Sundarbans Forest Health • If required, embankment should be constructed considering a setback distance from river/canal bank • 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 35th monitoring program (January, 2023)

Monitoring Team

Measuring tree height

Collecting survey data

Marking the tree

Counting Pneumatophores

Collecting Forest soil sample

Collecting water samples

Collecting Plankton sample

Insitu data collection of Water quality

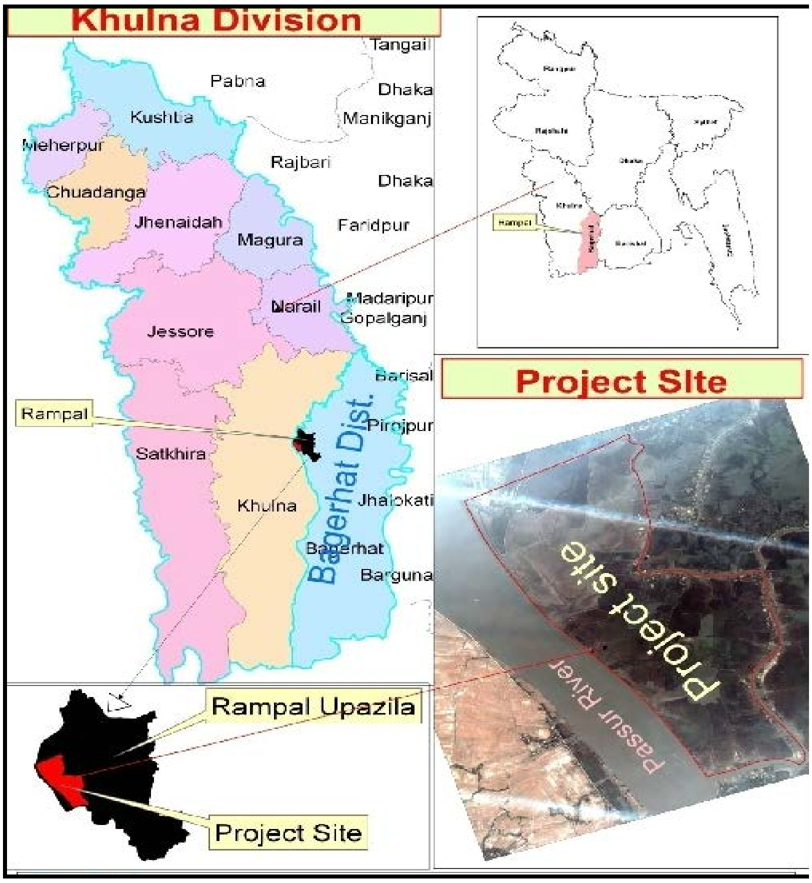
Appendix III: Terms of References (ToR)

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

Monitoring Parameter	Indicators
	Soil quality (Salinity, pH, OM,)
	Cropping pattern and crop intensities
	Irrigation and crop production
	Farmers survey result
Fisheries	Fish diversity and specification
	Fish production and availability
	Fisher survey result
Noise level	Sound level at the sensitive zone
Water resources	DO, BOD, COD, Salinity, TDS, TS, pH, Hg, Pb
	Total Hardness, Hg, NO_3 and PO_4
	River Morphology,
	Tidal inundation
	Drainage Network
	Erosion and Accretion
	Ground water quality
Air quality	SOx
	NOx
	SPM (PM_{10} and $PM_{2.5}$)
	CO

Air quality monitoring progress

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

- SOx: measured by Fluorescent signal generated by exiting SO_2 with UV light
- NOx: measured by Chemilumiscent reaction between NOx & O_3
- O_3: measured by ultra violet absorption analyzer, this determines the Ozone concentration by the attenuation of 254 nm UV light along this signal fixed path cell
- Particulate matter (SPM, PM_{10}, $PM_{2.5}$): measured by gravimetric methods including true micro weighing technology for automatic monitoring & instrument named 'Tapered element oscillating micro balance (TOEM)' has been most frequently used. Measurement on filter tape using the principles of beta attenuation for estimating 30 mnt or 1 hr average concentrations of PM_{10} or $PM_{2.5}$ has also been used.
- CO: In urban air pollution studies, a non-disruptive infrared photo meter utilizing a gas filter co relation technology & state of the art optical & electronic technology is used to measure low concentration of CO accurately & reliably.

Expected Output

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

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

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

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

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

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

Reporting Requirements

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

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

Appendix IV: Monitoring Data

(A) Air Quality Data

Table A1: Ambient Air Quality Monitoring Results

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	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	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	Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	Sunny	Sunny	
						Concentrations are in µg/m³																														
SW Corner of the PP area	$PM_{2.5}$	33	37	25	33	47	25	22	34	19	5	9	24.8	8.12	28.2	32.9	28.4	15.2	31.1	27.3	21.7	37.76	51.32	27.12	18.71	44.18	55.35	49.13	38.25	56.83	46.83	41.78	34.84	39.63	56.81	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	68.1	80.28	107.16	106.13	103.88	59.17	83.46	91.25	74.32	56.18	57.26	81.45	150^{24hr}
	SPM	207	239	190	200	177	42	91	175	332	51	53	115.7	122.4	169.4	145.6	121.5	12.9	137.4	151.6	128.6	109.25	183.56	108.4	98.26	149.73	163.48	155.14	99.44	144.48	159.45	139.42	106.28	109.27	144.17	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	18.35	19.91	26.63	14.74	16.26	14.49	16.28	21.54	15.22	11.04	10.18	19.56	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	12.12	8.82	16.62	37.16	22.31	19.87	21.64	39.5	22.49	23.18	17.64	18.61	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	28	0	2	0	0	1	0	1	1	0.3	0.6	0.8	$(5000)^{8hr}$
	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	8	8	8	9	16	42	11	12	18	12	19	20	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	19.14	20.35	29.17	52.74	48.64	41.2	44.65	39.86	36.71	41.2	49.63	43.95	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	83.22	71.06	84.3	112.04	83.1	64.28	71.35	58.29	68.79	64.29	58.48	58.71	150^{24hr}
	SPM	2156.3	263	217	274	266	47	79	192	187	27	23	154.2	136.7	45.3	181.4	138.7	113.4	143.9	168	150.8	123.56	120.45	106.3	95.24	119.22	170.33	139.26	116.48	118.49	128.34	158.14	118.62	123.62	111.63	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	27.41	17.44	14.15	18.32	14.06	11.77	14.55	14.48	13.96	12.58	16.71	17.48	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	18.77	10.17	14.18	29.9	21.65	21.394	20.85	20.44	20.47	18.4	25.45	15.72	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	44	4	0.013	0	0	1	1.1	1	1	1	0.4	0.8	$(5000)^{8hr}$
	O_3	33	26	26	23	21	16	1	1	1	0	0	1	08	25	04	4	8	6	4	1	34	22	9	6	2	6	9	28	41	49	8	16	14	21	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	21.61	21.93	46.73	68.26	58.81	22.66	41.98	42.81	54.16	39.36	46.32	55.86	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	77.69	76.76	110.43	131.84	97.61	48.19	61.48	73.42	63.26	58.03	64.18	81.08	150^{24hr}
	SPM	234	217	157	310	244	321	66	187	115	31	35	168	91.7	63.9	161.7	116.2	76.3	156.2	125.5	119.2	60.45	175.13	100.04	101.33	160.3	180.43	161.8	77.149	104.73	123.76	132.77	108.2	139.24	146.79	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	19.68	16.21	25.82	16.19	16.58	13.58	12.19	11.79	10.47	13.29	14.66	19.51	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	17.53	10.55	18.91	34.1	27.42	20.49	18.39	20.25	23.96	20.63	21.43	29.29	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	30	2	0.012	0	0.2	1	1.4	1	0.6	0.4	0.2	0.7	$(5000)^{8hr}$
	O_3	25	19	17	36	44	11	8	2	0	1	1	3	05	10	05	7	6	8	1	5	18	2	9	8	8	12	14	17	34	12	8	11	13	25	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	26.66	18.04	38.69	61.29	62.29	21.8	58.34	29.22	31.43	27.55	41.59	37.86	65^{24hr}
	PM_{10}	103	122	67	97	82	65	26	97	82	45	13	105.4	30.5	30.2	140	30.5	20.5	50.1	102	69.9	33.25	69.32	61.11	59.02	91.79	93.36	103.42	50.26	73.17	43.88	46.29	51.98	64.71	57.94	150^{24hr}
	SPM	233	244	183	277	236	79	112	176	268	69	30	167.8	95.6	57.2	171.9	90.6	5.2	113.5	127.5	92.2	75.13	102.17	98.74	82.02	128.48	159.8	154.35	83.2	134.6	92.38	98.15	93.44	111.39	102.3	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	18.88	24.29	20.17	16.47	13.52	14.44	21.39	14.36	18.42	10.57	13.88	12.69	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	11.58	10.62	14.47	21.18	19.371	19.48	38.46	21.92	40.28	16.4	20.31	15.78	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	32	0	0	0	0	0	0	0.1	1	0.8	0.1	0.7	$(5000)^{8hr}$
	O_3	26	29	22	19	15	9	6	4	0	0	3	5	08	6	04	6	6	2	3	4	7	52	12	8	0	6	2	19	28	6	10	14	33	16	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	39.44	18.22	43.91	59.18	53.36	33.27	29.61	45.3	48.94	38.48	30.22	57.36	65^{24hr}

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	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	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	Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	Sunny	Sunny	
		Concentrations are in $\mu g/m^3$																																		
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	100.08	59.91	88.93	117.42	86.44	61.9	44.28	66.54	86.48	53.19	39.66	96.94	150^{24hr}
	SPM	117	113	162	183	188	175	94	167	167	31	48	162	110.6	127.8	200	108	78.6	128.5	146.6	117.6	80.31	100.95	146.72	146.72	139.04	188.27	128.36	104.29	77.88	134.71	165.58	103.72	77.36	161.53	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	36.14	18.74	29.94	16.45	19.66	15.98	10.59	12.84	14.82	11.08	10.52	26.24	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	20.04	10.19	18.32	26.14	24.21	18.66	17.21	16.73	26.42	21.94	18.03	31.89	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	18	10	0	0.1	0.1	0.8	1	1	1	0.2	0.1	0.9	$(5000)^{8hr}$
	O_3	27	24	18	22	41	21	2	1	1	0	2	2	03	5	05	2	4	5	9	8	2	38	22	8	0	23	28	11	9	8	13	29	14	56	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	33.26	16.63	33.32	66.31	42.62	32.45	42.59	47.51	42.57	42.85	48.3	50.11	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	127.52	55.78	74.83	102.73	73.29	74.89	64.71	81.84	71.22	69.02	74.05	74.37	150^{24hr}
	SPM	297	266	254	208	299	339	183	198	114	78	34	194.6	179	87.5	223.9	154.1	98.4	139	178.2	141.1	93.5	100.95	160.02	70.23	111.95	156.56	116.73	118.4	107.31	148.93	128.98	127.39	138.51	133.66	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	30.89	16.73	21.39	16.16	13.1	14.61	12.8	21.4	19.71	12.71	15.42	16.42	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	19.02	10.52	12.12	28.54	17.18	20.27	19.33	38.27	29.44	23.16	22.14	23.94	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	11	0	0	1	0	1	1.1	2.8	2	0.4	0.6	0.5	$(5000)^{8hr}$
	O_3	49	38	36	27	11	13	5	2	2	0	0	3	06	0	06	6	8	8	8	3	22	26	2	2	4	20	2	10	19	48	39	37	24	37	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	38.92	41.33	40.75	74.19	65.37	22.54	51.83	26.39	28.19	43.8	58.46	53.71	65^{24hr}
	PM_{10}	139	174	77	82	35	52	33	132	45	29	15	119.3	93.6	97	209.1	89.9	47.5	103.7	109.3	131	119	64.12	119.61	126.13	114.61	118.67	129.71	64.44	72.4	61.63	51.66	62.53	93.43	69.26	150^{24hr}
	SPM	288	303	197	217	214	118	65	189	144	50	6	172.3	196	187.2	242	144.7	73.7	161.9	157.1	183.1	192.17	83.9	173.36	166.16	152.76	201.16	180.22	85.2	128.3	100.53	92	120.3	170.28	130.48	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	31.33	22.04	20.06	12.26	18.91	10.28	17.44	12.54	20.33	14.55	21.41	12.51	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	13.34	11.29	9.69	19.25	30.2	19.73	29.16	18.43	31.63	22.3	34	18.59	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	29	24	0	2	0.9	2	2.4	2	0.2	0.1	1.9	0.2	$(5000)^{8hr}$
	O_3	57	52	37	26	09	15	8	3	1	2	1	4	04	9	02	3	1	9	7	3	5	40	4	2	1	66	91	23	43	20	13	29	59	14	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	17.81	20.11	34.42	53.28	46.13	34.94	31.2	41.58	43.27	49.15	53.98	35.19	65^{24hr}
	PM_{10}	41	39	59	56	49	42	50	82	42	20	14	85.2	36.7	89.9	152.4	29.1	24.3	80.5	92.6	63.9	21.85	64.12	63.27	62.24	79.38	100.11	82.83	61.53	49.07	58.92	51.04	74.7	76.18	42.07	150^{24hr}
	SPM	111	117	129	139	109	70	73	159	91	43	44	93.5	103.7	107	189.9	72.4	47.6	90.3	118.3	90.9	48.09	83.9	87.51	87.71	122.94	146.2	133.1	108.74	83.16	118.83	110.28	141.48	142.09	85.63	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	16.47	13.31	19.74	14.66	16.58	14.75	12.68	22	13.76	14.9	12.37	13.27	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	9.9	8.13	10.16	21.44	0	23.28	22.27	27.2	39.23	20.82	20.41	20.18	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	30	8	0	0	3	1	1	1	1	0.4	0.3	0.3	$(5000)^{8hr}$
	O_3	13	12	13	11	14	12	4	2	2	0	1	4	08	0	02	2	6	4	3	5	8	40	12	22	3	6	46.13	9	11	41	24	31	41	11	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	23.04	13.16	22.74	48.2	41.33	39.16	23.6	29.65	58.43	30.22	35.35	54.94	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	82.91	58.82	56.74	90.12	84.16	76.18	51.88	53.69	77.69	60.21	50.14	97.62	150^{24hr}
	SPM	114	133	97	88	102	NO	51	128	46	23	27	90.9	137.0	41.8	175.1	90.3	58	121.4	117.8	71.1	83.9	122.62	121.68	78.8	80.31	144.95	131.46	123.59	79.47	98.47	141.37	103.5	99.42	159.36	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	24.21	15.06	12.74	15.05	17.44	16.55	15.89	15.53	21.81	12.59	11.06	25.7	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	16.74	10.47	6.64	20.6	23.5	21.28	21.39	19.38	38.3	19.69	18.2	27.24	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	20	14	0	0.2	0	2	1	1.4	0.3	0.9	1	0.8	$(5000)^{8hr}$
	O_3	11	14	9	10	27	NO	8	1	0	0	2	3	0	0	03	3	4	5	3	1	9	90	2	4	6	8	8	11	8	16	41	24	19	63	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	17.39	NO	28.15	55.71	NO	25.3	38.51	36.88	39.62	NO	57.2	47.31	65^{24hr}

Locations of Monitoring	Pollutants	1st QM, Apr 2014	2nd QM, Jul 2014	3rd QM, Oct 2014	4th QM, Jan 2015	5th QM, Apr 2015	6th QM, Jul2015	7th QM, Oct 2015	8th QM, Jan 2016	9th QM, Apr 2016	10th QM, Jul 2016	11th QM, Oct 2016	12th QM, Jan 2017	13th QM, April, 2017	14th QM, Oct, 2017	15th QM Jan, 2018	16th QM April, 2018	17th QM, Jul 2018	18th QM, Nov, 2018	19th QM, Feb, 2019	20th QM, Apr, 2019	21st QM, Jul, 2019	22nd QM, Jul, 2019	23rd QM, Feb, 2020	25th QM, July, 2020	26th QM, Oct, 2020	27th QM, Jan, 2021	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	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	Sunny	Rainy/Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Rainy/Cloudy	Rainy/Cloudy	Sunny	Sunny	
		Concentrations are in µg/m³																																		
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	72.45	NO	59.31	99.64	NO	59.7	49.27	58.45	48.81	NO	89.22	70.5	150^{24hr}
	SPM	101	119	107	97	110	NO	88	NO	132	NO	26	111.4	NO	102	173.7	NO	NO	107.9	127.8	NO	NO	90.31	94.28	NO	91.06	155.39	NO	94.7	89.36	106.93	96.23	NO	164.2	124.46	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	13.33	NO	11.36	16.2	NO	13.92	14.33	12.76	15.38	NO	16.82	14.26	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	8.65	NO	9.74	23.53	NO	20.06	16.27	19.66	39.72	NO	27.87	21.67	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	36	NO	0	0	NO	0	0	0.3	0.7	NO	0.5	0.1	(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	7	NO	1	11	NO	14	22	22	38	NO	28	35	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	40.22	46.73	48.32	88.71	71.2	29.47	65.66	61.57	67.33	69.28	63.57	51.17	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	116.16	119.11	109.63	159.22	120.38	64.44	124.55	100.3	92.36	100.28	92.2	64.49	150^{24hr}
	SPM	301	287	239	219	222	181	101	181	112	107	64	189.7	187.2	127.9	243.4	78.9	69.9	102.9	158	173.4	100.95	78.09	157.28	167.18	157.35	240.18	193.61	101.85	195.17	198.24	178.26	189.38	169.49	124.91	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	28.31	30.73	29.58	18.8	20.64	12.73	26.18	28.52	19.29	23.66	21.71	17.32	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	24.14	24.24	20.44	34.2	28.35	20.45	38.58	41.59	37.91	39.12	36.56	23.09	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	32	18	0.7	2	3	4	4.9	1.4	0.2	2.1	1.6	0.3	(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	10	4	0	80	63	21	59	53	36	66	64	12	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	44.26	22.08	41.29	166.72	67.82	59.2	79.64	56.26	69.23	51.29	61.47	59.24	65^{24hr}
	PM_{10}	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	70.3	60.8	111.7	88.7	61.6	96.71	98.15	122.73	86.26	97.16	234.41	108.16	94.6	102.33	104.73	94.28	69.28	84.89	91.3	150^{24hr}
	SPM	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	120.6	98.1	144.6	129.4	102.5	127.79	127.79	171.29	111.73	142.36	347.39	170.37	158	193.43	178.63	181.85	134.27	158.26	155.86	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	34.12	20.61	21.73	18.61	23.72	19.7	16.92	38.36	27.45	14.56	23.49	16.26	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	21.72	11.17	13.36	33.48	34.49	27.3	48.41	44.77	39.56	20.23	39.35	31.49	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	18	2	0	3	1	1	1	3.3	4	1.3	1	0.8	(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	4	2	0	212	108	92	68	93	59	38	49	38	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	26.26	20.16	38.72	94.23	64.73	52.2	55.31	57.29	31.28	28.43	42.84	40.29	65^{24hr}
	PM_{10}	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	118.1	83.7	128.3	112.9	137	142.84	79.92	91.39	78.69	93.48	188.64	119.73	96.1	69.4	69.89	59.15	53.42	71.49	74.81	150^{24hr}
	SPM	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	142.5	106.2	177.8	168.2	163.2	171.2	109.25	126.13	102.03	136.66	269.3	173.92	151	129.45	137.46	98.74	89.45	127.77	121.17	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	16.16	18.82	18.11	20.23	19.16	13.3	20.76	16.93	19.3	11.39	13.27	11.09	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	9.04	9.22	9.92	26.3	23.74	20.1	31.69	21.62	33.62	20.47	20.63	23.25	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	22	0	0	0.8	0.2	2	1	1	1	2	1.1	0.8	(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	6	8	2	68	46	16	29	72	31	23	14	17	100^{8hr}

Note(s): Concentrations are in µg/m³

- DoE- Department of Environment, NF- Not found; NO-Not observed; x-not measured at pre-construction stage.
- Fine Particulate Matter ($PM_{2.5}$), Respirable Dust Content (PM_{10}), Suspended Particulate Matter (SPM), Oxides of Nitrogen (NO_X). Sulfur dioxide (SO_2), Carbone Monoxide (CO) & Ozone (O_3);
- Standards for 1hr, 24hr or Annual are indicated using superscript;

  This monitoring was carried out by - Respirable Dust Sampler (Model-Envirotech India APM-460BL) and Fine Particulate Sampler (Model-Envirotech India APM-550). All data presented here are 8 hrs. Monitoring data.

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

Sampling Locations	Criteria Pollutant	Cement Industry	Condensate Fractionating Plant	LPG Bottling Plant	Brick Field	Road Traffic	Small vessels, engine boat	Inland Water Cargo vessel	Sea going Mother Vessel (MV)	Fly ash Carrier	Clinkers Carrier	Clinker, Fly Ash Handling	Coal Carrier (MV)	Coal Ash Carrier (MV)	Coal Carrier (Lighter Vessel)	Coal Ash Carrier (Lighter Vessel)	Coal Loading and Unloading	Coal Handling (Stock Yard, Conveyor belt, etc)	BIF Power Plant (PP)	Other Coal Based PP	Other Fuel Based PP	Dredging and Land Filling	Earth excavation	Other Construction Activities	Residential sources
SW Corner of the PP area	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	√	X	√	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Proposed Township area of the PP	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
NW Corner of the PP area	PM	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	√	X	X	√
	SOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Barni, Gaurambha	PM	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√	√
	SOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	NOx	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	GHGs	X	X	X	X	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
Chunkuri-2, Dacope	PM	√	X	X	X	√	√	√	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	√
	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
1QM	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
2QM	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
3QM	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
4QM	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
5QM	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
6QM	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
7QM	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
8QM	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
9QM	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
10QM	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
11QM	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
12QM	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
13QM	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
14QM	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
15QM	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
16QM	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
17QM	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
18QM	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
19QM	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
20QM	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

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
21QM	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
22QM	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
23QM	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
25QM	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
26QM	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
27QM	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
28QM	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
29QM	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
30QM	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
31QM	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
32QM	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
33QM	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
34QM	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
35QM	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
Standard (ECR'2023)	**6.5– 8.5 (Coastal area)**												**6.5– 8.5 (Reserved area)**		

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Table B.2: Surface Water Temperature (^0C) 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**
1QM	31	31	31	31	30	30	31	31	31	30	30	29	30	29	29
2QM	33	33	33	33	32	32	32	31	31	31	32	30	30	29	30
3QM	31	31	30	31	31	31	30	29	29	28	27	32	27	30	29
4QM	19	20	20	19	19	19	20	19	19	19	20	19	22	21	21
5QM	30	30	30	31	30	30	31	30	31	30	30	30	30	30	30
6QM	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
7QM	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
8QM	22	21	21	22	22	21	23	22	21	22	23	21	22	21	NS
9QM	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
10QM	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
11QM	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
12QM	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
13QM	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
14QM	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
15QM	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
16QM	30	30	31	28	29	28	28	28	28	28	31	30	30	32	NS
17QM	30	30	30	30	30	31	31	31	31	31	31	29	29	30	NS
18QM	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
19QM	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
20QM	31	31	31	31	31	31	33	31	32	33	32	31	31	31	NS
21QM	30	30	30	30	31	30	30	30	30	30	30	30	31	31	NS
22QM	27	27	27	28	28	28	27	27	27	27	27	28	30	29	31

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**
23QM	25	25	24	24	24	24	25	25	25	25	23	22	24	24	23
25QM	30	30	31	30	30	30	30	30	30	30	30	30	31	31	NS
26QM	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
27QM	20	20	20	20	20	20	21	20	21	22	21	21	21	22	22
28QM	31	30	30	30	30	30	30	30	30	31	31	29	30	30	NS
29QM	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
30QM	26	26	26	28	27	30	27	27	27	27	29	27	27	28	28
31QM	22	22	22	21	22	22	23	22	22	23	22	22	24	21	22
32QM	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
33QM	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
34QM	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
35QM	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
Standard (ECR*2023)	**N/A**														

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); 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
1QM	11.5	11.5	11.5	12	12	12	9.5	9	10	10	9	10	12	19	23
2QM	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
3QM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
4QM	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
5QM	13	15	16	9	13	14	14	13	12	10	9	14	15	20	25
6QM	0	0	0	0	0	0	0	0	0	0	0	0	0	NS	NS
7QM	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6.2
8QM	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
9QM	8	7.4	7	6	6.2	9	8	7	6.8	7.1	6.3	6	8.9	9.4	14
10QM	0	0	0	0	0	0	0	0	0	0	0	0	0	4	NS
11QM	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5.8
12QM	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
13QM	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
14QM	0	0	0	0	0	0	0	0	0	0	0	1.2	2.3	3.6	5.1
15QM	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
16QM	11.5	11.5	11.5	12	12	12	9.5	9	10	10	9	10	12	19	23
17QM	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
18QM	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
19QM	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
20QM	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
21QM	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
22QM	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
23QM	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
25QM	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
26QM	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

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
27QM	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
28QM	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
29QM	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
30QM	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
31QM	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
32QM	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
33QM	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
34QM	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
35QM	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
Standard (ECR*2023)	N/A														

Source: CEGIS Field Survey (In-situ up to January, 2023 and laboratory test –up to October, 2022); 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
1QM	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
2QM	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
3QM	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
4QM	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
5QM	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
6QM	5.3	5	5	6.7	6.6	6	7.5	7.4	7.3	6	6.4	7	7.5	NS	NS
7QM	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
8QM	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
9QM	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
10QM	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

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
11QM	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
12QM	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
13QM	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
14QM	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
15QM	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
16QM	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
17QM	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
18QM	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
19QM	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
20QM	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
21QM	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
22QM	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
23QM	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
25QM	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
26QM	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
27QM	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
28QM	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
29QM	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
30QM	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
31QM	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
32QM	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
33QM	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
34QM	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
35QM	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
Standard (ECR*2023)	**≥ 5 mg/L (Coastal area)**												**≥ 5 mg/L (Reserved area)**		

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); 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
1QM	288	284	328	376	400	364	364	400	408	276	284	408	372	536	540
2QM	24	20	56	28	60	496	108	40	120	32	96	172	216	520	416
3QM	6	30	14	18	14	18	10	22	10	10	26	14	14	54	122
4QM	128	68	92	84	116	108	104	16	100	116	84	96	96	316	472
5QM	87	58	132	102	110	88	96	18	106	88	94	92	102	302	470
6QM	42	43	18	26	21	24	32	25	25	51	36	30	26	NS	NS
7QM	32	36	28	36	36	40	42	28	48	40	42	46	36	84	96
8QM	124	100	96	100	108	80	100	100	124	100	108	88	100	96	NS
9QM	220	240	280	280	240	260	240	180	200	160	210	220	140	156	160
10QM	8	8	8	8	12	8	12	8	12	8	30	12	16	4	NS
11QM	12	8	8	12	16	12	8	8	12	8	8	16	12	68	56
12QM	56	40	44	48	52	42	56	52	44	36	48	40	40	56	196
13QM	52	48	56	40	36	48	42	36	52	44	40	64	216	240	NS
14QM	24	8	40	32	40	16	48	8	4	16	32	40	32	16	4
15QM	48	28	40	36	32	28	40	44	36	40	32	48	40	72	88
16QM	276	240	230	232	254	252	212	218	230	180	252	260	280	296	NS
17QM	20	24	12	30	16	12	10	24	16	40	20	10	16	110	NS
18QM	56	44	48	60	36	42	48	32	28	36	42	20	58	44	76
19QM	72	60	48	44	56	64	88	36	68	72	68	32	56	180	140
20QM	188	180	176	192	180	172	200	160	180	160	172	178	184	160	NS
21QM	36	24	32	20	28	24	28	20	32	24	20	24	32	220	NS
22QM	56	40	26	40	28	24	20	32	20	24	36	40	32	92	72
23QM	24	28	32	24	40	24	26	20	28	44	36	36	40	56	64
25QM	32	36	28	24	36	40	48	36	42	32	48	72	80	108	NS
26QM	16	12	8	28	16	20	8	12	20	12	28	56	76	60	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
27QM	56	32	20	48	20	56	48	56	8	12	24	32	12	28	NS
28QM	508	404	400	304	412	390	408	424	448	400	380	472	424	392	NS
29QM	4	4	4	4	4	12	8	8	12	16	48	32	16	80	32
30QM	44	52	40	20	40	4	4	24	4	48	4	12	4	192	180
31QM	24	12	8	40	32	12	16	36	12	12	32	16	60	36	40
32QM	24	28	48	36	24	20	24	48	52	56	96	96	240	36	NS
33QM	4	12	4	8	36	20	4	36	48	4	12	0.03	4	84	NS
34QM	4	8	4	12	4	4	8	8	4	8	12	8	16	8	8
Standard (ECR*2023)	**5 mg/L (Coastal area)**												**8 mg/L (Reserved area)**		

Source: CEGIS Field Survey (Insitu-upto January, 2023 and laboratory test –upto October, 2022); 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
1QM	<5	<5	<5	<5	<5
2QM	<5	<5	6.3	<5	<5
3QM	<5	<5	<5	<5	<5
4QM	>15	>15	>20	>20	>20
5QM	16.9	13	39.1	<5	<5
6QM	9	7.63	10.1	NS	NS
7QM	<5	9.87	<5	10.8	9.73
8QM	39	21	14	ND	36
9QM	61	30.3	26	31	82
10QM	5	13.5	5.73	NS	5.87
11QM	<5	<5	<5	10.1	<5
12QM	9.2	15.6	<5	13.8	14.2

Monitoring periods	Sampling Location ID				
	SL-7	SL-12	SL-13	SL-14	SL-15
13QM	*5.73*	<5	<5	7.71	ND
14QM	<5	<5	<5	<5	<5
15QM	16.6	<5	<5	<5	<5
16QM	<5	<5	<5	<5	<5
17QM	<1	<5	<1	NS	<1
18QM	<2.0	<2.0	<2.0	<2.0	<2.0
19QM	<2.0	<2.0	<2.0	<2.0	<2.0
20QM	<2.0	<2.0	<2.0	<2.0	<2.0
21QM	<2.0	<2.0	<2.0	<2.0	<2.0
22 QM	<2.0	<2.0	<2.0	<2.0	<2.0
23QM	2.3	<2.0	<2.0	4.4	2.3
25QM	<2.0	<2.0	<2.0	<2.0	<2.0
26QM	<2.0	<2.0	<2.0	<2.0	<2.0
27QM	2.93	<2.0	<2.0	<2.0	NS
28QM	<2.0	<2.0	<2.0	<2.0	3.2
29 QM	<2.0	<2.0	<2.0	<2.0	<2.0
30QM	<2.0	<2.0	<2.0	<2.0	<2.0
31QM	<2.0	<2.0	<2.0	<2.0	<2.0
32QM	<2.0	<2.0	<2.0	<2.0	<2.0
33rd	<2.0	<2.0	<2.0	<2.0	NS
34QM	<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 (Insitu-upto January, 2023 and laboratory test –upto October, 2022); 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
1QM	13060	12630	12900	13190	13330	13380	13180	13390	13240	12400	10970	12800	12280	21500	21500
2QM	251	246	383	445	353	402	655	587	916	455	2510	6410	9360	15960	14050
3QM	176	162	153	169	156	152	162	153	154	214	257	209	285	3400	5720
4QM	4360	3950	4330	4750	4920	4870	5040	5050	5130	5050	4390	5130	4780	12350	17900
5QM	14400	14700	14900	14600	14500	14200	14500	14600	14250	14000	13900	14050	13900	13600	25300
6QM	937	941	127	175	132	156	336	158	160	2320	355	298	683	NS	NS
7QM	158	169	152	172	162	160	192	164	164	183	176	227	205	4220	5830
8QM	5570	5910	5490	5720	5850	5480	5650	5740	5650	5450	4420	4540	4940	13330	NS
9QM	13400	13280	13560	12830	13100	13460	12820	12960	13590	13340	11700	11330	13580	20720	25500
10QM	179	112	125	162	185	143	205	195	140	165	5170	893	1321	7330	NS
11QM	138	106	108	147	110	112	113	108	146	196	238	162	301	2550	4120
12QM	3100	3140	3330	3630	3600	3520	3470	3790	3770	2920	3960	3370	3370	3580	12210
13QM	13400	13480	13400	13560	13490	13330	13640	13680	13360	13490	13110	12340	13600	19370	NS
14QM	496	122	123	172	125	125	160	126	127	1616	1200	204	245	3270	4450
15QM	1913	1919	1915	2500	2520	2500	2840	2710	2720	2500	2970	2570	2690	11390	14190
16QM	14500	14420	14650	14300	14450	14540	14400	14500	14610	14160	14450	14500	15350	20600	NS
17QM	315	224	232	328	235	208	205	286	296	265	340	580	2190	7680	NS
18QM	855	733	722	824	716	732	945	784	786	992	827	940	1715	8100	12500
19QM	9940	9950	9730	9860	9980	9800	10190	10280	10080	10040	8860	8350	10950	17200	21110
20QM	15800	15600	15500	15700	16000	16100	15640	16000	15800	15700	15100	15722	15400	14800	NS
21QM	290	150	152	205	142	150	208	145	154	940	365	172	560	12500	NS
22QM	480	175	170	190	175	174	325	180	172	1405	875	350	474	3950	5750
23QM	6800	6950	7300	6760	6760	6900	6740	6450	6700	7250	5800	6240	6430	16300	20400
25QM	134	114	116	221	125	132	195	128	114	229	2893	740	489	4188	NS
26QM	122	96	94	102	179	105	181	98	92	206	164	148	2260	1472	490

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
27QM	3770	4410	4390	4150	4170	4060	4100	4210	4450	4170	2320	3010	4060	11400	14600
28QM	12500	12700	12300	12800	13100	13200	13100	13300	13200	12500	11800	12100	12400	18500	NS
29QM	58	105	106	74	97	110	158	110	100	216	1270	180	240	1700	1610
30QM	160	150	147	158	150	153	155	153	156	160	780	203	275	3850	6300
31QM	1380	1300	1210	1230	1510	1380	1850	1680	1650	1540	1350	1580	3850	11600	15500
32QM	4870	4800	4350	5250	4920	4060	5150	5070	4750	5100	8900	7820	12200	16400	NS
33QM	190	125	122	140	115	135	150	127	125	134	2850	460	1020	6200	
34QM	155	150	136	158	135	133	235	136	132	210	140	210	315	2890	5300
Standard (ECR*2023)	N/A														

Source: CEGIS Field Survey (Insitu-upto January, 2023 and laboratory test –upto October, 2022); 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
1QM	2900	2500	2650	2550	2600	2625	2550	2800	2500	2500	2400	3150	2625	4500	4850
2QM	250	180	170	175	275	350	325	350	475	450	725	1400	2150	3625	3050
3QM	216	218	335	390	340	355	330	345	325	350	330	377	345	980	1440
4QM	930	870	870	940	990	970	1045	1125	975	980	970	1000	970	2380	2690
5QM	3000	3050	3250	3450	3250	3200	3600	3670	3540	3260	3190	3210	3080	3420	3640
6QM	245	110	105	118	103	105	153	105	165	470	130	135	200	NS	NS
7QM	250	330	360	365	355	350	345	390	445	183	340	410	430	1090	1460
8QM	1270	1380	1240	1220	1300	1260	1370	1340	1270	950	1075	1090	1100	2850	NS
9QM	3130	3090	3140	3010	3070	3100	3060	3130	3110	3180	3080	3060	3050	4520	5050
10QM	240	205	205	220	232	218	235	242	224	220	875	405	415	1750	NS
11QM	255	250	190	265	237	242	205	217	238	250	240	245	282	670	810
12QM	1090	980	1030	1020	915	1070	935	1100	1110	1040	1170	1070	1070	1130	2870

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
13QM	3640	3420	3300	3400	3440	3380	3540	3480	3600	1960	2300	2450	3560	4300	NS
14QM	200	150	155	160	145	140	150	155	175	165	320	220	200	640	905
15QM	430	510	498	570	590	480	505	530	512	505	478	1070	610	1475	1740
16QM	3100	1040	1030	1060	1040	1085	1080	1110	1100	1300	1120	1410	1330	1440	NS
17QM	210	205	185	200	210	215	205	212	205	210	220	245	530	2030	NS
18QM	335	310	313	285	255	275	295	265	325	295	315	325	2550	2750	4200
19QM	2050	3900	4100	4600	4200	4400	4400	4300	4600	4000	4100	4000	4500	5900	6900
20QM	3000	5000	5000	5200	5000	4800	4400	5100	4900	5200	5000	4782	4500	4500	NS
21QM	2100	1950	1900	1850	2500	2550	1700	1850	2000	2000	2200	1800	1400	4300	NS
22QM	215	125	190	175	178	155	175	150	115	350	285	200	185	830	1225
23QM	1540	1485	1530	1580	1560	1490	1530	1560	1485	1460	1440	1510	1390	3470	3850
25QM	205	200	187	217	215	202	195	210	207	310	742	250	280	1000	NS
26QM	272	195	225	210	235	200	240	235	243	198	217	265	225	210	230
27QM	2800	2700	2750	3000	3100	2500	2550	3200	2800	1400	1200	2850	2870	5050	5600
28QM	4500	4200	4300	4100	4500	4000	4400	4100	4400	4200	4100	4200	4400	4300	NS
29QM	140	200	180	200	175	175	140	130	100	145	400	150	160	480	470
30QM	145	125	130	175	140	145	160	170	155	165	265	190	170	1000	1450
31QM	370	385	310	375	325	340	375	420	430	380	435	500	680	6500	5300
32QM	2500	2400	2250	2500	2350	2100	2550	2400	2460	2450	3100	2300	4000	5000	NS
33QM	140	110	115	120	110	120	125	120	130	140	1000	215	930	2500	NS
34QM	190	140	150	130	125	115	152	140	130	155	140	115	110	2000	2500
Standard (ECR*2023)	**N/A**														

Source: CEGIS Field Survey (Insitu-upto January, 2023 and laboratory test –upto October, 2022); 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
1QM	598	45	53	54	60	55	24	27	67	7	9	50	65	115	91
2QM	126	92	112	99	100	105	116	112	37	65	24	310	90	99	72
3QM	234	193	174	227	232	186	185	536	459	798	389	203	869	28	267
4QM	180	210	230	450	250	200	300	530	450	280	206	280	400	103	200
5QM	160	167	170	160	165	155	150	147	155	148	160	165	160	150	180
6QM	26	25	127	30	27	40	32	40	44	36	28	24	42	NS	NS
7QM	76	80	65	92	85	97	104	90	82	96	92	60	74	110	144
8QM	14	12	14	17	18	22	20	7	18	11	10	15	22	16	NS
9QM	8	7	10	10	8	7	12	10	11	7	6	13	18	23	15
10QM	61	48	56	62	45	49	51	43	39	42	11	47	31	16	NS
11QM	20	18	16	20	24	19	20	18	16	24	30	27	18	41	33
12QM	46	52	48	42	54	46	61	58	63	55	66	61	**61**	34	49
13QM	51	42	48	52	43	38	32	44	40	37	49	38	33	28	NS
14QM	18	15	22	16	20	17	15	16	14	26	30	**25**	27	22	16
15QM	14	15	14	13	13	14	15	17	12	14	15	13	17	14	13
16QM	18	17	22	20	19	21	17	19	18	23	32	14	15	18	NS
17QM	17	16	15	18	16	15	16	14	20	13	12	17	13	14	NS
18QM	14	11	15	11	13	12	14	13	15	11	42	27	22	15	6
19QM	15	12	14	12	13	15	16	13	14	14	8	15	12	11	9
20QM	12	14	13	11	12	15	12	11	13	14	12	13	11	10	NS
21QM	14	11	13	12	13	14	13	12	13	15	12	13	12	7	NS
22QM	8	7	6	8	7	6	7	6	5	9	7	15	11	7	5
23QM	11	8	7	8	9	6	7	8	6	13	12	14	11	10	10
25QM	14	6	11	12	9	12	14	13	8	11	5	9	17	18	NS
26QM	7	11	8	7	6	9	15	8	6	8	7	8	5	8	6

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
27QM	11	6	7	7	6	8	7	6	6	7	8	6	8	11	6
28QM	15	23	20	13	12	16	14	15	13	17	12	3	14	11	NS
29QM	12	14	9	12	11	8	12	9	15	13	3	7	9	16	13
30QM	13	12	10	14	9	13	17	4	15	11	8	13	15	12	13
31QM	15	14	17	12	13	11	14	12	15	13	13	14	15	16	13
32QM	7	10	11	12	9	11	18	13	12	19	16	15	13	17	NS
33QM	27	23	24	31	27	26	29	26	24	30	15	64	21	32	NS
34QM	16	15	19	18	14	16	21	18	14	15	18	25	20	23	21
Standard (ECR'2023)	**50 mg/L (Coastal area)**												**25 mg/L (Reserved area)**		

*Source: CEGIS Field Survey (**In situ**-up to January, 2023 and **laboratory test** –up to October, 2022); 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
1QM	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
2QM	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
3QM	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
4QM	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
5QM	33	13	39	48	69	8	87	48	128	62	48	29	18	25	28
6QM	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
7QM	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
8QM	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
9QM	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
10QM	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
11QM	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
12QM	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

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**
13QM	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
14QM	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
15QM	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
16QM	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
17QM	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
18QM	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
19QM	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
20QM	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
21QM	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
22QM	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
23QM	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
25QM	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
26QM	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
27QM	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
28QM	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
29QM	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
30QM	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
31QM	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
32QM	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
33QM	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
34QM	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
Standard (ECR'2023)	**0.3 mg/L (Coastal area)**												**0.8 mg/L (Reserved area)**		

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); 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
1QM	1840	1320	1280	1360	1040	1320	1640	1520	1280	1120	1320	1360	1560	2600	2080
2QM	20	23	36	45	32	20	60	40	80	20	210	620	860	1400	1160
3QM	26	28	34	33	30	27	40	35	64	63	63	44	69	1390	2360
4QM	580	450	480	550	520	540	630	560	620	570	460	630	590	850	1500
5QM	1360	1260	1240	1240	1120	820	880	1180	900	1220	840	980	900	1540	1920
6QM	67	11	9	26	6	8	9	19	12	72	27	39	51	NS	NS
7QM	7	8	11	10	8	9	12	8	6	11	9	13	7	84	97
8QM	570	590	560	550	580	565	640	560	550	96	480	482	500	760	NS
9QM	1080	1040	1020	1060	980	1100	1060	1020	1080	1040	1020	1100	1080	1650	2100
10QM	18	10	13	15	17	14	15	18	12	11	480	42	60	620	NS
11QM	5	3	4	4	6	5	6	5	8	14	14	14	19	190	320
12QM	230	210	200	230	280	230	230	231	250	160	200	220	220	230	1090
13QM	422	460	1340	1380	1280	1400	880	1440	1340	1220	1340	1220	1300	1420	NS
14QM	29	3	5	2	1	2	2	1	3	120	76	**5**	13	30	2
15QM	630	370	410	310	310	490	700	340	340	270	350	280	220	760	510
16QM	1400	1320	1440	1260	1200	1400	1300	1380	1240	1200	1250	1260	1300	1460	NS
17QM	24	18	20	22	21	16	10	24	22	21	18	28	35	620	NS
18QM	51	49	46	52	38	42	56	52	39	65	46	30	20	250	780
19QM	760	756	764	748	760	762	768	760	770	758	760	765	756	764	769
20QM	1460	1380	1420	1410	1440	1400	1500	1450	1460	1500	1490	1446	1500	1500	NS
21QM	23	19	21	16	17	19	15	16	14	18	12	14	16	980	NS
22QM	37	6	6	5	4	8	25	9	6	71	55	33	38	370	540
23QM	490	510	560	530	640	490	520	470	510	490	565	580	470	410	445
25QM	4	3	5	8	10	13	16	8	16	16	21	12	34	60	NS
26QM	3	6	11	5	3	8	6	4	12	31	26	21	540	430	30

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
27QM	270	420	460	410	420	430	450	440	450	420	190	260	410	580	1240
28QM	1	5	2	1	3	2	3	1	2	3	15	13	5	5	NS
29QM	21	20	24	18	15	18	19	13	14	17	39	39	41	410	598
30QM	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
31QM	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
32QM	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
33QM	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
34QM	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
Standard (ECR'2023)	N/A														

Source: CEGIS Field Survey (In-situ up to January, 2023 and laboratory test –up to October, 2022); 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
1QM	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
2QM	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
3QM	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
4QM	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
5QM	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
6QM	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
7QM	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
8QM	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
9QM	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
10QM	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
11QM	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
12QM	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

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
13QM	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
14QM	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
15QM	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
16QM	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
17QM	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
18QM	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
19QM	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
20QM	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
21QM	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
22QM	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
23QM	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
25QM	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
26QM	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
27QM	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
28QM	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
29QM	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
30QM	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
31QM	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
32QM	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
33QM	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
34QM	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
Standard (ECR'2023)	**0.05 mg/L (Coastal area)**												**0.08 mg/L (Reserved area)**		

Source: CEGIS Field Survey (In-situ up to January, 2023 and laboratory test –up to October, 2022); 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**
1QM	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
2QM	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
3QM	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
4QM	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
5QM	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
6QM	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
7QM	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
8QM	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
9QM	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
10QM	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
11QM	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
12QM	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
13QM	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
14QM	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
15QM	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
16QM	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
17QM	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
18QM	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
19QM	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
20QM	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
21QM	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
22QM	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
23QM	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
25QM	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
26QM	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
27QM	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
28QM	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
29QM	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
30QM	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
31QM	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
32QM	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
33QM	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
34QM	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
Standard (ECR'2023)	**0.001 mg/L (Coastal area)**												**0.003 mg/L (Reserved area)**		

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); 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**
1QM	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
2QM	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
3QM	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
4QM	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
5QM	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
6QM	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
7QM	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
8QM	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
9QM	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
10QM	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
11QM	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
12QM	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
13QM	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
14QM	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
15QM	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
16QM	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
17QM	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
18QM	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
19QM	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
20QM	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
21QM	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
22QM	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
23QM	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
25QM	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
26QM	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
27QM	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
28QM	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
29QM	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
30QM	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
31QM	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
32QM	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
33QM	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
34QM	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
Standard (ECR'2023)	**0.05 mg/L (Coastal area)**												**0.05 mg/L (Reserved area)**		

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); 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**
1QM	<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
2QM	<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
3QM	<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
4QM	<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
5QM	<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
6QM	<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
7QM	<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
8QM	<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
9QM	<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
10QM	<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
11QM	<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
12QM	<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
13QM	<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
14QM	<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
15QM	<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
16QM	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
17QM	<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
18QM	<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
19QM	<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
20QM	<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
21QM	<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
22QM	<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
23QM	<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
25QM	<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
26QM	<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
27QM	<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
28QM	<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
29QM	<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
30QM	<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
31QM	<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
32QM	<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	<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
34QM	<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
Standards (ECR'2023)															

Source: CEGIS Field Survey (In situ-up to January, 2023 and laboratory test –up to October, 2022); Note: QM= Quarterly Monitoring, NS – Not Surveyed; SL-Sampling location

Parameters for ground water quality monitoring

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

pH					Temperature (^0C)				
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
1QM	7.6	7.6	7.6	6.3	**1QM**	27.3	29.6	29.2	27.5
2QM	7.7	7.8	7.7	6.5	**2QM**	28.5	29.9	28.9	28.7
3QM	7.9	8	8	NF	**3QM**	26	28	28	NF
4QM	8	8.2	8.1	NF	**4QM**	24.5	22.5	25.1	NF
5QM	TC	7.8	7.9	NF	**5QM**	TC	28.6	28.8	NF
6QM	8.1	8.3	8.3	NF	**6QM**	31	28	30	NF
7QM	7.49	7.93	7.7	NF	**7QM**	30	27.8	28.7	NF
8QM	7.6	8.1	7.9	NF	**8QM**	24	23	25	NF
9QM	7.8	8.3	8.2	NF	**9QM**	29.8	29.6	30.1	NF
10QM	7.8	8.1	7.9	NF	**10QM**	28.6	29.1	29.4	NF
11QM	8.4	7.9	7.9	NF	**11QM**	29.1	30.4	29.8	NF
12QM	8.1	7.5	7.6	NF	**12QM**	25.1	24.3	24	NF
13QM	7.4	7.8	7.4	NF	**13QM**	28.7	27.7	28.4	NF
14QM	8.2	8.1	7.8	NF	**14QM**	27.2	26.5	26.4	NF
15QM	6.9	7.4	7.2	NF	**15QM**	22.9	23.8	23.6	NF
16QM	NF	6.9	7.2	NF	**16QM**	NF	30.3	30.1	NF
17QM	NF	7.9	7.6	NF	**17QM**	NF	29.3	29.7	NF
18QM	NF	7.3	7.6	NF	**18QM**	NF	30	29	NF
19QM	7.1	6.9	6.5	NF	**19QM**	23.8	23.7	23.2	NF
20QM	8.3	8.4	8.9	NF	**20QM**	29	30	30	NF
21QM	8.2	7.9	8.1	NF	**21QM**	31.4	30	31.2	NF
22QM	7.2	7.6	7.4	NF	**22QM**	27	27	26	NF
23QM	7.8	7.3	7.5	NF	**23QM**	24	23	23	NF
25QM	**8.1**	**8**	**8**	NF	**25QM**	31	30	30	NF
26QM	7.4	8	8	NF	**26QM**	27	28	27	NF
27QM	**7.2**	**7.5**	**7.5**	NF	**27QM**	22	25	25	NF
28QM	8	8.3	8.2	NF	**28QM**	23	23	24	NF
29QM	5.6	6.2	7.4	NF	**29QM**	31.3	30.45	30.72	NF
30QM	8	8.6	9.1	NF	**30QM**	28.89	27.7	28.04	NF

pH					Temperature (^0C)				
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**
31QM	7.7	8.1	8.1	NF	**31QM**	23	24	25	NF
32QM	7.7	7.4	8.2	NF	**32QM**	29	31.48	29.37	NF
33QM	7.26	7.8	7.7	NF	**33QM**	32	30	29	NF
34QM	7.1	8.1	8	NF	**34QM**	26	26.69	26	NF
35QM	8.4	9.0	8.1	NF	**35QM**	31	27.3	26.9	NF
Standard (ECR'2023)	**6.5-8.5**				**Standard (ECR'2023)**	**(20^0C-30^0C) mg/L**			

Source: CEGIS Field Survey (In-situ up to January, 2023 and laboratory test –up to October, 2022); 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**
1QM	0	0	0	0	**1QM**	4.4	6	6.4	4.4
2QM	0	0	0	0	**2QM**	5.2	6.2	6.5	6
3QM	0	0	0	NF	**3QM**	6.5	7.7	6.1	NF
4QM	1	0	0	NF	**4QM**	6.7	6.3	6.5	NF
5QM	TC	0	0	NF	**5QM**	TC	6	6.6	NF
6QM	0	0	0	NF	**6QM**	6	5.9	6	NF
7QM	0	0	0	NF	**7QM**	5.4	6.1	5.6	NF
8QM	0	0	0	NF	**8QM**	4.9	5.2	4.8	NF
9QM	0	0	0	NF	**9QM**	6.1	5.8	5.6	NF
10QM	0	0	0	NF	**10QM**	5.8	6.1	5.7	NF
11QM	0	0	0	NF	**11QM**	6.3	5.8	6.1	NF
12QM	0	0	0	NF	**12QM**	4.5	4.8	4.6	NF
13QM	0	0	0	NF	**13QM**	5.1	5.3	5.7	NF
14QM	0	0	0	NF	**14QM**	6.2	5.8	6.2	NF
15QM	0	0.3	0.4	NF	**15QM**	5.2	4.47	4.26	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**
16QM	NF	0.3	0.2	NF	**16QM**	NF	6	5.4	NF
17QM	NF	0.1	0.1	NF	**17QM**	NF	6	5.9	NF
18QM	NF	0.1	0.1	NF	**18QM**	NF	5.9	6.1	NF
19QM	0.1	0.1	0.1	NF	**19QM**	6	6.1	6.2	NF
20QM	0.1	0.5	0.7	NF	**20QM**	6	6.5	6.2	NF
21QM	0.1	0.1	0.1	NF	**21QM**	6.1	6	6	NF
22QM	0	0	0	NF	**22QM**	6	6.2	6	NF
23QM	0.1	0.1	0.1	NF	**23QM**	6	6.1	6	NF
25QM	0.1	0.1	0.1	NF	**25QM**	6	6.1	6.1	NF
26QM	0.18	0.1	0.1	NF	**26QM**	6	6.2	6	NF
27QM	0.1	0.2	0.4	NF	**27QM**	6.4	6.7	4.9	NF
28QM	0.1	0.3	0.3	NF	**28QM**	6.4	6.3	6.3	NF
29QM	0.1	0.2	0.4	NF	**29QM**	6	6	5	NF
30QM	0	0	0	NF	**30QM**	6.5	7.7	6.1	NF
31QM	0.1	0.2	0.4	NF	**31QM**	6.2	4.7	3.5	NF
32QM	0.3	0.2	0.4	NF	**32QM**	4	2.99	3.8	NF
33QM	0.4	0.2	0.1	NF	**33QM**	2.6	5.9	6	NF
34QM	0.2	0.2	0.4	NF	**34QM**	3.2	5	3.8	NF
35QM	0.6	0.2	0.4	NF	**35QM**	5.99	5.8	3.8	NF
Standard (ECR'2023)	**N/A**				**Standard (ECR'2023)**	**N/A**			

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); 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
1QM	1113	4090	643	1055	**1QM**	-	-	-	-
2QM	999	371	635	970	**2QM**	6	6	8	48
3QM	-	-	-	-	**3QM**	19	2	6	NF
4QM	1021	378	600	NF	**4QM**	40	28	32	NF
5QM	NO	390	600	NF	**5QM**	NF**	4	6	NF
6QM	881	574	328	NF	**6QM**	23	16	14	NF
7QM	377	1007	611	NF	**7QM**	4	5	4	NF
8QM	447	491	284	NF	**8QM**	31	46	41	NF
9QM	1025	384	645	NF	**9QM**	3	4	3	NF
10QM	1000	408	607	NF	**10QM**	5	4	4	NF
11QM	617	382	636	NF	**11QM**	7	4	5	NF
12QM	623	401	998	NF	**12QM**	32	28	25	NF
13QM	395	617	558	NF	**13QM**	4	10	9	NF
14QM	602	996	390	NF	**14QM**	8	10	9	NF
15QM	405	602	994	NF	**15QM**	12	6	7	NF
16QM	NF	615	370	NF	**16QM**	NF	12	5	NF
17QM	NF	390	608	NF	**17QM**	NF	2	3	NF
18QM	NF	365	610	NF	**18QM**	NF	6	8	NF
19QM	1315	376	927	NF	**19QM**	3	3	4	NF
20QM	915	380	610	NF	**20QM**	3	2	4	NF
21QM	25	602	360	NF	**21QM**	2	1	4	NF
22QM	900	385	603	NF	**22QM**	4	3	4	Nf
23QM	3080	660	370	NF	**23QM**	2	3	2	NF
25QM	1196	701	316	NF	**25QM**	1	3	1	NF
26QM	139	335	202	NF	**26QM**	3	5	2	NF
27QM	200	350	610	NF	**27QM**	1	2	5	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**
28QM	810	450	570	NF	**28QM**	1	1	1	NF
29QM	890	360	610	NF	**29QM**	1	1	2	NF
30QM	350	615	860	NF	**30QM**	1	4	3	NF
31QM	0.86	350	620	NF	**31QM**	1	1	1	NF
32QM	1150	360	620	NF	**32QM**	2	1	2	NS
33QM	350	620	900	NF	**33QM**	1	2	1	NF
34QM	885	620	510	NF	**34QM**	1	1	3	NF
Standard (ECR'2023)	**1000 mg/L**				**Standard (ECR'2023)**	**10 mg/L**			

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); 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**
1QM	425	220	190	780	**1QM**	32	28	48	32
2QM	250	175	140	450	**2QM**	32	28	32	36
3QM	300	180	180	NF	**3QM**	34	18	34	NF
4QM	235	110	125	NF	**4QM**	20	16	20	NF
5QM	NO	138	216	NF	**5QM**	NO	14	18	NF
6QM	225	125	115	NF	**6QM**	12	10	14	NF
7QM	325	450	480	NF	**7QM**	4	8	4	NF
8QM	295	195	225	NF	**8QM**	4	4	4	NF
9QM	305	263	163	NF	**9QM**	4	4	4	NF
10QM	320	248	28	NF	**10QM**	4	4	2	NF
11QM	175	295	183	NF	**11QM**	4	4	4	NF
12QM	550	510	620	NF	**12QM**	4	4	4	NF
13QM	720	420	654	NF	**13QM**	4	4	4	NF
14QM	145	240	215	NF	**14QM**	8	8	16	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
15QM	NF	265	305	NF	**15QM**	NF	4	4	NF
16QM	NF	195	215	NF	**16QM**	NF	4	4	NF
17QM	NF	235	170	NF	**17QM**	NF	4	4	NF
18QM	NF	178	138	NF	**18QM**	NF	4	4	NF
19QM	355	215	270	NF	**19QM**	4	3	4	NF
20QM	235	182	167	NF	**20QM**	352	4	4	NF
21QM	97	167	212	NF	**21QM**	4	4	4	NF
22QM	145	245	137	NF	**22QM**	4	4	4	NF
23QM	137	118	145	NF	**23QM**	4	4	4	NF
25QM	625	210	237	NF	**25QM**	4	4	4	NF
26QM	232	185	207	NF	**26QM**	4	4	4	NF
27QM	160	145	130	NF	**27QM**	4	4	4	NF
28QM	1400	1600	1200	NF	**28QM**	16	32	8	NF
29QM	160	195	140	NF	**29QM**	32	28	36	NF
30QM	70	243	155	NF	**30QM**	4	20	28	NF
31QM	180	200	210	NF	**31QM**	12	8	28	NF
32QM	320	165	275	NF	**32QM**	32	28	32	NF
33QM	225	415	515	NF	**33QM**	4	4	4	NF
34QM	265	130	110	NF	**34QM**	4	4	4	NF
Standard (ECR'2023)	**N/A**				**Standard (ECR'2023)**	**N/A**			

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); 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
1QM	0.2	0.6	0.8	0.4	**1QM**	-	-	-	NF
2QM	0.48	0.68	0.4	0.56	**2QM**	3	2	10	3
3QM	<0.10	0.31	0.8	NF	**3QM**	-	-	-	NF
4QM	28	26	13	NF	**4QM**	-	-	-	-
5QM	-	-	-	NF	**5QM**	-	-	-	-
6QM	7.6	2.2	4.7	NF	**6QM**	-	-	-	-
7QM	4.3	4.2	3.8	NF	**7QM**	1	2	2	-
8QM	2.1	1.9	2.8	NF	**8QM**	5	6	2	NF
9QM	1.7	2.3	1.9	NF	**9QM**	1	2	8	NF
10QM	3.8	3.3	3.7	NF	**10QM**	1	1	1	NF
11QM	6.1	7.51	10.16	NF	**11QM**	1	1	1	NF
12QM	4.65	7.02	4.65	NF	**12QM**	1	1		NF
13QM	9.32	14.7	10.2	NF	**13QM**	5	1	3	NF
14QM	3.3	2.5	4.6	NF	**14QM**	1	1	2	NF
15QM	5.9	7.2	1.7	NF	**15QM**	8	2	6	NF
16QM	NF	5.3	5.7	NF	**16QM**	NF	2	4	NF
17QM	NF	8.6	7.8	NF	**17QM**	NF	4	6	NF
18QM	NF	0.9	1.4	NF	**18QM**	NF	1	1	NF
19QM	1.7	4.4	2.1	NF	**19QM**	1	2	1	NF
20QM	4.4	2.7	8.3	NF	**20QM**	4	1	4	NF
21QM	1.4	2.7	1.7	NF	**21QM**	1	2	1	NF
22QM	1.8	3.1	1.6	NF	**22QM**	2	2	1	NF
23QM	1.9	1.4	2.7	NF	**23QM**	2	3	2	NF
25QM	1.7	7.5	1.7	NF	**25QM**	4	3	4	NF
26QM	0.5	3.8	3.1	NF	**26QM**	9	3	3	NF
27QM	2.4	2.2	4.9	NF	**27QM**	1	1	7	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
28QM	1	1	2	NF	**28QM**	1	1	1	NF
29QM	1.5	2.1	2.1	NF	**29QM**	1	4	3	NF
30QM	3.7	4.1	2.6	NF	**30QM**	2.2	6.3	2.6	NF
31QM	12.09	4.02	8.83	NF	**31QM**	14.94	4.22	9.51	NF
32QM	4.331	12.304	1.9372	NF	**32QM**	2.1054	6.83	1.76	NF
33QM	4.88	0.801	4.33	NF	**33QM**	1.41	1.36	3.31	NF
34QM	15.51	1.22	4.82	NF	**34QM**	0.2	1.9	1.0	NF
Standard (ECR'2023)	**45 mg/L**				**Standard (ECR'2023)**	**250 mg/L**			

Source: CEGIS Field Survey (In situ up to January, 2023 and laboratory test –up to October, 2022); 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
1QM	NF	-	-	NF	**1QM**	0.013	0.006	0.036	0.376
2QM	2.2	2.5	6.2	1.2	**2QM**	0.02	0.009	0.033	0.407
3QM	-	-	-	NF	**3QM**	0.012	0.006	0.02	NF
4QM	0.74	0.44	0.48	NF	**4QM**	0.014	0.008	0.017	NF
5QM	NO	1.98	4.54	NF	**5QM**	NO	0.01	0.034	NF
6QM	1.4	1.6	4.1	NF	**6QM**	0.015	0.014	0.024	NF
7QM	0.31	0.27	0.48	NF	**7QM**	0.002	0.012	0.011	NF
8QM	0.267	0.179	0.179	NF	**8QM**	0.008	0.002	0.002	NF
9QM	1.08	1.53	3.26	NF	**9QM**	0.018	0.007	0.047	NF
10QM	0.17	0.29	0.31	NF	**10QM**	0.012	0.018	0.005	NF
11QM	0.167	0.67	0.6	NF	**11QM**	0.033	0.011	0.016	NF
12QM	1.18	1.21	1.18	NF	**12QM**	0.028	0.005	0.028	NF
13QM	2.18	1.8	2.1	NF	**13QM**	0.012	0.022	0.01	NF
14QM	1.68	3.5	4.7	NF	**14QM**	0.014	0.004	0.027	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
15QM	0.13	0.17	0.18	NF	**15QM**	0.002	0.012	0.002	NF
16QM	NF	4..5	0.27	NF	**16QM**	0.001	0.022	0.001	NF
17QM	NF	2.9	4.8	NF	**17QM**	NF	0.012	0.004	NF
18QM	NF	0.15	0.26	NF	**18QM**	NF	0.007	0.05	NF
19QM	2.1	1.3	3.6	NF	**19QM**	0.014	0.003	0.004	NF
20QM	2.3	2.5	3.2	NF	**20QM**	0.012	0.012	0.012	NF
21QM	0.3	4	2	NF	**21QM**	0.014	0.006	0.022	NF
22QM	1	0.5	1.5	NF	**22QM**	0.001	0.027	0.001	NF
23QM	1.1	0.4	0.9	NF	**23QM**	0.018	0.006	0.033	NF
25QM	0.3	1.5	1.7	NF	**25QM**	0.02	0.068	0.003	NF
26QM	0.7	6.3	2.3	NF	**26QM**	0.022	0.045	0.004	NF
27QM	2	1.8	2.3	NF	**27QM**	0.003	0.053	0.006	NF
28QM	1.4	0.98	4	NF	**28QM**	0.002	0.004	0.049	NF
29QM	1.7	1.2	5	NF	**29QM**	0.002	0.003	0.008	NF
30QM	0.9	1.4	0.6	NF	**30QM**	0.012	0.003	0.061	NF
31QM	1	0.6	1.4	NF	**31QM**	0.003	0.063	0.014	NF
32QM	0.8	1.4	0.3	NF	**32QM**	0.016	0.003	0.048	NF
33QM	1.2	0.5	1.36	NF	**33QM**	0.008	0.003	0.064	NF
34QM	0.7548	0.5	1.5	NF	**34QM**	0.02	0.00	0.05	NF
Standard (ECR'2023)					**Standard (ECR'2023)**	**0.05 mg/L**			

Source: CEGIS Field Survey (In-situ up to January, 2023 and laboratory test –up to October, 2022); 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
1QM	0.002	<0.002	<0.002	0.002	1QM	<0.00015	<0.00015	<0.00015	<0.00015
2QM	<0.002	<0.002	0.004	0.008	2QM	<0.00015	<0.00015	<0.00015	<0.00015
3QM	0.004	<0.002	<0.002	NF	3QM	<0.0005	<0.0005	<0.0005	NF
4QM	0.023	0.016	0.013	NF	4QM	<0.0005	<0.0005	<0.0005	NF
5QM	NO	0.013	0.017	D	5QM	<0.0005	<0.00015	<0.00015	NF
6QM	0.002	0.0027	0.002	D	6QM	0.00015	0.00015	0.00015	NF
7QM	0.006	0.021	0.005	NF	7QM	<0.00015	<0.00015	<0.00015	NF
8QM	0.026	0.011	0.012	NF	8QM	<0.00015	<0.00015	<0.00015	NF
9QM	0.019	0.007	0.008	NF	9QM	<0.00015	<0.00015	<0.00015	NF
10QM	0.002	0.002	0.002	NF	10QM	<0.00015	<0.00015	<0.00015	NF
11QM	0.001	0.001	0.001	NF	11QM	<0.00015	<0.00015	<0.00015	NF
12QM	0.01	0.009	0.016	NF	12QM	<0.00015	<0.00015	<0.00015	NF
13QM	0.001	0.001	0.001	NF	13QM	0.001	0.001	0.001	NF
14QM	0.003	0.007	0.002	NF	14QM	<0.0001	<0.0001	<0.0001	NF
15QM	0.001	0.002	0.001	NF	15QM	<0.001	<0.001	<0.001	NF
16QM	0.001	0.001	0.001	NF	16QM	<0.001	<0.001		NF
17QM	0.001	0.001	0.001	NF	17QM	<0.001	<0.001	<0.001	NF
18QM	NF	0.001	0.001	NF	18QM	<0.001	<0.001	<0.001	NF
19QM	NF	0.004	0.056	NF	19QM	<0.001	<0.001	<0.001	NF
20QM	0.008	0.003	0.004	NF	20QM	<0.001	<0.001	<0.001	NF
21QM	0.004	0.004	0.006	NF	21QM	0.001	0.003	0.001	NF
22QM	0.018	0.002	0.001	NF	22QM	<0.001	<0.001	<0.001	NF
23QM	0.002	0.008	0.001	NF	23QM	<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**
25QM	0.001	0.001	0.002	NF	**25QM**	<0.001	<0.001	<0.001	NF
26QM	0.001	0.001	0.001	NF	**26QM**	<0.001	<0.001	NF	NF
27QM	0.004	0.006	0.002	NF	**27QM**	<0.001	<0.001	<0.001	NF
28QM	0.048	0.016	0.056	NF	**28QM**	<0.001	<0.001	<0.001	NF
29QM	0.003	0.008	0.002	NF	**29QM**	<0.001	<0.001	<0.001	NF
30QM	0.009	0.002	0.001	NF	**30QM**	<0.001	<0.001	<0.001	NF
31QM	0.001	0.001	0.001	NF	**31QM**	<0.001	<0.001	<0.001	NF
32QM	0.003	0.004	0.003	NF	**32QM**	<0.001	<0.001	<0.001	NF
33QM	0.8	1.4	0.3	NF	**33QM**	0.008	0.003	0.064	NF
34QM	0.002	0.003	0.001	NF	**34QM**	<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 (In situ up to January, 2023 and laboratory test –up to October, 2022); 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

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
	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
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

Source: CEGIS Field Survey; Up to July 2022.

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	
	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
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
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

Source: CEGIS Field Survey, Up to July 202

(C) Noise Level monitoring data

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

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

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

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

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

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

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

Sl No	Location	QM9 (Noise Level in dB (A)) Apr-16				QM 10 (Noise Level in dB (A)) Jul-16				QM 11 (Noise Level in dB (A)) Oct-16				QM 12 (Noise Level in dB (A)) Jan-17				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	67.71	61.23	66.31	65.08	50.92	50.04	52.3	51.42	60.1	68.6	67.8	65.5	54.4	61	61.46	58.95	70
2	NW Corner of the Project area	53.81	48.66	49.90	50.79	54.40	53.19	50.36	52.65	54.7	54.8	57.0	55.5	44.52	44.52	NM	44.52	50
3	Chunkuri-2, Bajua	43.30	43.35	46.84	44.49	56.29	49.4	54.51	53.4	50.4	47.7	56.6	51.6	55.73	56.2	NM	55.31	50
4	SW corner of the Project area	56.81	54.73	51.97	54.50	67.38	74.12	54.61	65.37	47.8	49.0	50.8	49.2	44.41	45.96	NM	45.19	50
5	Proposed Township area, Project site	55.02	52.41	52.69	53.37	62.71	52.98	51.67	55.79	45.8	41.6	48.7	45.4	NM	43.4	41.85	42.63	50
6	Barni, Gaurambha	50.63	54.19	57.09	53.97	51.2	59.54	59.53	56.75	52.4	57.3	55.0	54.9	49.75	48.35	NM	49.05	50
7	Khan Jahan Ali Bridge, Khulna	66.40	64.82	66.34	65.85	63.52	62.15	65.73	63.80	61.9	59.6	61.3	60.9	51.69	60.05	54.97	55.57	70
8	Mongla Port area	49.89	48.67	51.07	49.88	53.87	52.04	52.7	52.87	49.5	50.0	50.2	49.9	47.82	48.67	50.33	48.94	75
9	Harbaria, Sundarbans	44.40	44.69	NM	44.55	53.87	53.04	52.79	52.9	57.2	53.5	49.3	53.3	41.13	38.4	37.98	39.17	45
10	Akram Point, Sundarbans	45.60	40.29	NM	42.95	47.16	46.48	50.24	47.96	40.5	43.0	42.5	42.0	38.74	38.45	37.06	38.08	45
11	Hiron Point, Sundarbans	48.53	37.69	NM	43.11	NM	NM	NM	NM	46.1	42,08	41.9	44.0	43.62	40.96	42.29	42.29	45

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

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

Sl No	Location	QM13 (Noise Level in dB (A)) Apr-17				QM 14 (Noise Level in dB (A)) Oct-17				QM 15 (Noise Level in dB (A)) Jan-18				QM 16 (Noise Level in dB (A)) April-18				Std*
		Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Morning (9:00)	noon (13:00)	Evening (18:00)	Day time AVG	Day time
1	Chalna, Dacope	58.21	59.00	66.57	61.62	47.65	51.06	50.27	49.66	60.2	60.2	60.5	60.3	64.09	59.30	65.43	62.94	70
2	NW Corner of the Project area	44.97	49.30	47.31	47.19	47.65	45.12	46.65	46.47	47.8	48.1	49.2	48.37	47.92	54.32	61.14	54.46	55
3	Chunkuri-2, Bajua	45.60	52.29	53.42	50.44	39.82	45.60	41.73	42.38	51.1	51.2	52.1	51.47	44.77	46	63.14	51.30333	55
4	SW corner of the Project area	39.62	42.64	47.48	43.25	60.80	64.08	62.52	62.47	43.5	43.5	45.7	44.23	64.45	63.49	66.63	64.85667	55
5	Project site near Shapmari area	41.40	43.09	43.45	42.65	43.05	48.52	45.01	45.53	53.2	54	52.82	53.34	51.95	59.66	56.8	56.13667	55
6	Barni, Gaurambha	43.05	46.45	45.01	44.83	45.60	52.29	53.42	50.44	56.5	54.2	56.1	55.6	55.6	51.80	51.39	52.93	60
7	Khan Jahan Ali Bridge, Khulna	54.01	57.50	58.66	56.72	40.60	42.64	46.55	43.26	60.2	62.1	62.2	61.5	49.4	45.25	47.98	47.54333	70
8	Mongla Port area	47.78	47.45	45.25	47.61	41.40	44.68	45.71	43.93	60.2	60.2	58.4	59.6	50.84	48.33	53.25	50.80667	75
9	Harbaria, Sundarbans	50.79	53.67	57.84	54.10	44.25	46.67	47.31	46.08	45.8	44.7	43.8	44.7	50.23	45.55	65.43	53.73667	50
10	Akram Point, Sundarbans	43.41	45.60	43.89	44.30	58.21	58.59	58.70	58.50	39.4	40.5	41.1	40.3	58.31	60.93	64.87	61.37	50
11	Hiron Point, Sundarbans	NM	NM	NM	NM	39.92	39.79	33.5	37.74	37.2	39	38.4	38.2					50

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

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

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

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

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

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

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

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

Sl No	Location	QM 30 (Noise Level in dB (A)) Oct, 2021				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; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

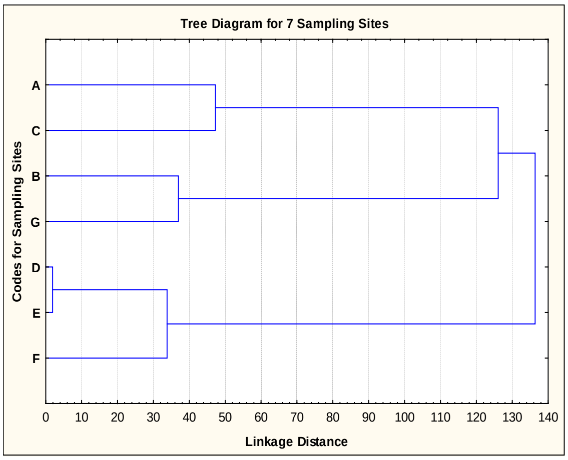
Table C.9: Ambient noise monitoring status at the monitored locations

Sl. No	Location	QM 34(Noise Level in dB (A)) Oct, 2022				QM 35 (Noise Level in dB (A)) Jan, 2023				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	
1	Chalna, Dacope	78.10	72.20	76.20	75.50	69.50	67.00	62.70	66.40	**70**
2	NW Corner of the Project area	57.00	57.7	52.3	55.67	53.40	48.30	43.20	48.30	**55**
3	Chunkuri-2, Bajua	63.50	55.40	54.6	57.83	51.80	55.40	53.30	53.50	**55**
4	SW corner of the Project area	56.20	53.70	52.70	54.20	49.80	53.80	NM	51.80	**55**
5	Project site near Shapmari area	57.40	50.90	NM	54.15	56.30	53.80	46.40	52.17	**55**
6	Barni, Gaurambha	62.50	60.50	62.60	61.87	59.90	57.00	58.45	58.45	**60**
7	Khan Jahan Ali Bridge, Khulna	65.10	63.20	NM	64.15	70.20	68.9	75.90	71.67	**70**
8	Mongla Port area	61.50	67.9	65.60	65.00	65.2	68.10	56.4	63.23	**75**
9	Harbaria, Sundarbans	49.60	50.40	NM	50.00	48.10	41.78	NM	44.94	**50**
10	Akram Point, Sundarbans	42.50	41.70	NM	42.10	42.85	37.56	NM	40.21	**50**
11	Hiron Point, Sundarbans	47.80	NM	NM	47.80	41.30	41.30	NM	41.30	**50**

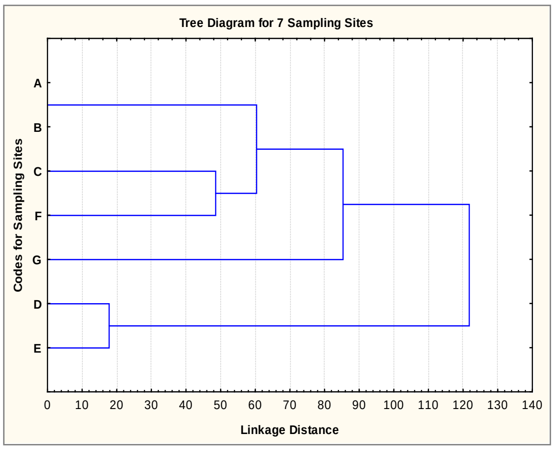
*Source: CEGIS field Survey; Note: NM-Not measured; *Std- Standard as defined in National Noise Control Rules 2006.*

(D) Fisheries resources monitoring data

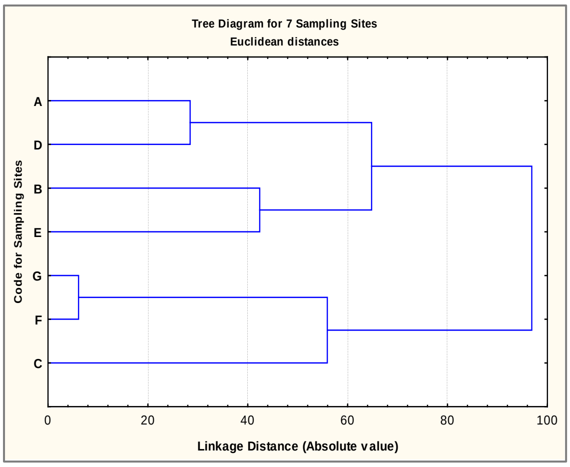
D1: Classification of functional habitat



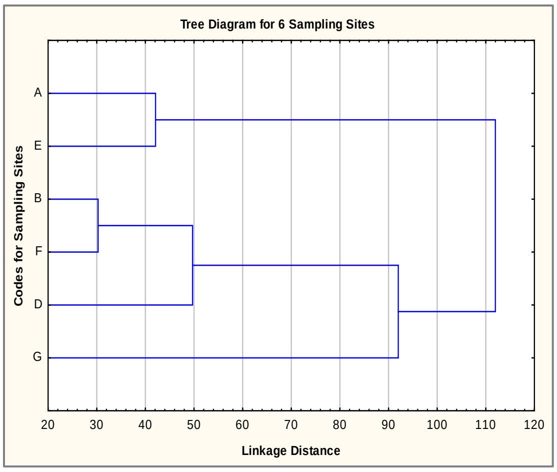
1st Monitoring, April, 2014



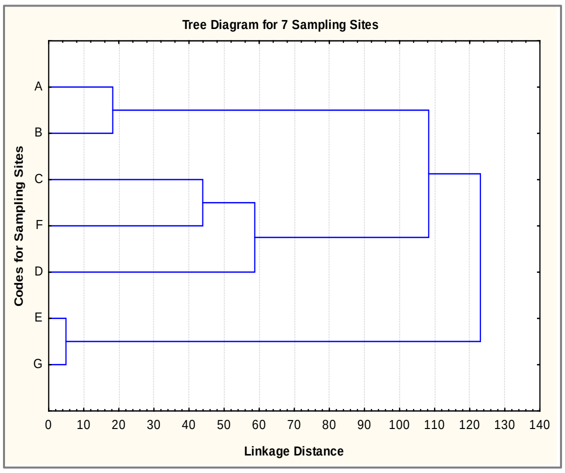
2nd Monitoring, July 2014



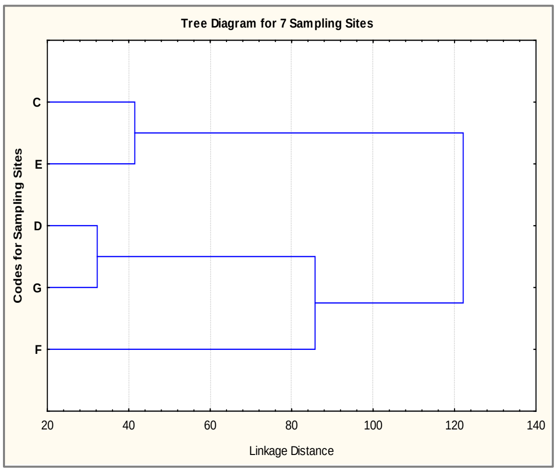
3rd Monitoring, October, 2014



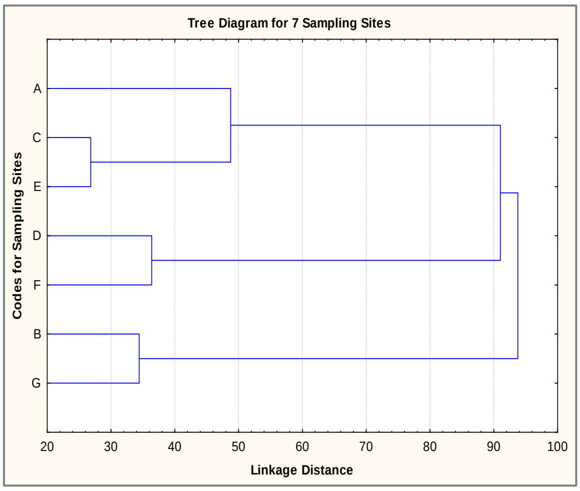
4th Monitoring, January 2015



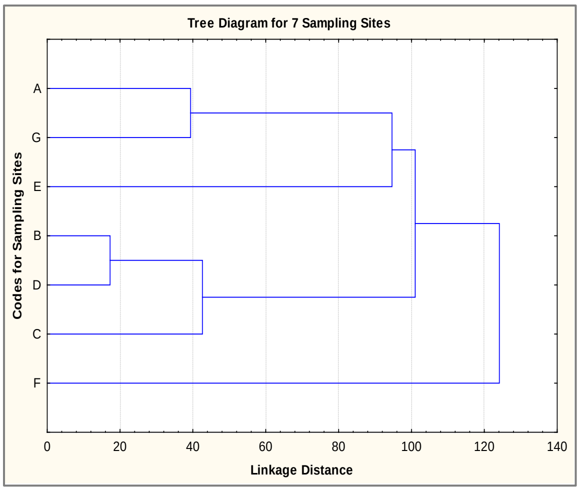
5th Monitoring, April, 2015



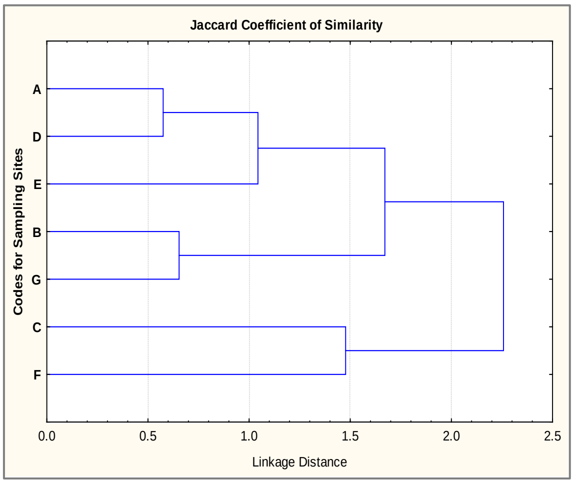
6th Monitoring, August, 2015

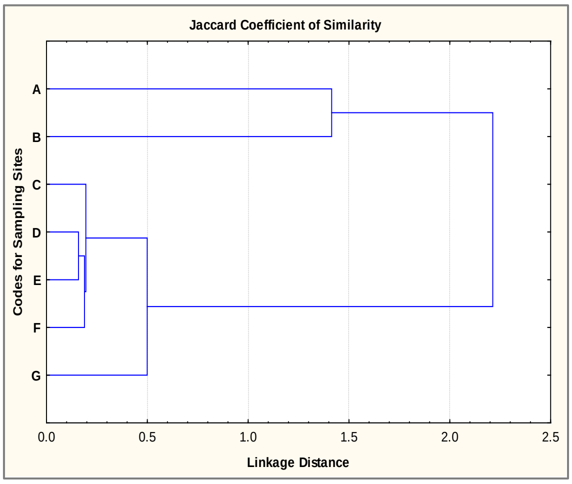


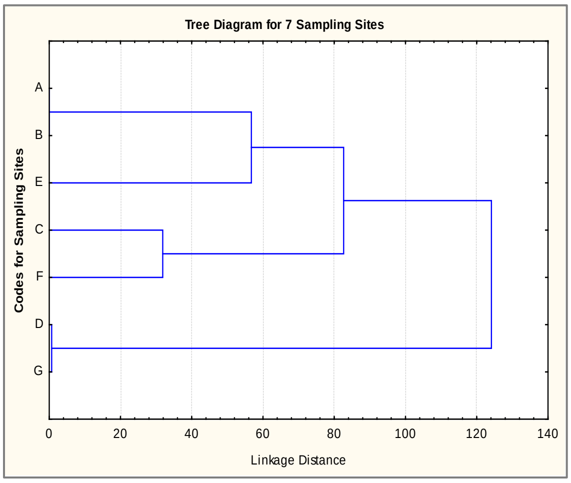
7th Monitoring, October, 2015



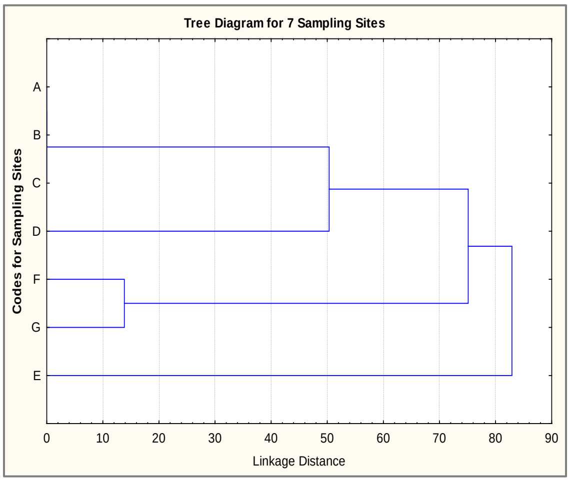
8th Monitoring, January, 2016



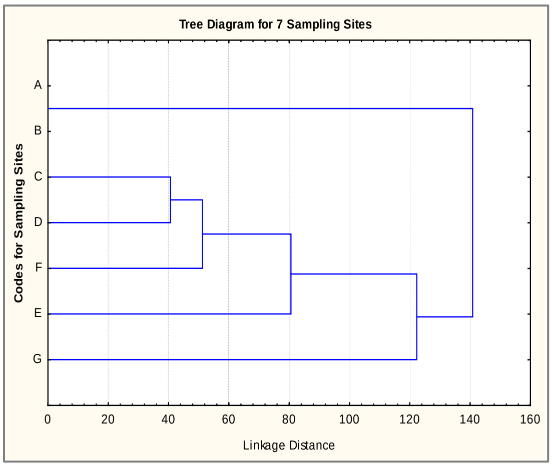




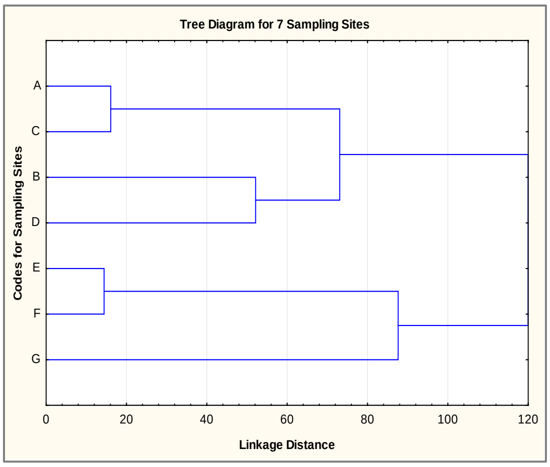
9th Monitoring, April, 2016



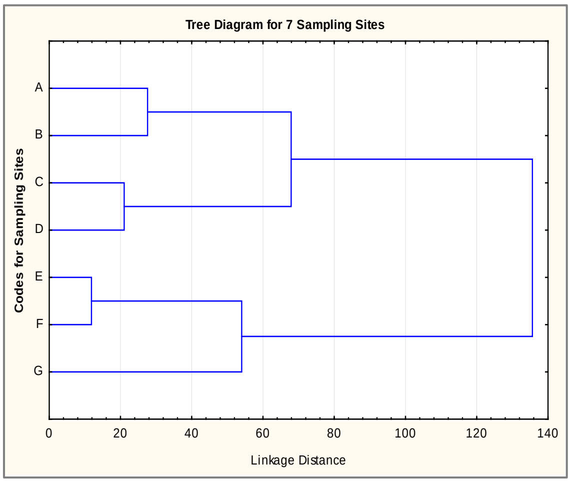
10th Monitoring, July, 2016



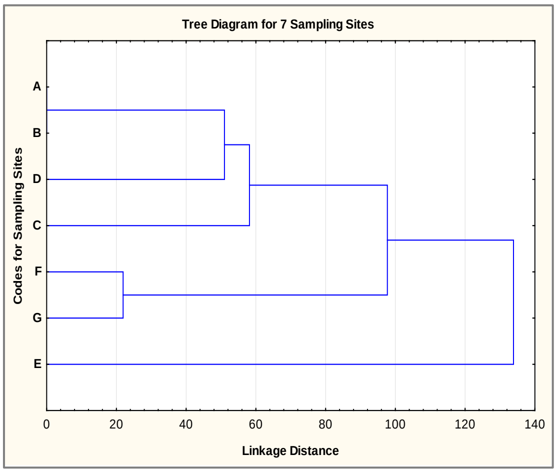
11th Monitoring, October, 2016



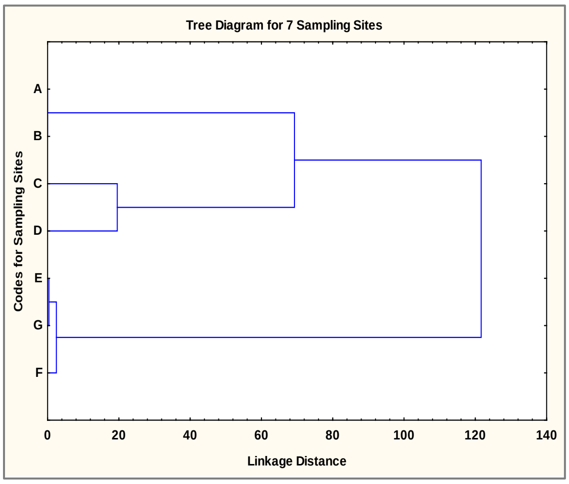
12th Monitoring, January, 2017



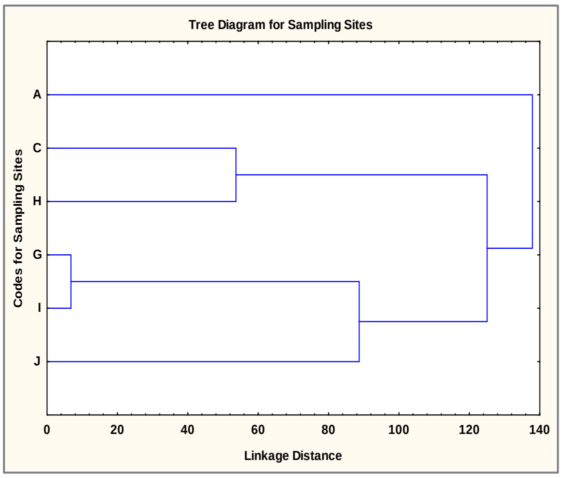
13th Monitoring, April, 2017



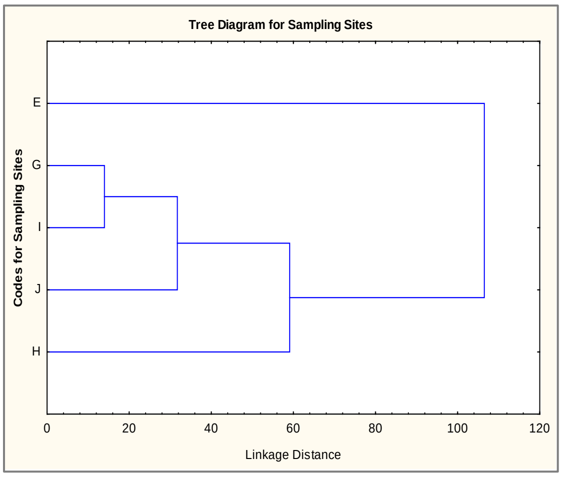
14th Monitoring, October, 2017



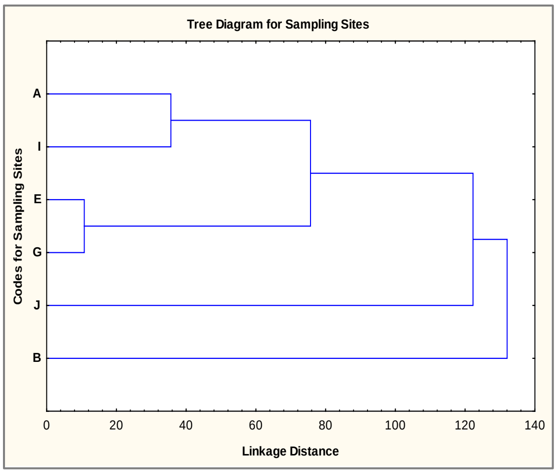
15th Monitoring, January, 2018



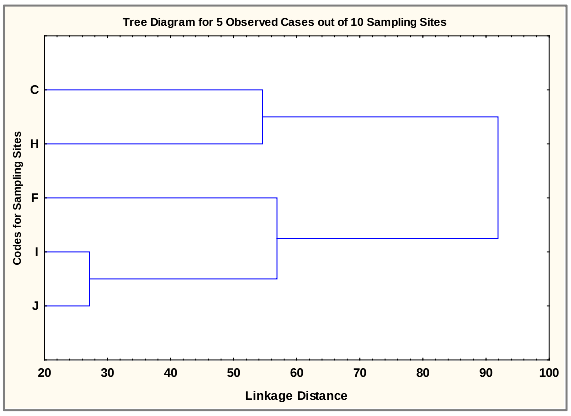
16th Monitoring, April, 2018



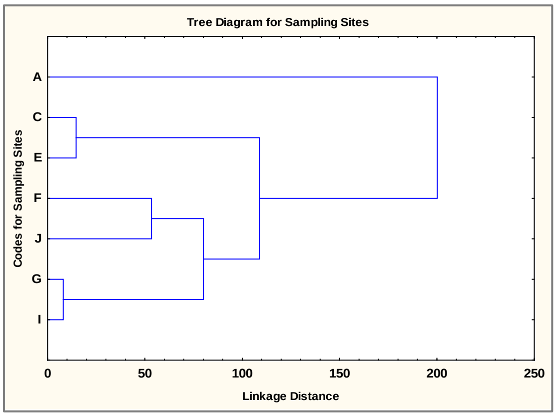
17th Monitoring, July, 2018



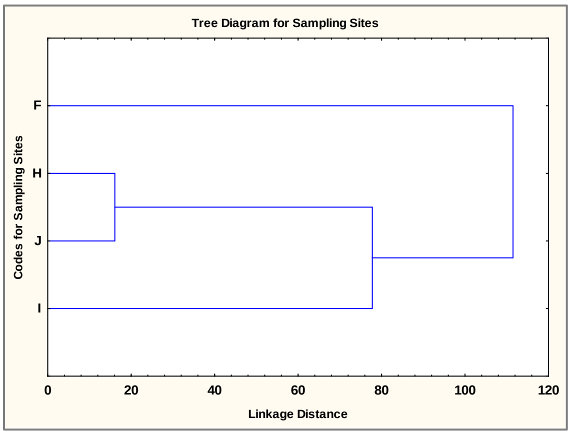
18th Monitoring, November, 2018



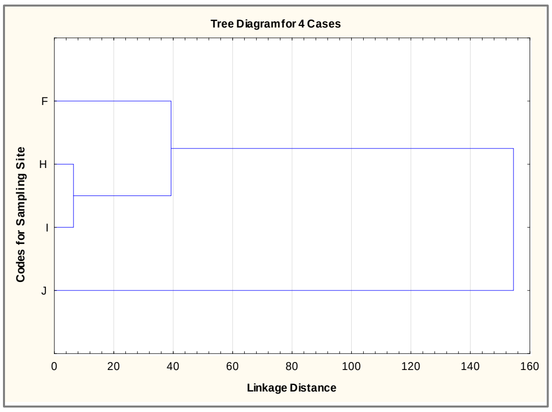
19th Monitoring, February, 2019



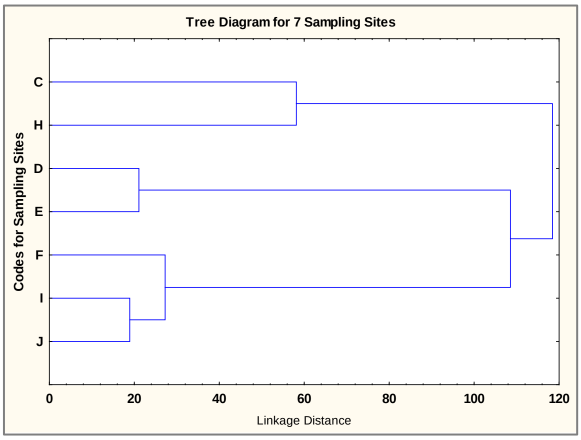
20th Monitoring, April, 2019



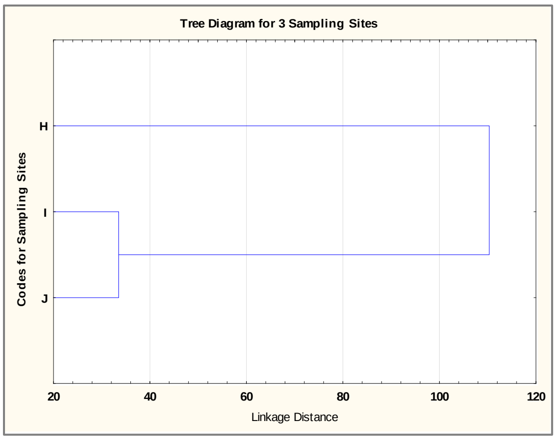
21st Monitoring, July 2019



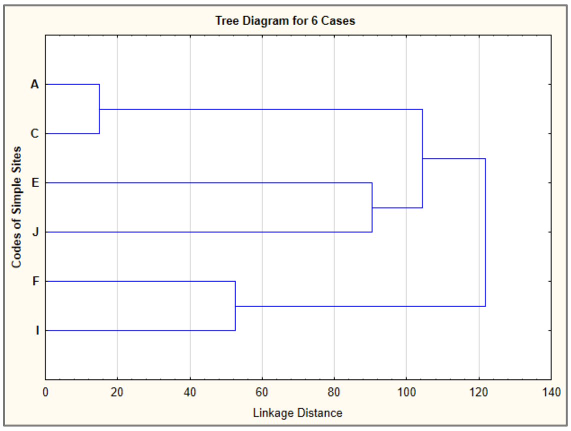
22nd Monitoring, November, 2019



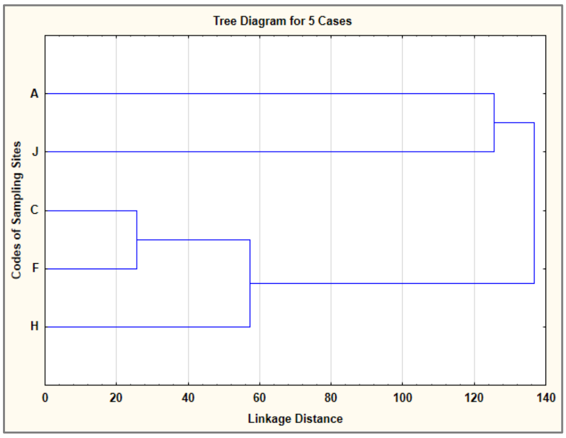
23rd Monitoring, February 2020



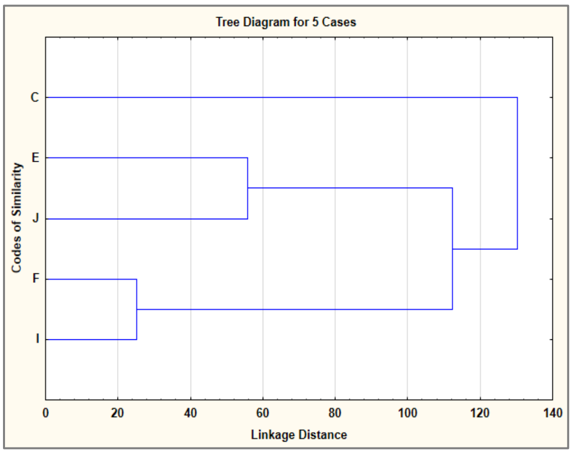
25th Monitoring, July 2020



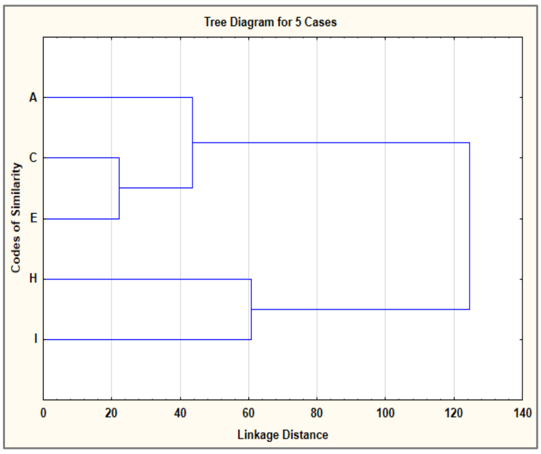
26th Monitoring, November 2020



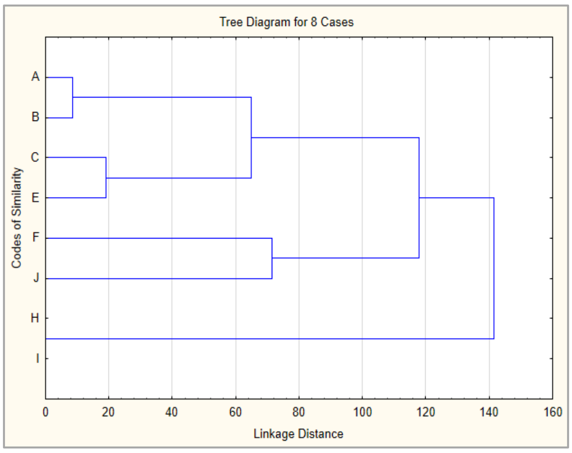
27th Monitoring, January 2021



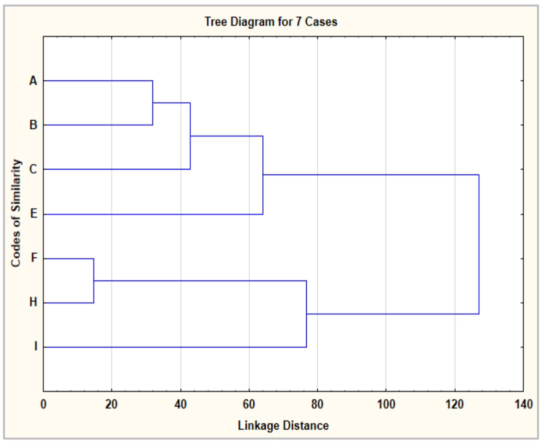
28th monitoring, April 2021



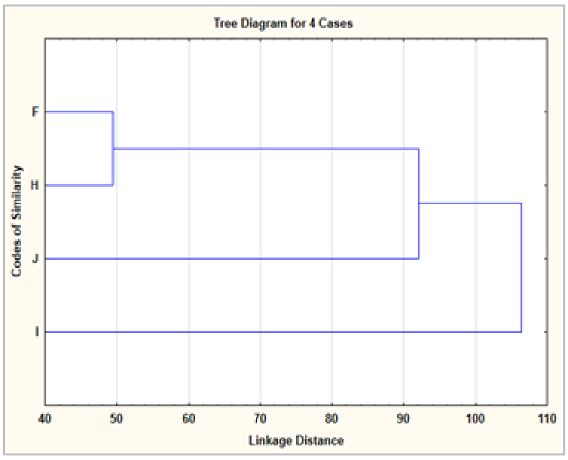
29th Monitoring, August 2021



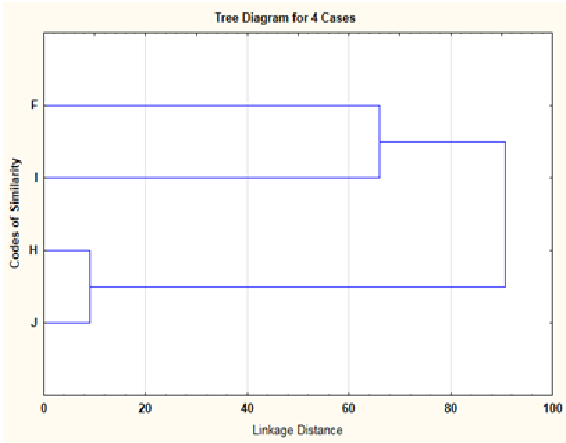
30th Monitoring, November 2021



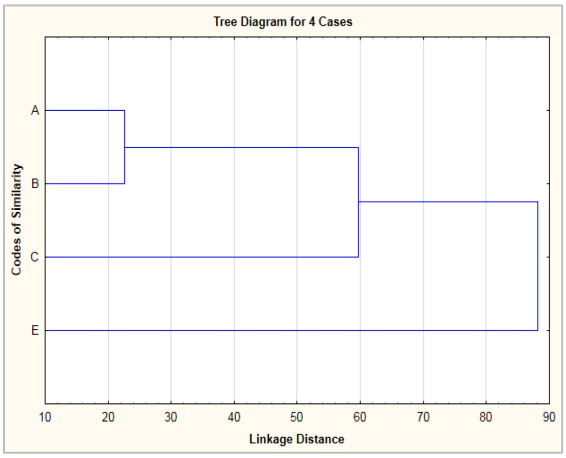
31st Monitoring, February, 2022



32nd Monitoring, May 2022

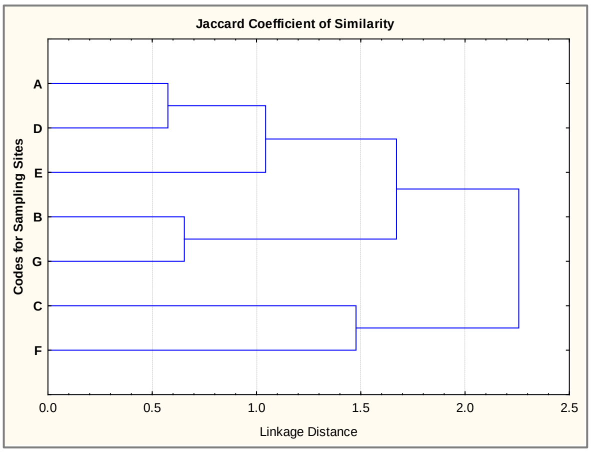


33rd Monitoring, July 2022

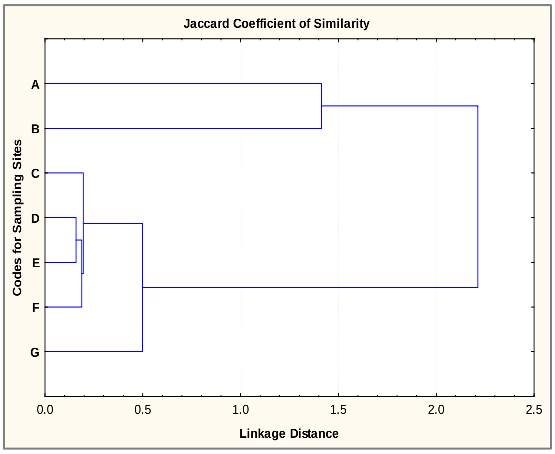


34th Monitoring, Oct 2022

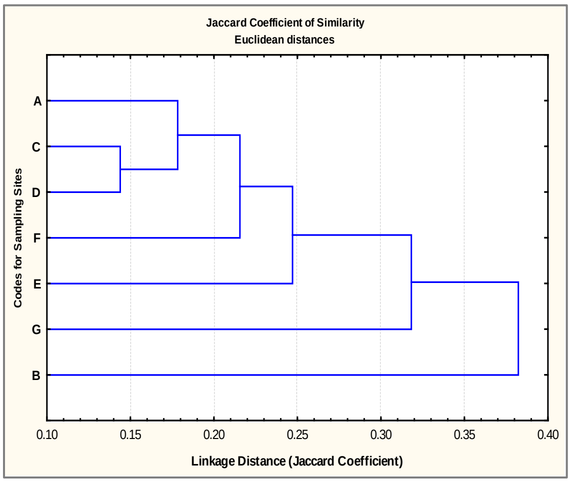
D2: Jaccard Co-efficient of Similarity of Habitats respecting fish species occurrence



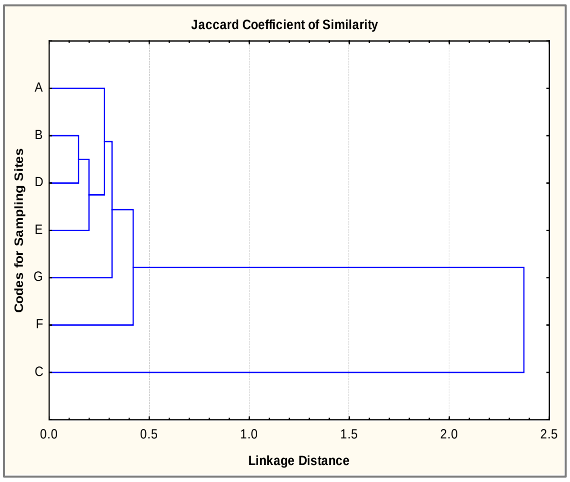
1st Monitoring, April, 2014



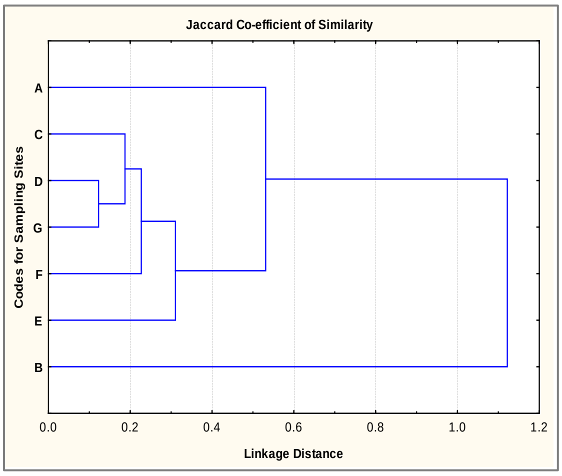
2nd Monitoring, July 2014



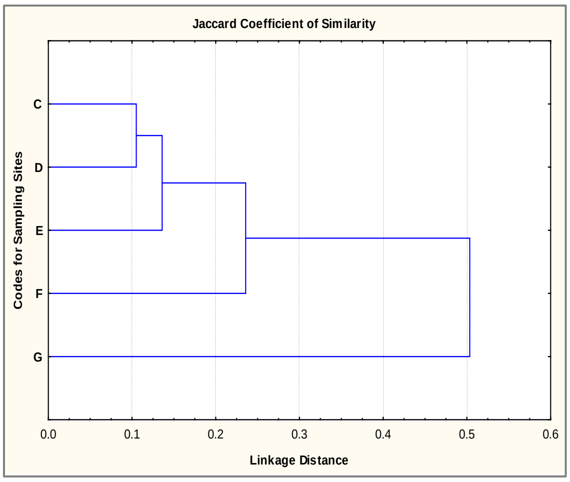
3rd Monitoring, October, 2014



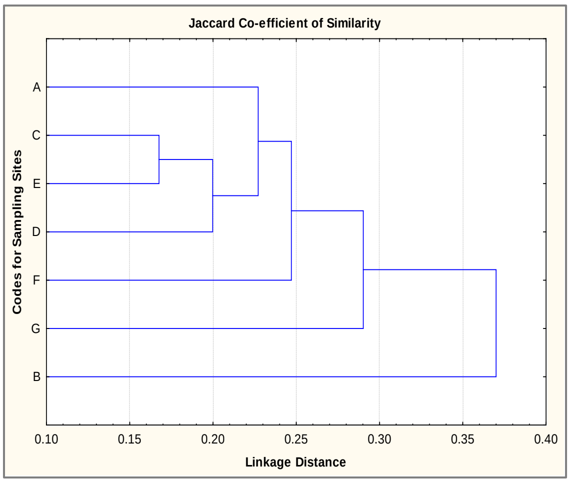
4th Monitoring, January 2015



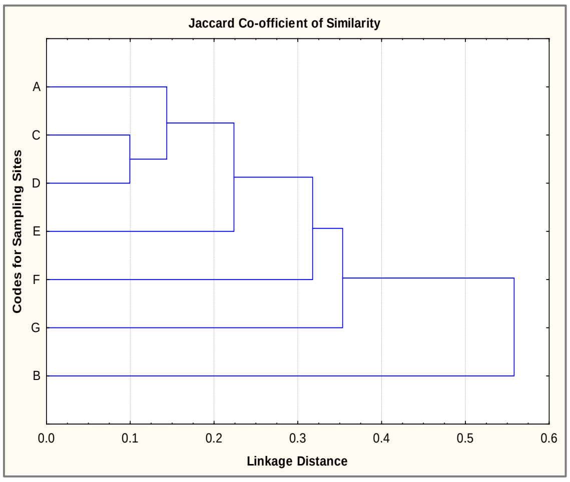
5th Monitoring, April, 2015



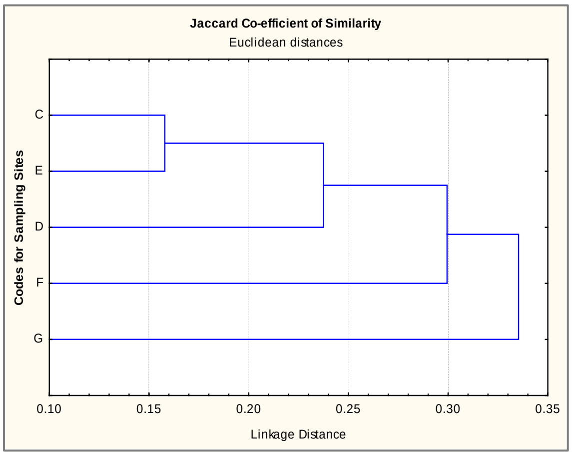
6th Monitoring, August, 2015



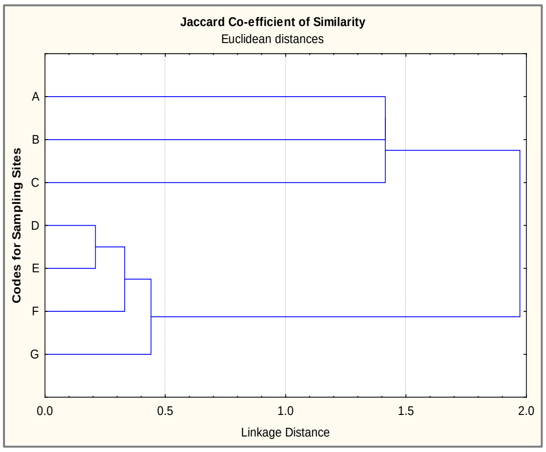
7th Monitoring, October, 2015



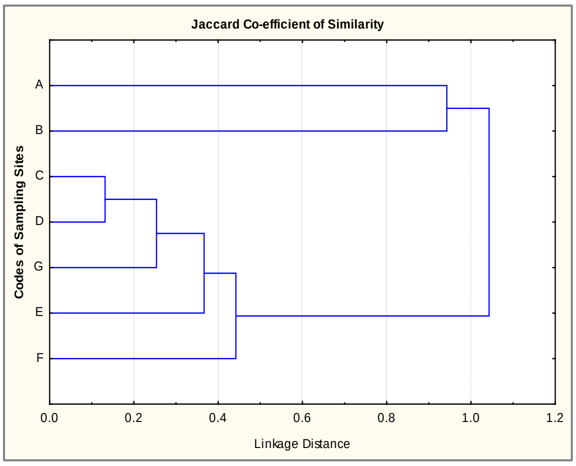
8th Monitoring, January, 2016



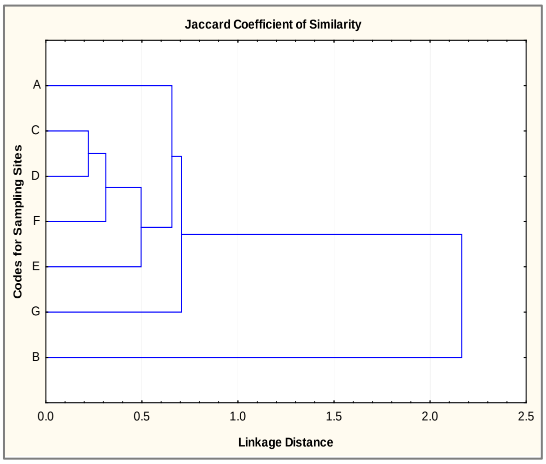
9th Monitoring, April, 2016



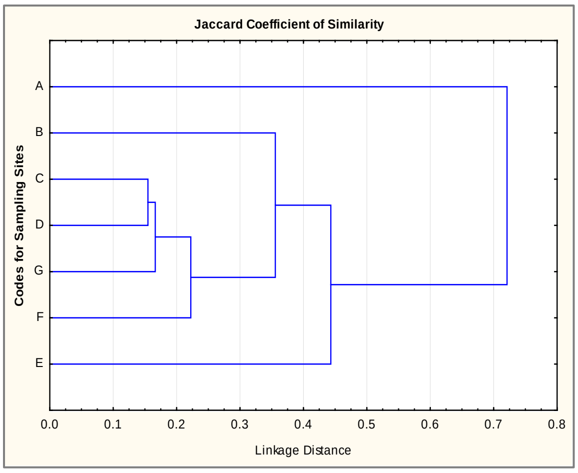
10th Monitoring, July, 2016



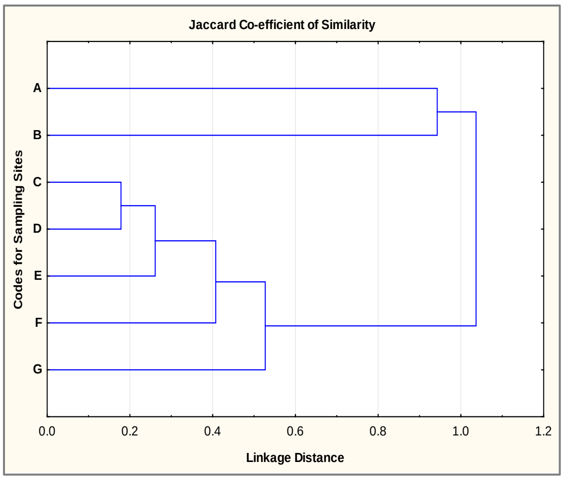
11th Monitoring, October, 2016



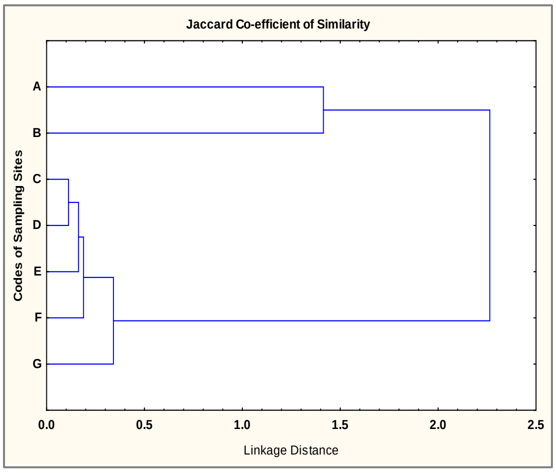
12th Monitoring, January, 2017



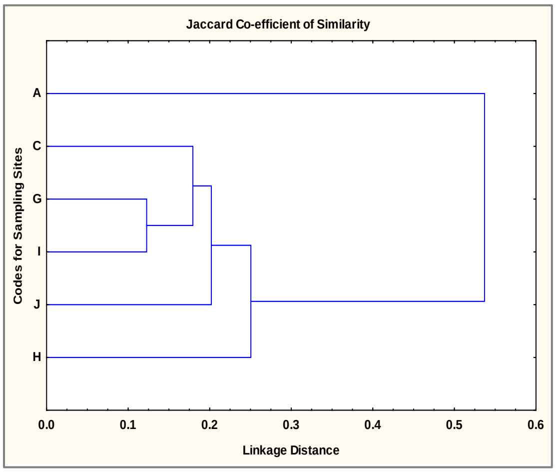
13th Monitoring, April, 2017



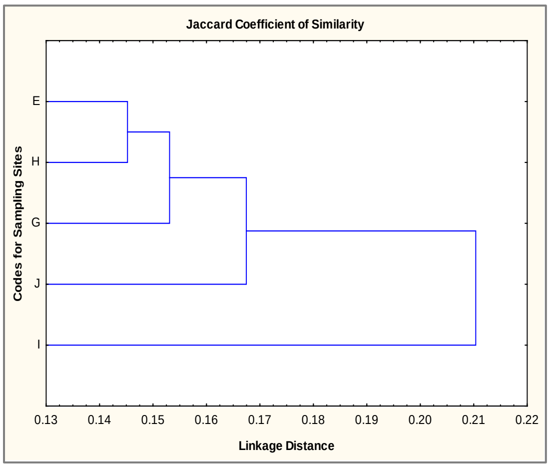
14th Monitoring, October, 2017



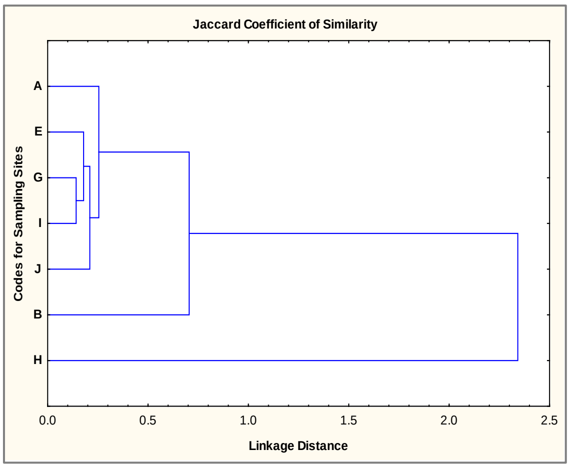
15th Monitoring, January, 2018



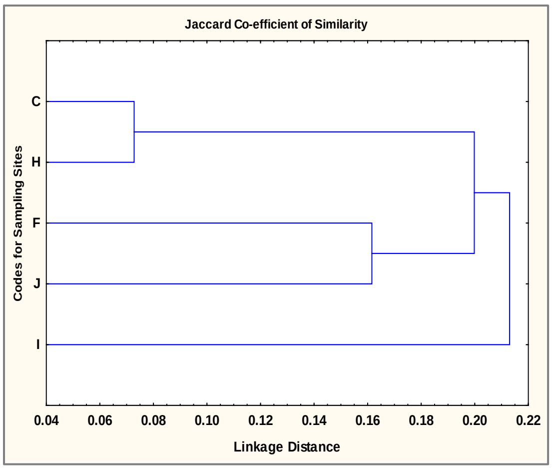
16th Monitoring, April, 2018



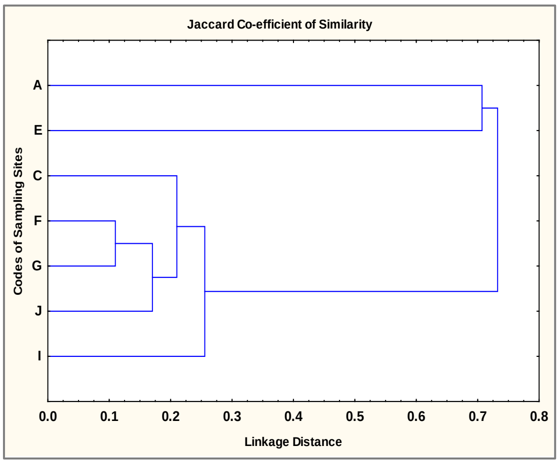
17th Monitoring, July, 2018



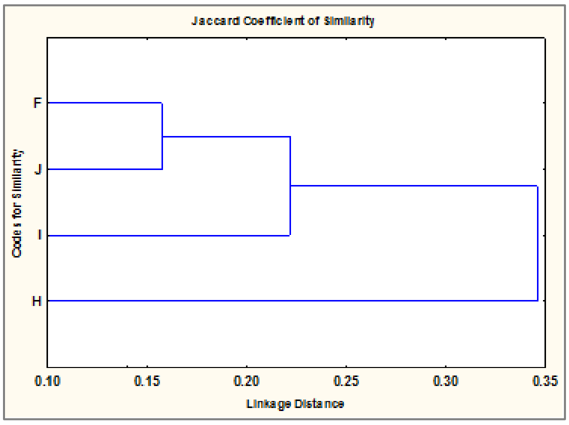
18th Monitoring, November, 2018



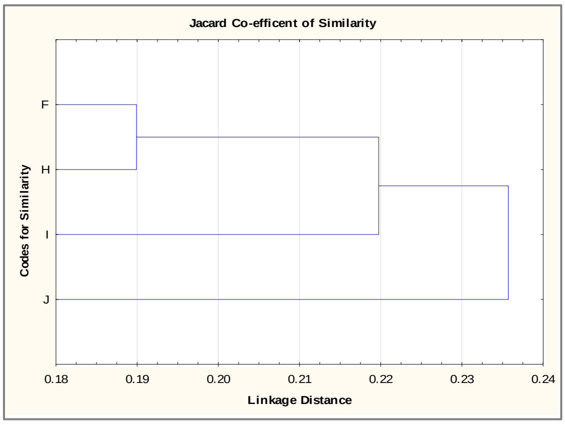
19th Monitoring, February, 2019



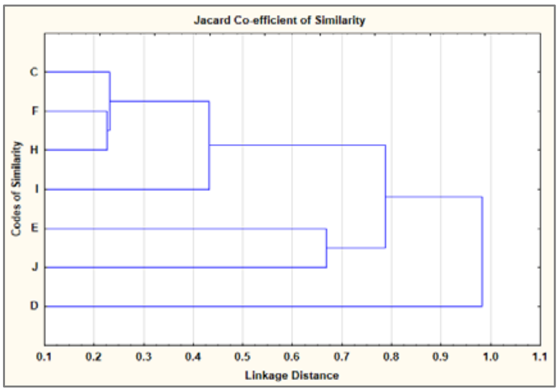
20th Monitoring, April, 2019



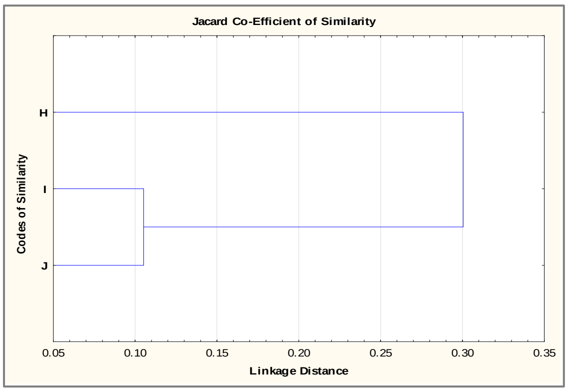
21st Monitoring, July 2019



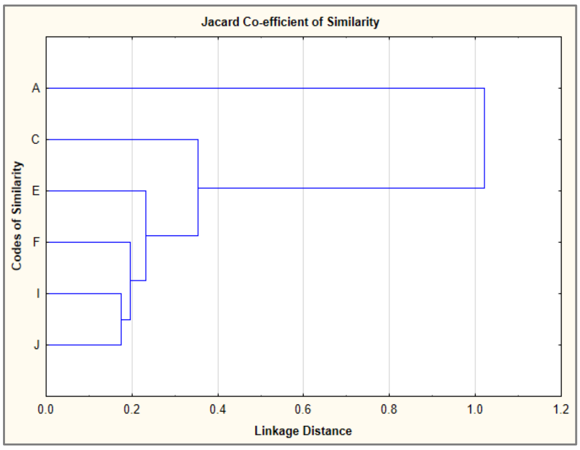
22nd Monitoring, November 2019



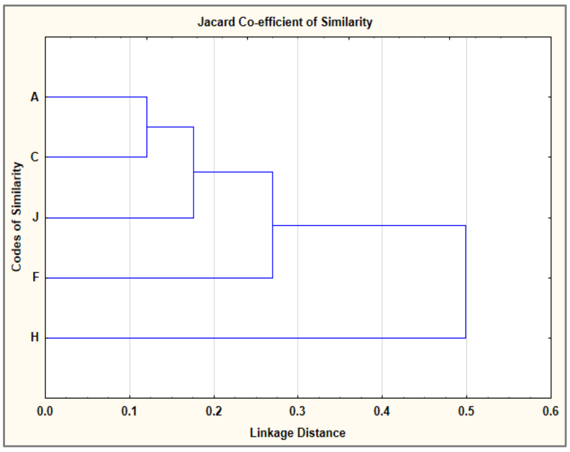
23rd Monitoring, February 2020



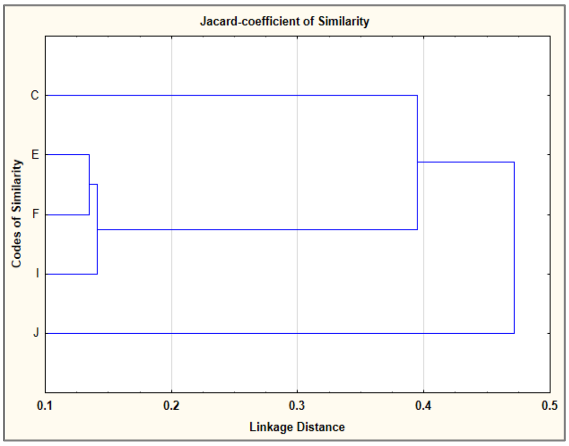
25th Monitoring, July 2020



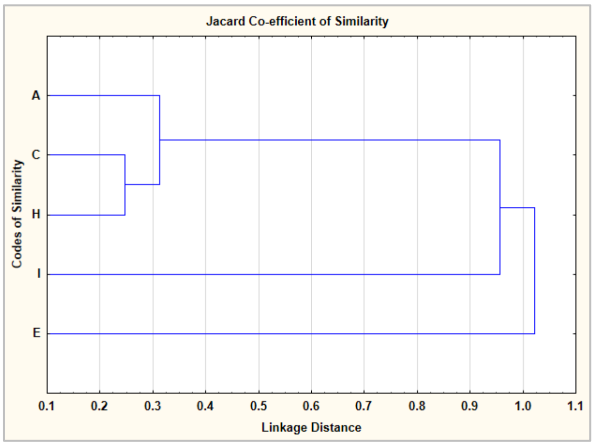
26th Monitoring, November, 2020



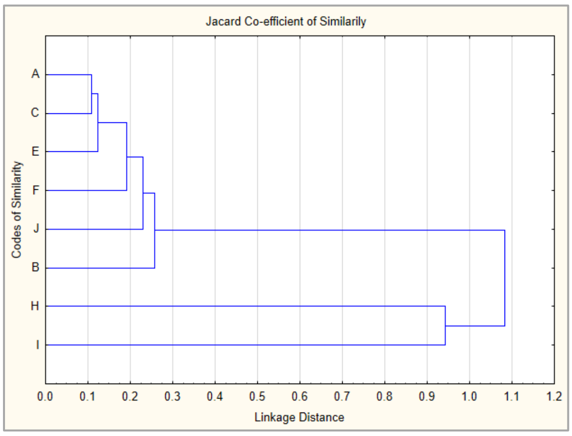
27th Monitoring, January, 2021



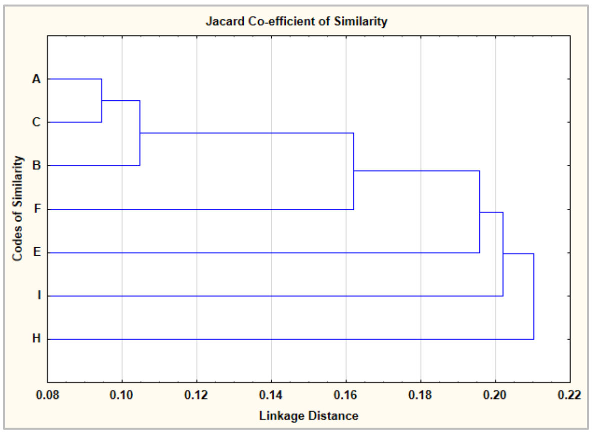
28th monitoring, April, 2021



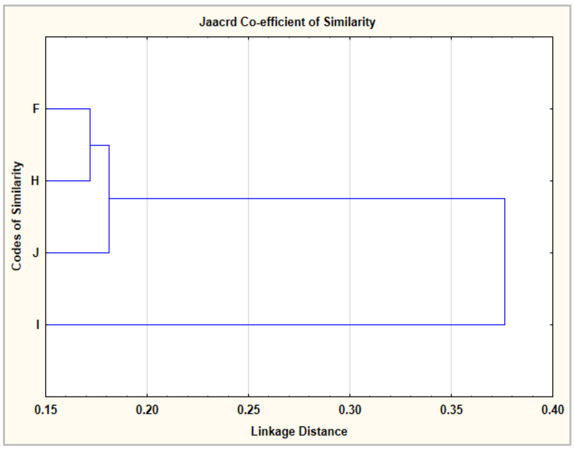
29th monitoring, August, 2021



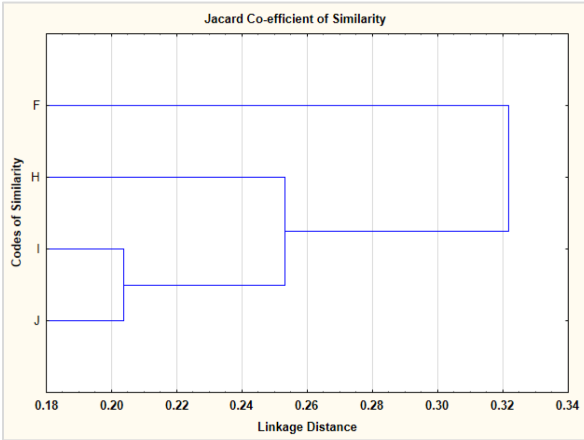
30th Monitoring, November 2021



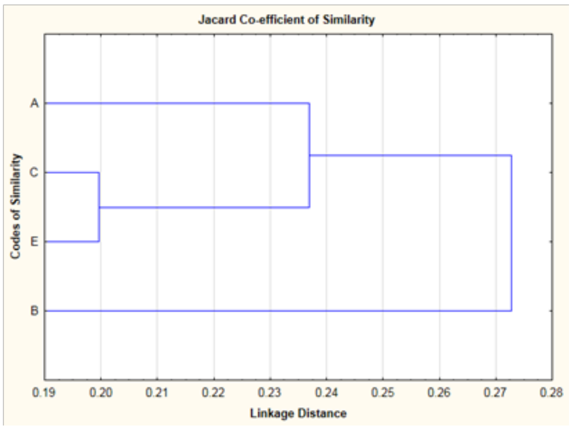
31st Monitoring, February, 2022



32nd Monitoring, May 2022

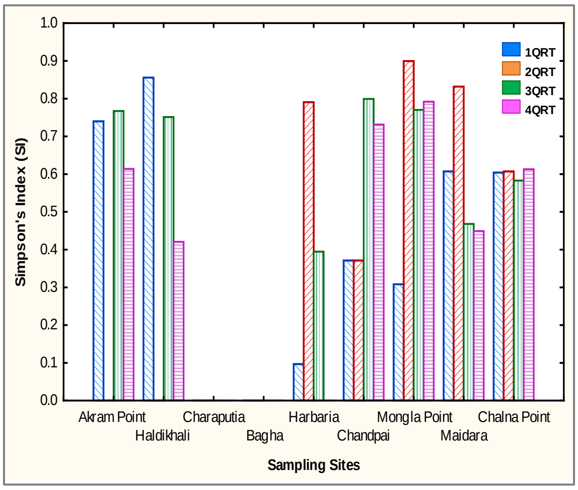


33rd Monitoring, July 2022

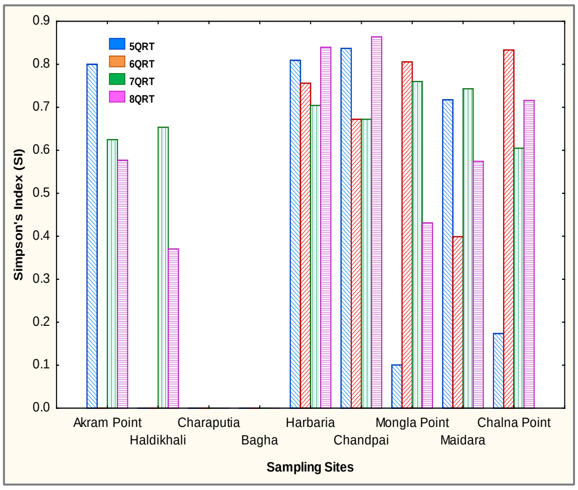


34th Monitoring, Oct 2022

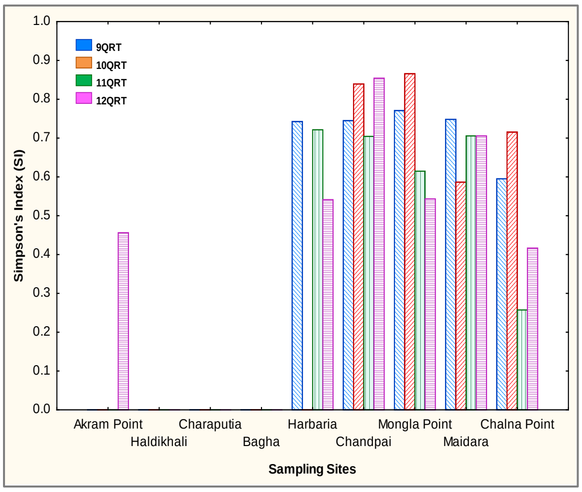
D.3: Site-wise fish species richness (FSR) in the Passur River System



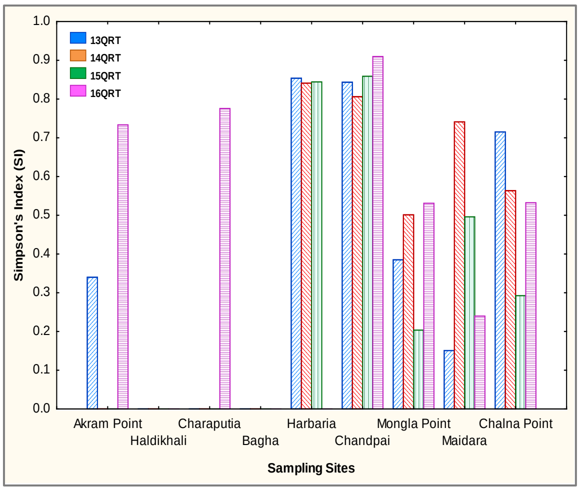
2014-2015



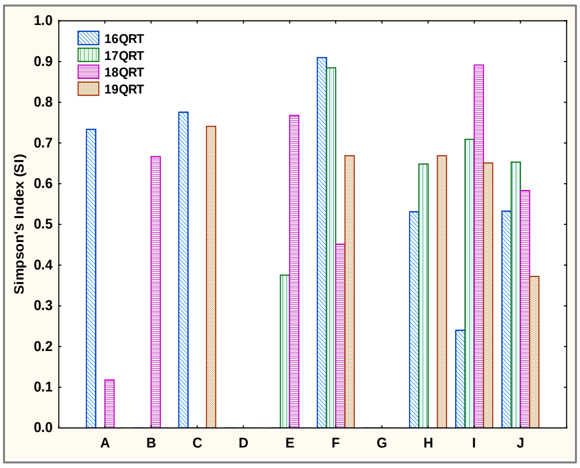
2015-2016



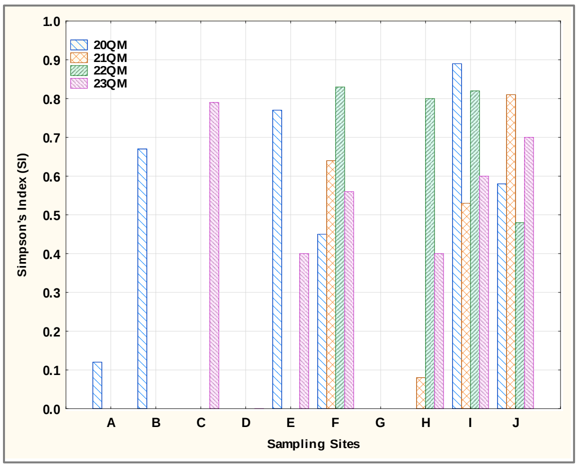
2016-2017



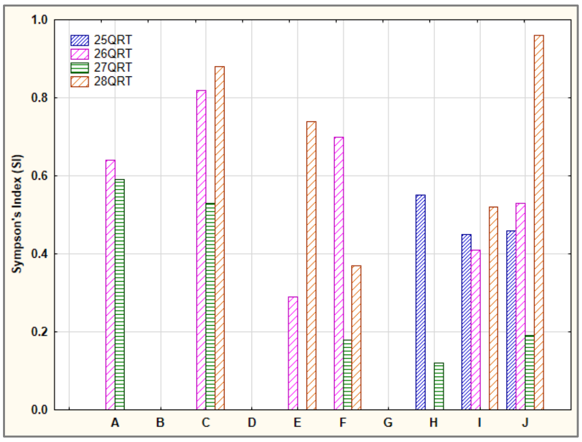
2017-18



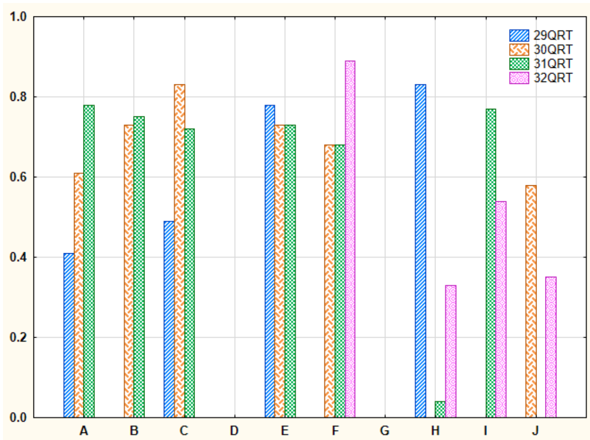
2018-19



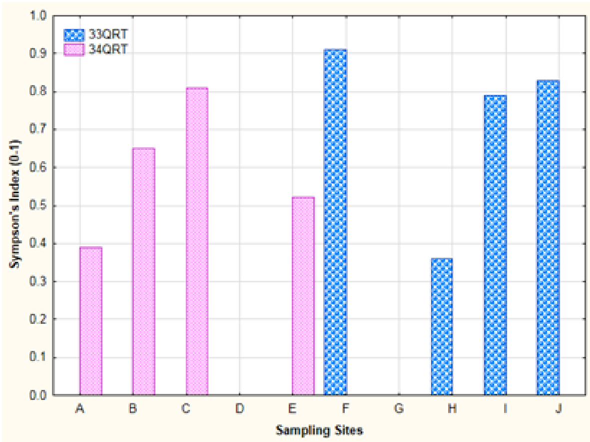
2019-20



2020-21

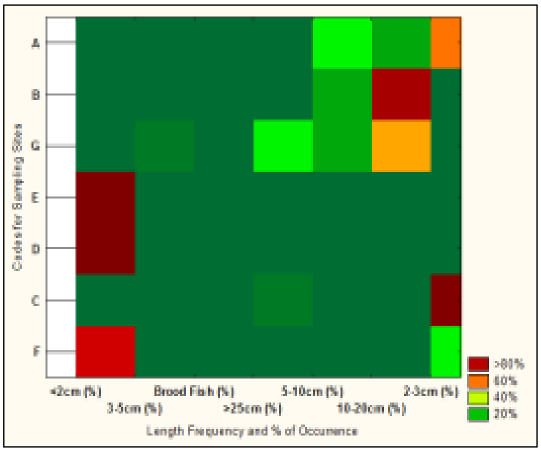


2021-2022

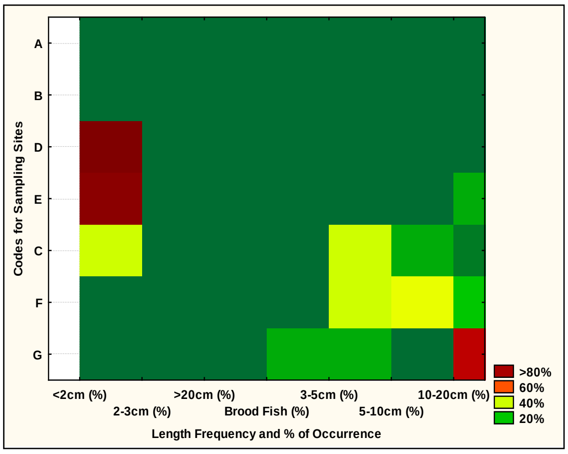


2022-23

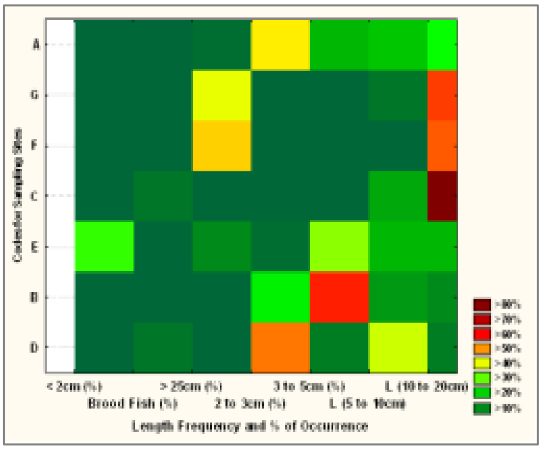
D4: Fish Community Structure



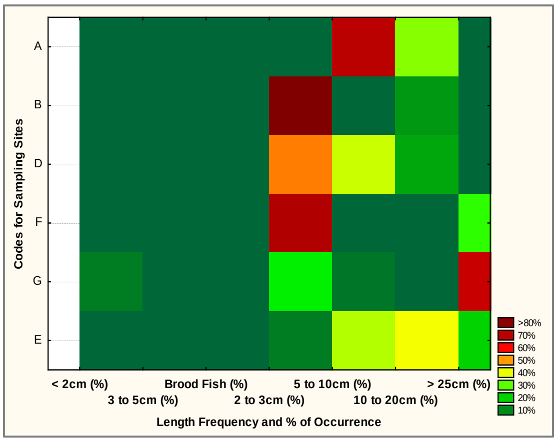
1st Monitoring, April, 2014



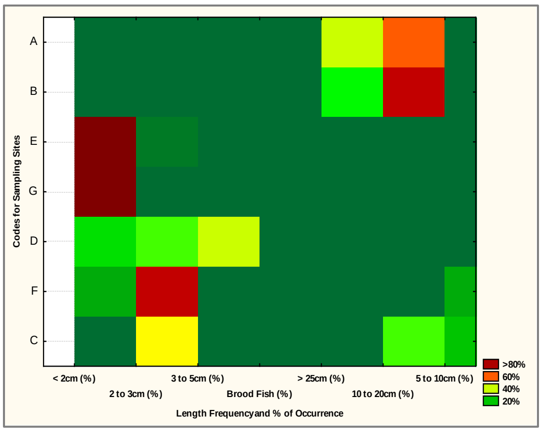
2nd Monitoring, July 2014



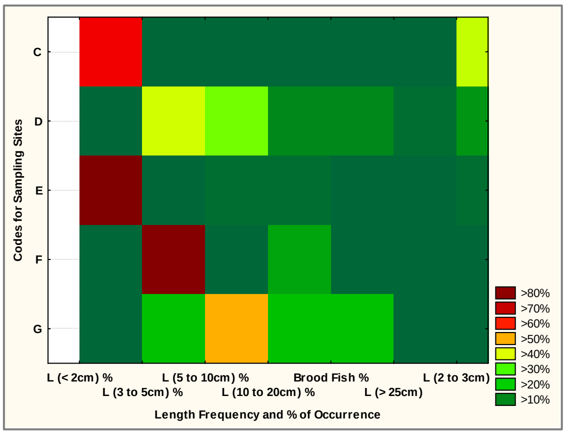
3rd Monitoring, October, 2014



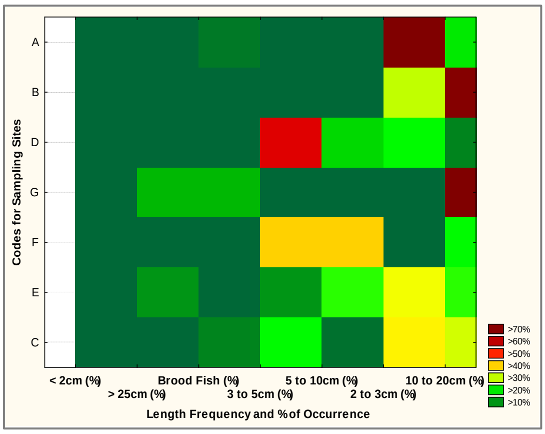
4th Monitoring, January 2015



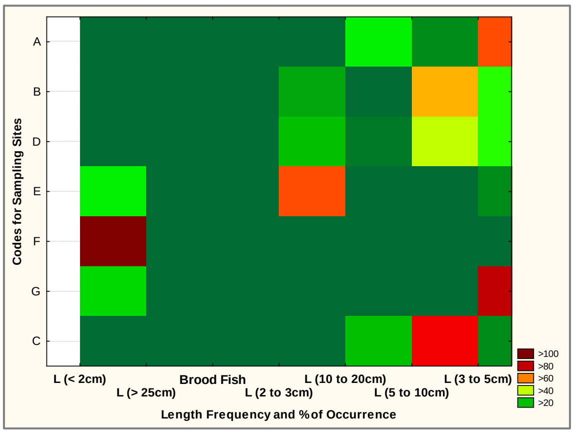
5th Monitoring, April, 2015



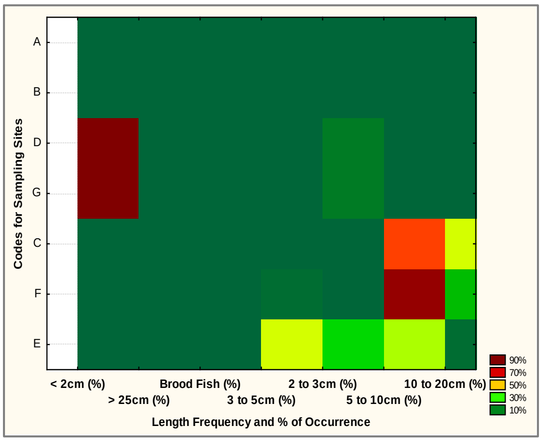
6th Monitoring, August, 2015



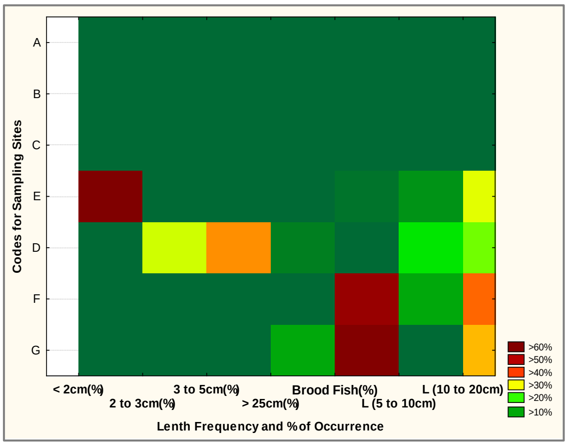
7th Monitoring, October, 2015



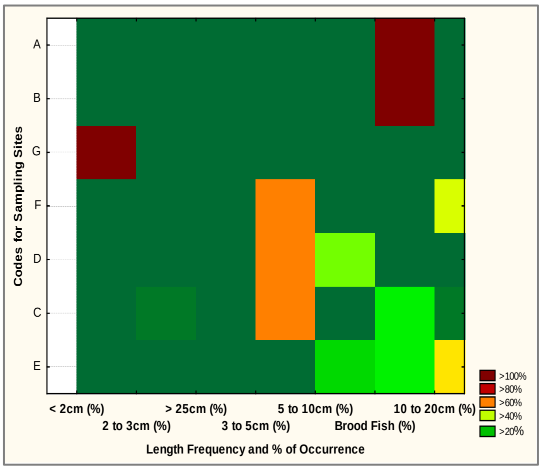
8th Monitoring, January, 2016



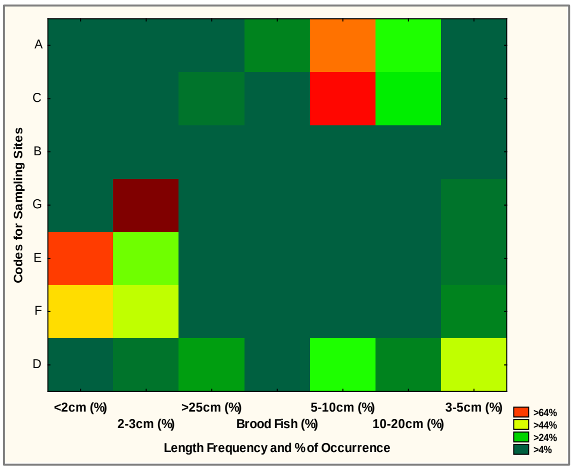
9th Monitoring, April, 2016



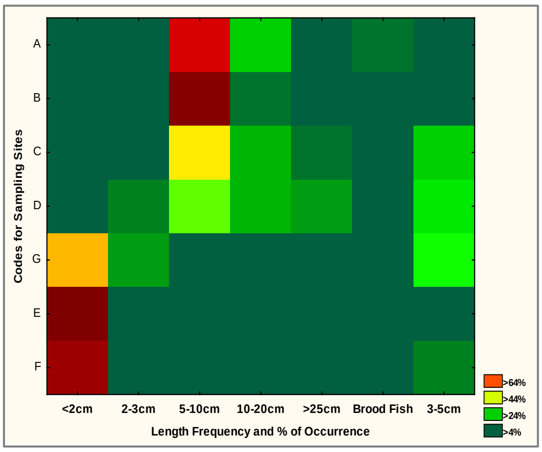
10th Monitoring, July, 2016



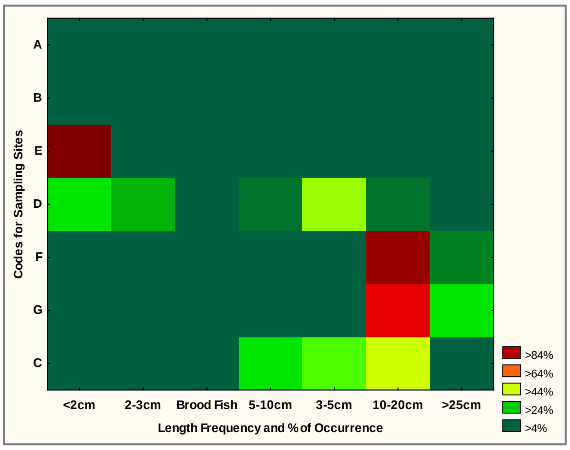
11th Monitoring, October, 2016



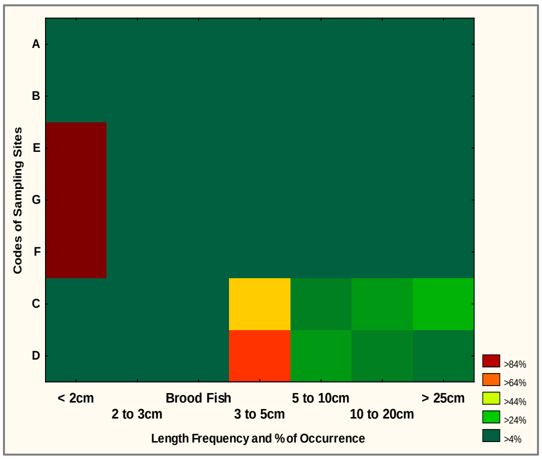
12th Monitoring, January, 2017



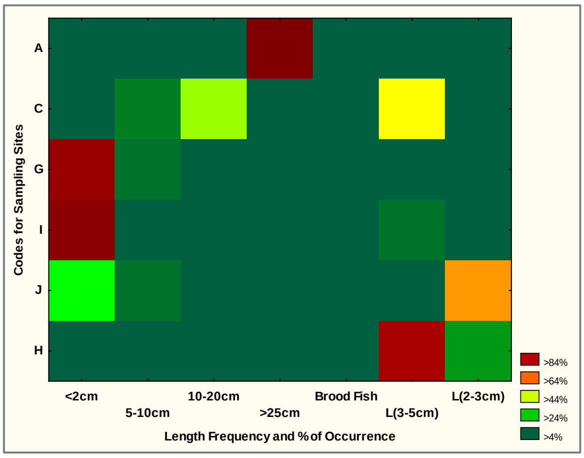
13th Monitoring, April, 2017



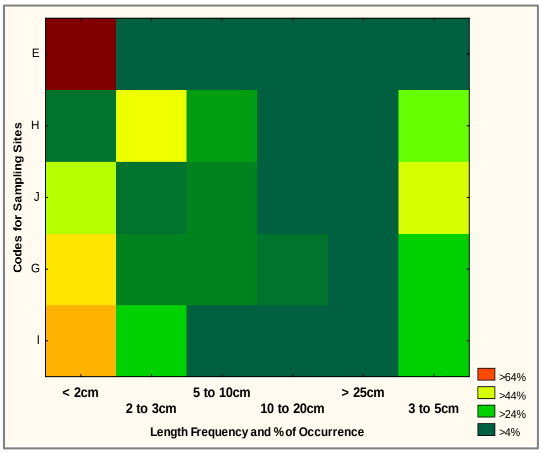
14th Monitoring, October, 2017



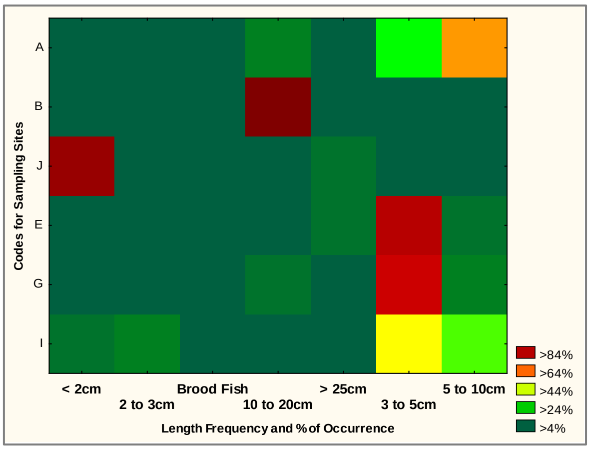
15th Monitoring, January, 2018



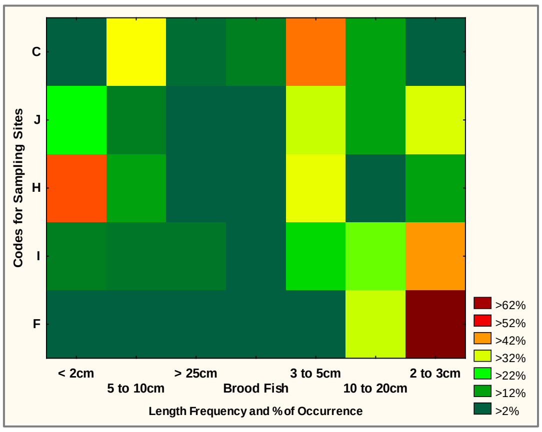
16th Monitoring, April, 2018



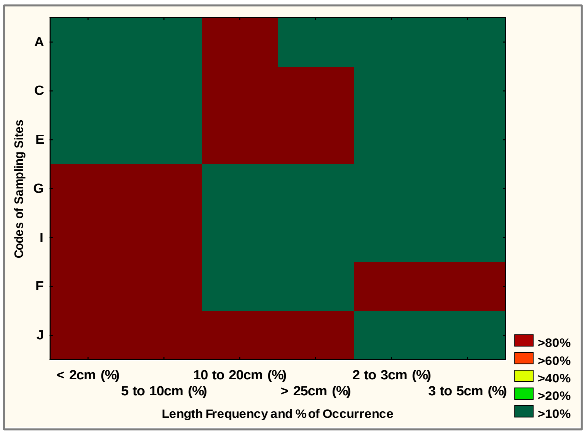
17th Monitoring, July, 2018



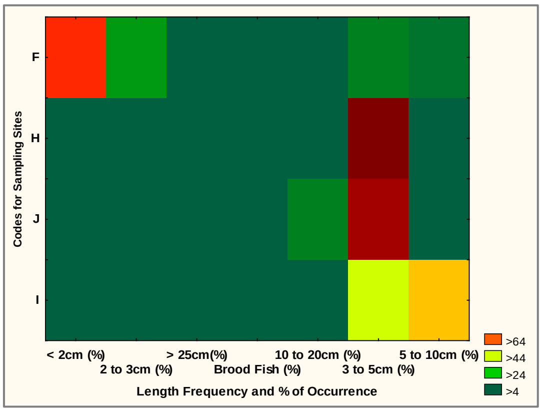
18th Monitoring, November, 2018



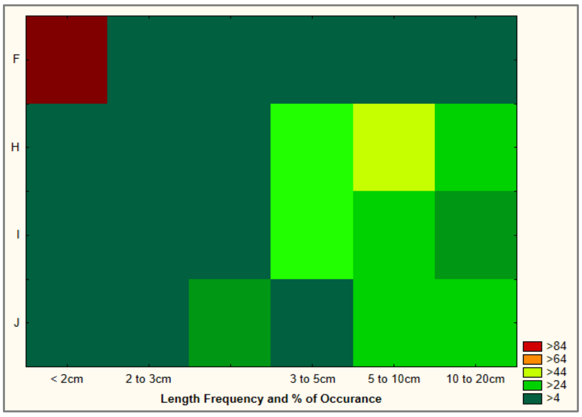
19th Monitoring, February, 2019



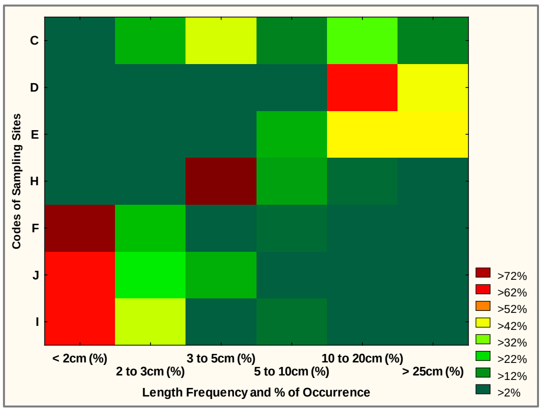
20th Monitoring, April, 2019



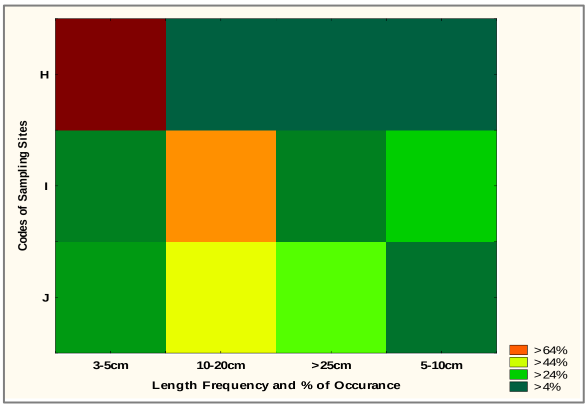
21st Monitoring, July 2019



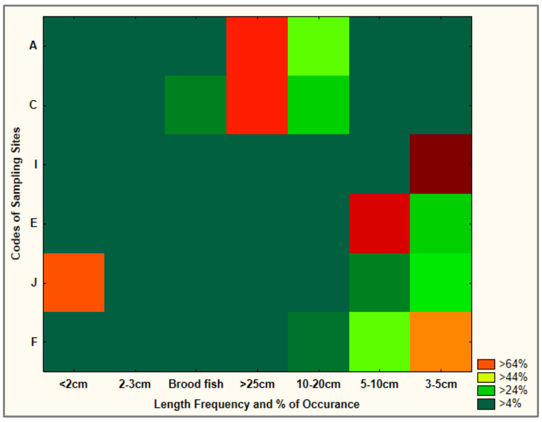
22nd Monitoring, November 2019



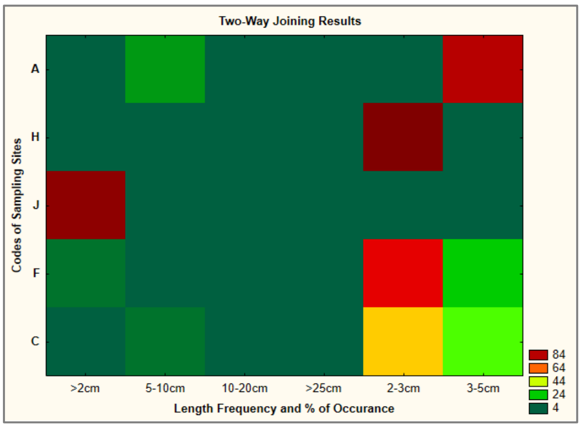
23rd Monitoring, February 2020



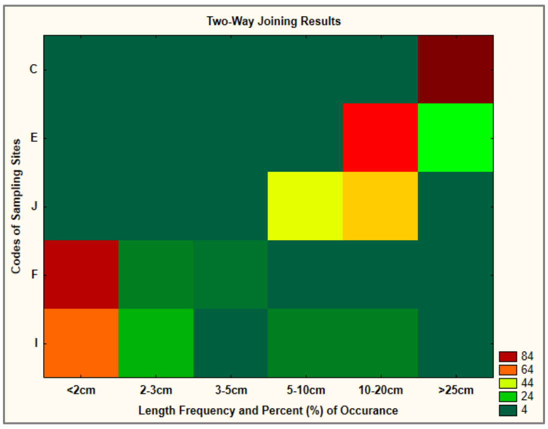
25th Monitoring, July 2020



26th Monitoring, November 2021

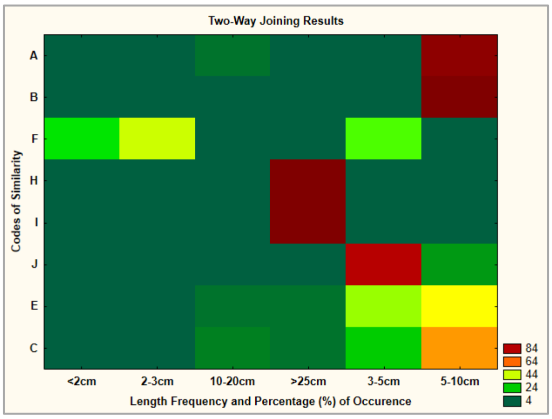


27th Monitoring, January, 2021

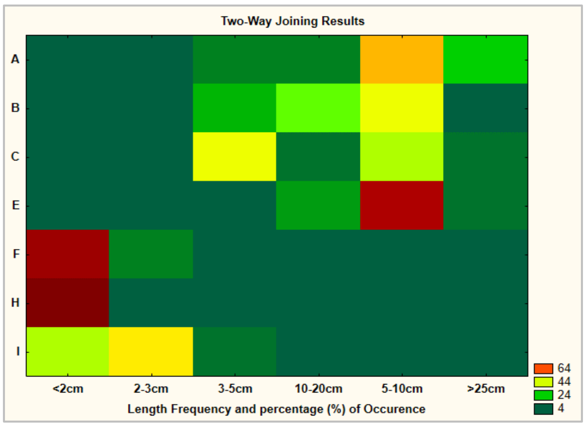


28th monitoring, April, 2021

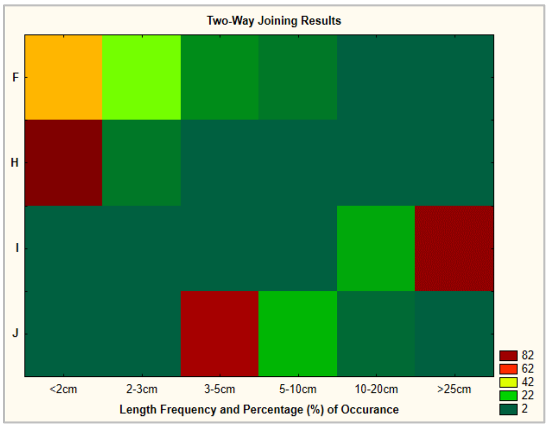
29th monitoring, August, 2021



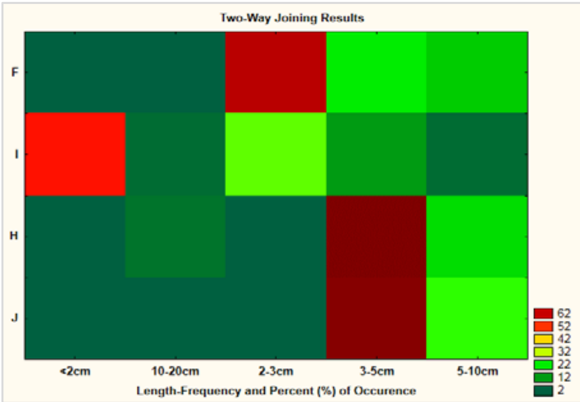
30th Monitoring, November, 2021



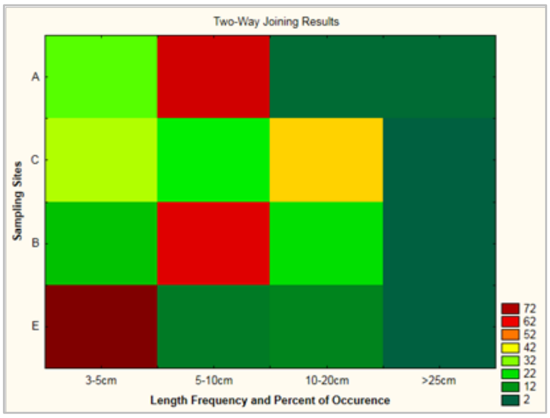
31st Monitoring, February, 2022



32nd Monitoring, May 2022



33rd Monitoring, July 2022



34th Monitoring, Oct 2022

D.4: Occurrence of Species

Local Name	Scientific Name	Local Status*	1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
			'-' = No; '+' = Occurrence											
Hilsa	*Tenualosa ilisha*	NO	-	-	+	-	-	+	+	-	-	-	+	-
Sagor Baim	*Anguilla bengalensis*	NT	+	-	-	-	-	+	-	-	-	-	-	-
Bacha	*Eutropiichthys vacha*	CR	+	-	-	-	-	-	-	-	-	+	-	-
Bagda Chingri	*Penaeus monodon*	DD	+	+	+	+	+	+	+	+	+	+	-	+
Banspata	*Brachypleura novae-zeelandiae*	NO	+	+	+	+	-	+	+	+	+	-	+	+
Kukurjib	*Cynoglossus lingua*	NO	+	-	-	-	-	-	-	+	+	+	-	+
Bele	*Glossogobius giuris*	NO	+	+	+	+	+	+	+	+	+	-	+	+
Aswine Bele	*Butis butis*	NO	-	-	-	-	-	-	+	+	+	+	+	+
Bairagi	*Coilia dussumieri*	NO	+	+	+	+	+	+	-	+	-	-	-	+
Boishakhi Chingri	*Macrobrachium* sp.	NO	-	+	-	-	+	+	+	+	+	-	-	-
Chammu Chingri	*Metapenaeus brevicornis*	DD	+	+	+	-	+	+	+	+	+	+	+	-
Chaka Chingri	*Penaeus indicus*	DD	+	+	-	+	+	+	+	+	+	-	+	-
Ghora Chela	*Securicula gora*	-	+	-	-	-	-	-	-	-	-	-	-	-
Chanda Chela	*Securicula* sp.	-	-	+	+	-	-	-	-	-	+	+	-	-
Sada Chewa	*Trepauchen vagina*	NO	+	-	+	-	-	+	-	-	-	+	-	-
Lal Chewa	*Taenioides cirratus*	NO	+	+	+	+	+	+	+	+	+	-	-	-
Chhuri	*Trichiurus muticus*	NO	+	-	+	-	-	-	-	-	-	-	-	-
Sagor Chela	*Megalops cyprinoids*	NO	+	-	-	-	-	-	-	-	-	-	-	-
Purabi Chela	*Thryssa purava*	NO	+	-	-	-	-	-	-	-	-	-	-	-
Kabashi Tengra	*Mystus cavasius*	DD	+	-	-	-	-	-	-	-	-	-	-	-
Gagra Tengra	*Nemapteryx nenga*	DD	-	+	+	-	+	-	+	-	+	+	+	+
Gulsha Tengra	*Mystus bleekery*	DD	+	+	-	+	-	+	+	+	+	+	+	+
Harina Chingri	*Metapenaeus ensis*	DD	+	+	+	+	+	+	+	+	+	-	+	-
Ekthuto	*Hyporhampus limbatus*	NO	+	-	+	+	-	-	-	+	+	-	+	-
Kakila	*Xenentodon cancila*	NO	+	-	-	-	-	-	-	-	-	-	+	-
Chapila	*Gudusia chapra*	NO	+	+	-	-	-	-	-	-	-	+	-	-
Kuchia	*Monopterus cuchia*	DD	+	+	-	+	+	+	+	+	+	+	+	+
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
		‘-‘ = 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
			‘-‘ = No; ‘+’ = Occurrence																					
Mud Crab	*Scylla serrata*	NO	+	+	+	+	-	+	+	+	-	+	+	-	-	-	-	-	+	+	+	+	+	+
Tular Dandi	*Sillaginopsis panijus*	NO	-	+	-	-	-	+	+	+	+	-	-	-	+	-	+	-	+	-	+	-	-	-
Paira Chanda	*Scatophagus argus*	DD	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	+	-	-	+	-
Paissa	*Liza parsia*	NO	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+
Pangas	*Pangasius pangasius*	CR	-	-	-	-	-	+	+	+	+	+	-	-	-	-	-	+	+	+	-	-	+	-
Tak Chanda	*Leiognathus equulus*	NO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pheksa	*Setipinna phasa*	NO	+	+	-	+	-	-	+	+	+	+	+	-	+	-	+	+	-	+	-	-	-	+
Teli Pheksa	*Setipinna phasa*	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Poma	*Poma poma*	NO	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+
Potka	*Chelonodon patoca*	NO	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	+	-	+	+	-	-	+
Shilong	*Silonia silondia*	EN	+	+	-	-	-	-	-	-	-	+	-	+	-	-	-	+	+	-	-	-	-	-
Tailla	*Eleutheronema tetradactylum*	DD	-	-	-	-	-	+	-	+	+	-	-	-	+	+	-	+	+	-	-	-	+	-
Tapse	*Polynemus paradiseus*	DD	-	+	+	+	+	+	+	+	+	-	+	+	+	-	-	+	+	-	+	-	-	-
Daitna	*Acanthopagrus latus*	DD	-	+	+	+	-	+	+	+	-	-	+	-	+	+	-	-	-	+	-	-	+	+
Shole	*Channa striatus*	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-
Magur	*Clarias batrachus*	DD	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Koi	*Anabas testudineus*	DD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Vetki	*Lates calcarifer*	DD	+	+	+	+	-	+	+	-	+	-	-	-	+	-	-	+	-	-	-	-	+	-

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

Fish Species	Sampling	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Amadi	A	0	0	0	100	0	0	0
	F	100	0	0	0	0	0	0
Bagda	F	100	0	0	0	0	0	0
	H	0	100	0	0	0	0	0
	I	0	100	0	0	0	0	0
Banshpata	A	0	0	0	0	100	0	0
	F	0	100	0	0	0	0	0
	J	0	0	0	100	0	0	0
Bele	F	50	50	0	0	0	0	0
	H	0	100	0	0	0	0	0
	I	0	50	50	0	0	0	0
Bhangan	F	0	0	100	0	0	0	0
Chaka Chingri	A	0	0	25	75	0	0	0
	F	0	0	0	100	0	0	0
	I	0	100	0	0	0	0	0
Chali Chingri	A	0	0	33.33	66.67	0	0	0
	B	0	0	0	100	0	0	0
	F	33.33	0	66.67	0	0	0	0
	H	0	100	0	0	0	0	0
Chapila	A	0	0	50	50	0	0	0
Chela	F	0	50	0	50	0	0	0
	I	0	0	100	0	0	0	0
Chewa	F	0	0	0	50	50	0	0
	H	0	0	0	100	0	0	0

Fish Species	Sampling	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
	I	0	0	0	100	0	0	0
Chota Baila	A	0	0	0	0	50	50	0
	F	0	0	0	100	0	0	0
	J	0	0	100	0	0	0	0
Datina	A	0	0	0	50	50	0	0
	B	0	0	0	50	50	0	0
	E	0	0	0	50	50	0	0
Dogri	F	0	0	0	100	0	0	0
	H	0	0	0	100	0	0	0
	I	0	0	0	100	0	0	0
	J	0	0	0	100	0	0	0
Gagra Tengra	C	0	0	0	0	100	0	0
	E	0	0	0	0	100	0	0
	F	0	0	0	100	0	0	0
Galda	B	0	0	0	0	100	0	0
	C	0	0	0	0	100	0	0
	E	0	0	0	0	100	0	0
Goda Chingri	H	0	100	0	0	0	0	0
	J	0	0	100	0	0	0	0
Harina	F	0	0	100	0	0	0	0
	H	0	0	0	100	0	0	0
	J	0	0	33.33	66.67	0	0	0
Java	B	0	0	0	0	0	100	0
	E	0	0	0	0	0	100	0
Kain	B	0	0	0	0	0	100	0
	C	0	0	0	0	0	100	0
	E	0	0	0	0	0	100	0
Kakila	A	0	0	0	0	100	0	0
	B	0	0	0	0	100	0	0
Khaira	I	0	100	0	0	0	0	0
Kharolla	H	0	100	0	0	0	0	0
Kumirer Khil	H	0	0	0	100	0	0	0
	I	0	0	0	100	0	0	0
Motka	F	0	0	100	0	0	0	0
	I	0	50	50	0	0	0	0
	J	0	0	100	0	0	0	0
Mutkura	F	100	0	0	0	0	0	0
	H	0	100	0	0	0	0	0
Paisse	A	0	0	0	50	50	0	0
	B	0	0	0	50	50	0	0
	F	33.33	33.33	33.33	0	0	0	0
	H	0	100	0	0	0	0	0
	I	0	100	0	0	0	0	0
Phesa	A	0	0	0	50	50	0	0
Poa	A	0	0	0	50	50	0	0
	E	0	0	0	50	50	0	0
Sada Baila	A	0	0	0	50	50	0	0

Fish Species	Sampling	L (< 2cm)	L (2 to 3cm)	L (3 to 5cm)	L (5 to 10cm)	L (10 to 20cm)	L (> 25cm)	Brood Fish
Tengra	F	0	0	0	100	0	0	0
Tepa	I	0	0	100	0	0	0	0
Tiger Chingri	A	0	0	0	50	50	0	0
	F	0	0	0	100	0	0	0
	H	0	0	0	100	0	0	0
	J	0	0	0	100	0	0	0
Tirel	F	0	0	100	0	0	0	0
Vati Chingri	F	100	0	0	0	0	0	0
	I	100	0	0	0	0	0	0

Source: CEGIS field survey, October, 2022

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

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

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
		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	-	-	-		-	-
	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	-	-	-	-	-	-		-	-

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	-	-	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 and Growing		-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing	-			-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-		Feeding and Growing	-
Potka	Haldikhali	Adult	Feeding and Breeding	-	-	-	-	-	-	-	-		-	-
	Chandpai	Fry	Spawning	Spawning and Nursing	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	Feeding
		Adult	-	-	-	Feeding	-	-	-	-	-		Feeding	-
	Mongla Point	Fry	Spawning	-	-	-	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	-	Feeding and Growing		-	-
	Harbaria	Fry	-	-	-	-	-	Nursery	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	-	Feeding and Growing	-		-	-

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
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		-	-
	Chandpai	Juvenile and Adult	-	-	Feeding and Growing	Feeding	-	Feeding	-	Feeding	-		Feeding and Growing	
	Harbaria	Juvenile and Age-1 Adult	-	-	-	-	-	-	Feeding and Growing				-	-
	Mongla Point	Fry	Breeding and Spawning	-	-	-	-	Nursery	-	-	-		-	-
	Mongla Point	Fry, Juvenile-1 and Juvenile			Nursing and Growing	-	-	-	-	-	-		-	-
	Mongla Point	Juvenile and Adult	-	-	-	Feeding	Feeding and Growing	Feeding	Feeding and	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
									Growing					
	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
		Juvenile	-	-	-	-	-	-	Feeding and Growing			-	-	-
	Haldikhali	Juvenile and Adult	Feeding	-	Feeding And Growing	Feeding	-	-	-	-	-		-	-
		Juvenile	-	-	-	-	-	-	Feeding	-	-		-	-

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose											
			1st QM	2nd QM	3rd QM	4th QM	5th QM	6th QM	7th QM	8th QM	9th QM	10th QM	11th QM	12th QM
									and 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	-	-	-	-	-	-		-	-

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

Migratory Fish Species	Sampling Sites	Year Class*	Migration Purpose																					
			13th QM	14th QM	15th QM	16th QM	17th QM	18th QM	19th QM	20th QM	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
Tapsi	Haldikhali	Juvenile and Age-1 adult	-	-	G	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Charaputia	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-
	Chalna Point	Age-1 adult and Brood fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	M&F	-	-	-
		Adult	-	F	-	-	F	-	-	F	F		-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile and Age-1 adult	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	-	-	-	-
	Akram Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	F	F	-	-	-	-	F&G
	Chandpai	Fry	-	N	-	N	-	-		N	-		-	-	-	-	-	-	-	-	-	-	-	N
		Juvenile	-	F&G	F&G	F&G	-	M	F&G	-	N		-	-	-	-	-	-	-	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
	Chalna Point	Juvenile and Age-1 adult	-	-	-	-	-	-	-	F	-		-	-	-	-	-	-	-	-	M&F	-	-	-
		Fry	N	-	-	-	-	N	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	F&G	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Fry	N	-	N	-	-	-	-	-	-		N	N	-	-	-	-	-	-	F&G	-	-	-
		Juvenile	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Juvenile	-	-	-	-	-	M	-	-	-	F&G	-	-	-	-	F&G	-	-	-	M	-	-	-
		Fry	N	-	N	-	-	N	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-
	Charaputia	Adult	-	-	-	-	-	-	-	F	-		-	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-
Chapila	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	G	-	-	-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Fry	-	-	-	-	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	-	-	-	-	-	-
	Charaputia	Brood Fish	-	-	-	S	-	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile and Adult	-	-	-	F	-	-	G&M	F	-		G&M	-	-	G&M	M	-	M	G&M	-	-	-	-
	Chandpai	Fry	-	-	-	N	N	-	-	-	-		-	-	-	-	-	-	N	-	G	-	-	-
		Juvenile	F&G	-	-	F&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	-	-	-	-	-	-	-	-	-	-

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
		Juvenile	-	-	-	-	-	-	-	-	N		-	-	-	-	-	-	-	-	-	-	-	-
		Age-1 Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	M	-	-	-	-	-	-
	Maidara	Adult	-	F	-	-	-	-	M&F	-	-		F	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	-	-	-	-	-	-	M&F	-	-	-	-	-	-	-	-	-	-
		Fry	-	-	-	-	-	N	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Juvenile and Adult	-	F&G	-	-	-	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	-	-	-	-
	Charaputia	Juvenile and Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-
	Harbaria	Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	-	-	N&M	-	-	-	-	-	-	-	-	-
	Chalna Point	Fry and Juvenile	-	-	-	N&F	-	-	-	-	-	N&M	-	N&M	-	-	-	-	-	-	-	M&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	-	-	-
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	-
		Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Haldikhali	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	F&G	-	-	-	-	-
		Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-	-
	Harbaria	Adult	F	B	-	-	-	-	F	-		-	-	-	M	-	M	F	M	-	-	-	-	
		Juvenile	-	-	-	-	M	-	M	-		-	-	-	-	-	-	-	-	-	-	-	-	F&G
	Charaputia	Juvenile and Age-1 adult	-					M	-	-		M	-	-	M	-	M	-	M	-	-	-	M&F	M
Gulsha Tengra	Haldikhali	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	M	-	-	-	-
	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	M	-	-	-	-
	Chandpai	Age-1 adult	F	-	F&G	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	F&G	-	F&G	-	-	-	-	-		-	-	-	-	-	-	F&G	-	F&G	F&G	-	-
	Charaputia	Juvenile	-	-	-		-	-	F&G	-	-		-	-	-	-	-	-	-	-	-	-	-	-
		Age-1 adult	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	M	-	-	-	-	-
	Mongla Point	Age-1 adult	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	-	-	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
		Age-1 adult	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Juvenile	-	-	-	-	-	-	-	-	-	-	-	F&G		-	-	-	-	-	-	M	-	-
Potka	Akram point	Adult	-	-	-	--		-	-	-	-	-	--		-	-	-	-	-	F	-	-	-	-
	Haldikhali	Adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-
	Chalna Point	Fry	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chandpai	Fry	-	-	-	-	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	F	-	-	-	-	-	F&G	-	-		-	-	-	-	F and G	-	-	-	-	-	-	-
		Adult	-	F&G	F	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-
	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	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-
		Fry and Juvenile	-	-	-	-	-	-	-	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	-	-	-	-	N	M	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	-	-

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
	Chalna Point	Fry	-	-	N	N	-	-	-	-			-		-	-	-	-	-	-	-	-	-	-
		Fingerling	-	-	-	-	N	-	-	-	-		N	N	-	-	-	-	-	-	-	-	-	-
		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	-	-	-	-	-	-	-
		Fry	N	-	N	-	-	-	-	-		-	-		-	-	-	-	-	N	-	-	-	N
	Charaputia	Juvenile and Age-1 adult	-	-	-	-	-	M	-	-		-	-		-	-	-	M	-	M	-	-	-	-
Tular Dandi	Akram Point	Adult	-	-	-	-	-	-	-	F&M	-		-	-	-	-	-	-	-	-	-	-	-	-
	Chandpai	Age-1 Adult	-	-	F	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
		Juvenile	-	-	-	-	-	G	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
		Fry	-	-	-	-	-	-	-	N	-		-	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Adult	-	F	-	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	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		-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Juvenile	-	-	-	-	-	G	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
Pheksa	Akram Point	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	M	M	-	-	-	-	
	Charaputia	Juvenile and Adult	-	-	-	-	-	-	-	F&M	-			-	-	-	-	-	-	M	-	-	-	
	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Maidara	Adult	-	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	-

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
		Adult	-	F	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	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	-	-			-	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Fry	-	-	-	-	-	-	-	N			-	-	-	-	-	-	-	-	-	-	-	-
	Harbaria	Juvenile	-	-	F&G	-	-	M	-	-			-	-	F&G	-	-	-	F&G	F&G	-	-	G&M	-
	Mongla Point	Fry	-	-	N	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-
		Age-1 Adult	-	-	-	-	-	-	-	-		M	-	-	-	-	-	-	-	-	-	G&M	-	-
	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	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Jongra	Juvenile	-	-	-	-	-	-	-	M	-		-	-	-	-	-	-	-	-	-	-	-	-
	Charaputia	Juvenile and Age-1 Adult	-	-	-	F	-	-	G&M	-	-		-	-	-	G&M	-	-	G&M	M	-	-	-	-
	Akram Point	Juvenile	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	G&M	-	-	-	G&M
	Haldikhali	Juvnile and adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	M	-	-	-	-
	Harbaria	Adult	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	F& G	-	-	-	-	-
	Mongla Point	Juvenile	-	-	-	-	F&G	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Maidara	Juvenile and Age-1 Adult	-	-	-	-	-	G&M	G&M	-	-		-	-	M	-	-	-	-	-	-	-	-	-
		Adult	-	F	-	-	-	F	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
	Chalna Point	Juvenile and Age-1 Adult	-	-	-	-	-	-	G&M	F	G&M		-	G&M	-	-	-	-	-	-	-	-	-	-
Hilsa	Akram Point	Brood Fish	-	-	-	-	-	-	-	-	-		-	-	-	-	-	M	-	-	-	-	-	-
	Maidara	Age-1 Adult	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-	M	M	-	-	-	-	-
	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: Field findings at different times *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.7: The Present Catch in Three Sampling Ghers

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

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
	-	-	-	-	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**

Sampling Site	Total Catch (ton): 2015-2016							
	5th QM		6th QM		7th QM		8th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
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

Sampling Site	Total Catch (ton): 2016-2017							
	9th QM		10th QM		11th QM		12th QM	
	Species	ton	Species	ton	Species	ton	Species	ton
	-	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					-	-	-	-

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
							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**							**-**	**-**

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**
							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
	-	-	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

Total Catch (ton): 2019-20, 2020-21, 2021-22 and 2022-23																												
Sampling Site/ Location	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	
	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)
	Bagda	2.72	Bagda	0.8	Harina	0.02	Bagda	1.2	Patari	0.2	-	-	Bagda	0.7	Bagda	0.5	Patari	0.30	-	-	Bagda	1.2	Bagda	1.2	Bagda	0.7	Bagda	-
	Harina	3.44	Harina	1.0	-	-	Harina	2.0	Tilapia	0.5	-	-	Harina	0.15	Harina	0.6	Harina	0.10	-	-	Harina	0.5	Harina	0.2	Harina	0.2	Harina	-
	Tilapia	0.7	Chali	0.2	-	-	Tilapia	1.0	Paissa	0.05	-	-	-	-	Paissa	0.05	Tilapia	1.20	-	-					Tilapia	2.0	Tilapia	1.0
	Parse	0.17	Patari	0.3	-	-	-	-	Harina	0.2	-	-	-	-	Tilapia	2.0	Chali	0.10	-	-					Paissa	0.5	Paissa	0.2
Bhekatkhali Khal, Rajnagar	-	-	Tairel	0.03	-	-	-	-	Carpu	1.0	-	-	-	-	Chali	0.3									Patari	0.05	Patari	0.1
	-	-	Tilapia	0.5	-	-	-	-	Rui	0.05	-	-	-	-											-	-	-	-
	-	-	Datina	0.02	-	-	-	-	Grass Carp	0.05	-	-	-	-											-	-	-	-
									Golda	0.02	-	-	-	-													-	-
									Bagda	0.3	-	-	-	-														
Sub-total =		**7.0**		**2.8**		**0.02**		**4.2**		**2.37**	**-**	**-**		**0.85**		**3.45**		**1.70**	**-**	**-**		**1.7**		**1.4**		**3.0**		**1.3**
	Bagda	6.74	Bagda	3.42	Harina	0.01	Bagda	4.84	Bagda	1.45	-	-	Bagda	0.04	Bagda	2.73	Bagda	0.07	-	-	Bagda	3.2	Bagda	1.5	Bagda	0.07	-	-
	Golda	0.01	Harina	3.96	-	-	Hatina	0.92	Hatina	1.08	-	-	Hatina	0.14	Harina	0.96	Harina	0.81	-	-	Harina	0.28	Harina	0.16	Harina	0.8	-	-
	Harina	0.65	Chali	0.38	-	-	Chali	0.20	Chali	0.30	-	-	Chali	0.03	Chali	0.11	Chali	0.01	-	-	Chali	0.12	Chali	0.1	Chali	0.12	-	-
	Chali	0.04	Bele	2.11	-	-	Bele	0.27	Bele	0.19	-	-			Bele	0.44	Bele	0.58			Bele	0.15	Bele	0.15	Bele	0.52	-	-
	Bele	0.09	Paissa	2.62	-	-	Paissa	0.04	Paissa	1.80	-	-			Paissa	0.2	Paissa	0.34			Paissa	0.1	Paissa	0.2	Paisas	0.32	-	-
Kapashdanga-Muralia	Tilapia	0.22	Tilapia	9.85	-	-	Tilapia	3.87	Tilapia	6.93	-	-			Tilapia	12.9	Tilapia	7.82			Tilapia	4.5	Tilapia	1.5	Tilapia	7.0	-	-
	Tengra	0.57	Golda	0.04	-	-	Golda	0.03	Golda	0.03	-	-			Tengra	0.01	Tengra	0.02			Patari	0.4	Tengra	0.1	Tengra	0.02		
	Bhangan	0.08	Tengra	0.17	-	-	Tengra	0.01	Tengra	0.17	-	-					Patari	1.76					Patari	0.6	Patari	1.60		
	-	-	Patari	2.25	-	-	Patari	0.11	Patari	0.25	-	-					Datina	0.06					Datina	0.14	Datina	0.06	-	-
	-	-	Chemo	0.02	-	-	Datna	0.01	Catol	0.04	-	-					Rui	0.27					Rui	0.6	Rui	0.24	-	-
	-	-	Datina	1.01	-	-	Rui	0.47	Chemo	0.32	-	-					Kailla	0.03					Kailla	0.1			-	-
	-	-	Rui	1.27	-	-	Chaka	0.05			-	-																

Total Catch (ton): 2019-20, 2020-21, 2021-22 and 2022-23																												
	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	
Sampling Site/ Location	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**	**Fish Species**	**Production (ton)**
	-	-	Chaka	0.01	-	-	-	1.56			-	-																
	-	-	Kailla	0.96	-	-	-	-			-	-																
	-	-	Nundi Bele	0.02	-	-	-	-			-	-																
	-	-	Kakra	0.49	-	-	-	-			-	-																
Sub-total =		**8.0**		**29**		**0.01**		**12.38**		**12.57**	**-**	**-**		**0.21**		**17.38**		**11.76**	**-**	**-**		**8.39**		**5.15**		**10.75**		
Chunkuri-2	Patari	0.01	Tilapia	0.02	-	-	Paissa	0.05	Sada Chingri	0.03	-	-	Bagda	0.01	Paissa	0.12	Paissa	0.08	-	-	Bagda	0.04	Bagda	0.05	Kharalla	0.05	-	-
	Tair/Tailla	0.01	Paissa	0.066	-	-	Golda	0.03	Paissa	0.03	-	-	Harina	0.06	Bagda	0.04	Bagda	0.04	-	-	Harina	0.07	Harina	0.4	Paissa	0.80	-	-
	Bhangan	0.01	Khorsul	0.009	-	-	Kharulla	0.01	Patari	0.02	-	-	Kakra	0.01	Tilapia	0.08	Tilapia	0.16	-	-			Paissa	0.4	Bagda	0.06	-	-
	Datina	0.03	Bagda	0.015	-	-	Bagda	0.10	Tengra	0.01	-	-			Harina	0.06	Harina	0.04							Patari	0.04	-	-
	Bagda	0.02	Golda	0.006	-	-	Bele	0.03	Datina	0.02	-	-			Kakra	0.12	Patari	0.04							Tilapia	0.12		
	Golda	0.03	Patari	0.015	-	-	Harina	0.15	Ilish	0.005	-	-			Patari	0.02	Kala Chingri	0.04							Harina	0.40		
	Faissa	0.01	Harina	0.008	-	-	Tengra	0.02	Golda	0.01	-	-			Kala Icha	0.04	Sada Chingri	0.04										
	Chaka Chingri	0.01	Chali	0.009	-	-	Tairu	0.03	Nilotica	0.06	-	-			Sada Icha	0.04	Golda	0.01										
	Harina	0.02	China Punti	0.047	-	-	Chaka	0.01	Baila	0.004	-	-			Bele	0.01												
	-	-	Tengra	0.008	-	-	Datina	0.02	Goda Chingri	0.001	-	-			Golda	0.01												
	-	-	Baila	0.003	-	-	-	-	Chaka Chingri	0..2	-	-																
	-	-	Datina	0.02	-	-	-	-	Harina	0.02	-	-																
									Chitra	0.004	-	-																

Total Catch (ton): 2019-20, 2020-21, 2021-22 and 2022-23																												
Sampling Site/ Location	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	
	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)	Fish Species	Production (ton)
									Pheksa	0.01	-	-																
									Bhangan	0.004	-	-																
									Tairel	0.01	-	-																
									Golda	0.01	-	-																
									Bagda	0.02	-	-																
Sub-total =		**0.15**		**0.46**		**0.00**		**0.44**		**0.25**	**-**	**-**		**0.08**		**0.54**		**0.45**	**-**	**-**		**0.11**		**0.13**		**1.47**		

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

(E) Traffic Survey data

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

Date: January 28, 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	60	100	0	25	50	0.0	13	56	0
Auto Rickshaw	0.8	3	3	5	5	2	5.6	0	0	0
Van	0.6	200	155	213	185	120	183.0	130	170	180
Cycle	0.2	26	126	30	30	25	11.0	40	28	14
Human Howler	0.6	9	3	7	6	5	6.6	8	33	25
CNG	0.5	30	40	35	28	22	25.0	20	25	23
Private Car	1	55	85	140	40	77	117.0	23	119	142
Motor Cycle	0.3	450	440	267	225	195	126.0	310	336	194
Jeep	1	23	8	31	8	15	23.0	6	19	25
Pick-up	2	15	71	172	12	38	100.0	18	55	146
Micro	1	70	55	125	30	38	68.0	41	82	123
Bus	2.5	157	110	668	95	114	522.5	66	130	490
Light Truck	2	33	6	78	63	25	176.0	20	19	78
Medium Truck	2	144	95	478	77	77	308.0	121	100	442
Heavy Truck	2	24	28	104	5	30	70.0	30	25	110
			Total	**2353**		**Total**	**1741.7**		**Total**	**1990.5**

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

Date: January 26, 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	44	40	0	10	9	0	22	40	0
Auto Rickshaw	0.8	2	1	2.40	0	0	0	1	1	2
Van	0.6	66	121	112.20	90	145	141	92	99	115
Cycle	0.2	11	5	3.20	11	3	3	8	18	5
Human Howler	0.6	23	30	31.80	21	33	32	21	31	31
CNG	0.5	72	80	76.00	33	32	33	55	65	60
Private Car	1	24	13	37.00	20	16	36	30	22	52
Motor Cycle	0.3	150	70	66.00	52	91	43	170	183	106
Jeep	1	15	8	23.00	8	5	13	9	6	15
Pick-up	2	8	10	36.00	5	3	16	5	7	24
Micro	1	25	16	41.00	9	22	31	16	15	31
Bus	2.5	44	34	195.00	8	29	93	20	22	105
Light Truck	2	10	6	32.00	4	7	22	9	4	26
Medium Truck	2	55	29	168.00	25	30	110	33	23	112
Heavy Truck	2	11	7	36.00	12	8	40	14	22	72
			0	**860**		**Total**	**612**		**Total**	**756**

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

Date: January 27, 2023

Vehicles		7:00 AM to 10:00AM			12:00 PM to 2:00PM			17:00 PM to 19:00PM		
Direction	**Factor**	**Power Plant to Zero Point**	**Zero Point to Power plant**	**PCU**	**Power Plant to Zero Point**	**Zero Point to Power plant**	**PCU**	**Power Plant to Zero Point**	**Zero Point to Power plant**	**PCU**
Pedestrian	0	48	5	0	16	4	0	33	7	0
Auto Rickshaw	0.8	1	0	0.8	1	0	0.8	1	0	0.8
Van	0.6	44	85	77.4	45	55	60	66	39	63
Cycle	0.2	19	72	18.2	19	2	4.2	30	12	8.4
Human Howler	0.6	20	55	45	15	21	21.6	11	22	19.8
CNG	0.5	25	15	20	35	5	20	33	14	23.5
Private Car	1	7	8	15	5	1	6	6	5	11
Motor Cycle	0.3	75	199	82.2	44	35	23.7	155	25	54
Jeep	1	1	3	4	2	8	10	1	2	3
Pick-up	2	8	5	26	2	1	6	7	2	18
Micro	1	15	22	37	7	21	28	15	2	17
Bus	2.5	4	3	17.5	2	0	5	2	0	5
Light Truck	2	12	2	28	11	0	22	21	1	44
Medium Truck	2	0	4	8	1	15	32	5	11	32
Heavy Truck	2	0	0	0	3	0	6	5	2	14
			Total	**379**		**Total**	**245**		**Total**	**314**

Monitoring results

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010301	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_01)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	30	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
5	Chloride	150-600	40	mg/L	Titrimetic	-
6	Bi-Carbonate (HCO3-)	0.0	38	mg/L	Titrimetic	-
7	Cr (Total)	0.05	0.018	mg/L	AAS	0.0003
8	Hardness	200-500	190	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	3.91	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	13	mg/L	AAS	0.05
12	Phosphate	6.0	0.30	mg/L	UVS	0.10
13	Potassium (K)	12.0	12	mg/L	AAS	-
14	Total Dissolved Solid (TDS)	1000	155	mg/L	Multimeter	-
15	Total Suspended Solid (TSS)	10	16	mg/L	Gravimetric Method	-
16	Turbidity	10	108	NTU	Turbidity Meter	-
17	Carbonate (CO3)	-	0.20	mg/L	Titrimetic	-

Comments: Sample was collected & supplied by client.

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

Alam

02/02/2023

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	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023 02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	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: 736/ CC, DPHE, CL, Dhaka — Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010302	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_02)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	8	mg/L	CRM	-
4	Cr (Total)	0.05	0.013	mg/L	AAS	0.0003
5	Hardness	200-500	140	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.003	mg/L	AAS	0.001
7	Phosphate	6.0	0.25	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	150	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	15	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka — Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010303	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_03)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.007	mg/L	AAS	0.0003
5	Hardness	200-500	150	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.004	mg/L	AAS	0.001
7	Phosphate	6.0	0.40	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	136	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	19	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010304	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_04)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	35	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	12	mg/L	CRM	-
5	Chloride	150-600	45	mg/L	Titrimetic	-
6	Bi-Carbonate (HCO3-)	0.0	40	mg/L	Titrimetic	-
7	Cr (Total)	0.05	0.008	mg/L	AAS	0.0003
8	Hardness	200-500	130	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	3.60	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	16	mg/L	AAS	0.05
12	Phosphate	6.0	0.46	mg/L	UVS	0.10
13	Potassium (K)	12.0	10	mg/L	AAS	-
14	Total Dissolved Solid (TDS)	1000	158	mg/L	Multimeter	-
15	Total Suspended Solid (TSS)	10	18	mg/L	Gravimetric Method	-
16	Turbidity	10	119	NTU	Turbidity Meter	-
17	Carbonate (CO3)	-	0.34	mg/L	Titrimetic	-

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

Alam ~~Ihna~~ Jon. BHossain 02/02/2023

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	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023 BHossain 02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010305	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_05)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.010	mg/L	AAS	0.0003
5	Hardness	200-500	125	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
7	Phosphate	6.0	0.35	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	135	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	14	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010306	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_06)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.007	mg/L	AAS	0.0003
5	Hardness	200-500	115	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.003	mg/L	AAS	0.001
7	Phosphate	6.0	0.37	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	133	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	16	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010307	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_07)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	Calcium (Ca)	75	24	mg/L	AAS	0.17
4	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
5	Chloride	150-600	80	mg/L	Titrimetic	-
6	Bi-Carbonate (HCO3-)	0.0	45	mg/L	Titrimetic	-
7	Cr (Total)	0.05	0.009	mg/L	AAS	0.0003
8	Hardness	200-500	152	mg/L	Titrimetic	-
9	Iron (Fe)	0.3-1	3.46	mg/L	AAS	0.05
10	Lead (Pb)	0.05	0.005	mg/L	AAS	0.001
11	Magnesium (Mg)	30-35	17	mg/L	AAS	0.05
12	Phosphate	6.0	0.41	mg/L	UVS	0.10
13	Potassium (K)	12.0	9	mg/L	AAS	-
14	Total Dissolved Solid (TDS)	1000	235	mg/L	Multimeter	-
15	Total Suspended Solid (TSS)	10	21	mg/L	Gravimetric Method	-
16	Turbidity	10	147	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, MFM-Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ - Limit of Quantitation.

02/02/2023
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	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010308	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_08)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	8	mg/L	CRM	-
4	Cr (Total)	0.05	0.010	mg/L	AAS	0.0003
5	Hardness	200-500	140	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.005	mg/L	AAS	0.001
7	Phosphate	6.0	0.50	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	136	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	18	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010309	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_09)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	4	mg/L	CRM	-
4	Cr (Total)	0.05	0.015	mg/L	AAS	0.0003
5	Hardness	200-500	130	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	132	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	14	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka — Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010310	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_10)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	8	mg/L	CRM	-
4	Cr (Total)	0.05	0.011	mg/L	AAS	0.0003
5	Hardness	200-500	155	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.007	mg/L	AAS	0.001
7	Phosphate	6.0	0.43	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	210	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	15	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka — Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010311	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_11)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	12	mg/L	CRM	-
4	Cr (Total)	0.05	0.009	mg/L	AAS	0.0003
5	Hardness	200-500	140	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.006	mg/L	AAS	0.001
7	Phosphate	6.0	0.56	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	140	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	18	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010312	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_12)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	8	mg/L	CRM	-
4	Cr (Total)	0.05	0.010	mg/L	AAS	0.0003
5	Hardness	200-500	115	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.024	mg/L	AAS	0.001
7	Phosphate	6.0	0.38	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	210	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	25	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010313	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_13)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	16	mg/L	CRM	-
4	Cr (Total)	0.05	0.016	mg/L	AAS	0.0003
5	Hardness	200-500	110	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.010	mg/L	AAS	0.001
7	Phosphate	6.0	0.60	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	315	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, MFM-Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010314	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_14)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	8	mg/L	CRM	-
4	Cr (Total)	0.05	0.009	mg/L	AAS	0.0003
5	Hardness	200-500	2000	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.012	mg/L	AAS	0.001
7	Phosphate	6.0	0.63	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	2890	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	23	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010315	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Surface Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : SW_15)	Union:, Vill.:
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	8	mg/L	CRM	-
4	Cr (Total)	0.05	0.030	mg/L	AAS	0.0003
5	Hardness	200-500	2500	mg/L	Titrimetic	-
6	Lead (Pb)	0.05	0.003	mg/L	AAS	0.001
7	Phosphate	6.0	0.46	mg/L	UVS	0.10
8	Total Dissolved Solid (TDS)	1000	5300	mg/L	Multimeter	-
9	Total Suspended Solid (TSS)	10	21	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010316	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Ground Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW_01)	Union:, Vill.:Rajnagar
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

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	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	130	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.003	mg/L	AAS	0.001
5	Phosphate	6.0	0.80	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	510	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010317	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Ground Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW_02)	Union:, Vill.:Karpasdanga
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.048	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	110	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.001	mg/L	AAS	0.001
5	Phosphate	6.0	0.56	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	620	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, MFM-Membrane Filtration Method, CRM-Closed Reflex Methods, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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: 736/ CC, DPHE, CL, Dhaka

Date: 02-02-2023

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2023010318	Sample Receiving date: 06-12-2022
Ref. Memo No: 42.06.2626.119.37.001.19-3104 & Dated: 05-12-2022	Sample Source: Ground Water
Sent by:Mohammed Mukteruzzaman ,Director, P, E & Mineral Resources Division , CEGIS, Gulshan-1, Dhaka.	Dist:Bagerhat, Upa:Rampal
Care Taker: CEGIS (Sample ID : GW_03)	Union:, Vill.:Project Site
Sample Collection date:	Date of Testing: 06/12/2022-31/01/2023

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.015	mg/L	AAS	0.001
2	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
3	Hardness	200-500	265	mg/L	Titrimetic	-
4	Lead (Pb)	0.05	0.002	mg/L	AAS	0.001
5	Phosphate	6.0	0.40	mg/L	UVS	0.10
6	Total Dissolved Solid (TDS)	1000	885	mg/L	Multimeter	-
7	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 02.02.2023	1.) Name: Mita Sarker Designation: Senior Chemist	02/02/2023
2.) Name: Taslima Akhter Designation: Sample Analyzer	02.02.2023	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	02/02/2023 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

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

Institute of National Analytical Research and Service (INARS)

ANALYSIS REPORT

ASC Ref No.	: IN-614 of Analytical Service Cell BCSIR, 24/11/2022
Lab/Sample ID	: A-696-718
Client's Details	: মোহাম্মদ মুক্তারুজ্জামান পরিচালক (ভারপ্রাপ্ত) এবং সিনিয়র স্পেশালিস্ট **Center For Environmental And Geographic Information Service (CEGIS)** House No. 06, Road No. 23/C, Gulshan-01, Dhaka-1212
Number of Sample	: 23 (Twenty Three)
Sample Description	: রামপাল ২x৬৬০ মেঃ ওঃ কয়লাভিত্তিক তাপবিদ্যুৎ কেন্দ্রের পরিবেশগত পরিবিক্ষন কাজের নিমিত্তে ভূপৃষ্ঠস্থ পানির নমুনা পরীক্ষণ প্রসংগে, তারিখ ঃ ২৪/১১/২০২২ ইং।
Test Commencement Date	: 24/11/2022
Test Completion Date	: 23/01/2023

Lab ID	Particulars of supplied sample	Parameters	Results	Test Method (APHA)
A-696	Water (Sample:01, Mongla)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-697	Water (Sample:02, Maidara)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-698	Water (Sample:03, Harbaria)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-699	Water (Sample:04, Hiron Point)	Oil and Grease	Less than 2.0 mg/L	5520.B
A-700	Water (Sample:05, 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-701	River water (Sample-01)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-702	River water (Sample-02)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-703	River water (Sample-03)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-704	River water (Sample-04)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-705	River water (Sample-05)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-706	River water (Sample-06)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-707	River water (Sample-07)	Mercury (Hg)	0.002 mg/L	3112.B
A-708	River water (Sample-08)	Mercury (Hg)	0.003 mg/L	3112.B
A-709	River water (Sample-09)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-710	River water (Sample-10)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-711	River water (Sample-11)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-712	River water (Sample-Mongla)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-713	River water (Sample-Harbaria)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-714	River water (Sample-Akram Point)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-715	River water (Sample-Hiron Point)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-716	River water (Sample-Rajnagar)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-717	River water (Sample-kapashdanga)	Mercury (Hg)	Less than 0.001 mg/L	3112.B
A-718	River water (Sample-RO Drinking)	Mercury (Hg)	Less than 0.001 mg/L	3112.B

24.01.23 — Analyst
A. H. M. Shofiul Islam Molla Jamal, Senior Scientific Officer, Institute of National Analytical Research & Service (INARS), BCSIR, Dhaka-1205.

H.K 24.01.2023 — Supervisor
Dr. Md. Humayun Kabir, Senior Scientific Officer, Institute of National Analytical Research & Service (INARS), BCSIR, Dhaka-1205.

24.01.23 — Director
Shamim Ahmed, Director (In-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.
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

---

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. ELAB202303002041 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_001 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	200.77	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	-	-	7	-	0.2761	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	2.1427	ppm	UV-VIS	

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

Test Performed by
Name: Rafiqul Islam & Rafiqul Alam
Designation: Research Associate & In-Charge of Scientific Equipment and Laboratory Expert
Signature: 16.04.2023

Approved by
Name: Rafiqul Alam
Designation: Laboratory Expert
Signature: 16.04.2023

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. ELAB202303002042 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_002 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 $(SO4^{2-})$	-	-	-	-	206.51	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate $(NO3^{-})$	-	-	7	-	0.0868	ppm	UV-VIS	
03		Phosphate $(PO4^{3-})$	-	-	0.5	-	1.1970	ppm	UV-VIS	

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

Test Performed by ✓

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002043 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_003 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 $(SO4^{2-})$	-	-	-	-	200.31	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate $(NO3^{-})$	-	-	7	-	0.2340	ppm	UV-VIS	
03		Phosphate $(PO4^{3-})$	-	-	0.5	-	0.0449	ppm	UV-VIS	

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

Test Performed by ✓

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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: 8802 58817649-52, 9842581, 9842551 Fax: 88 02 9843128 e-mail: cegis@cegisbd.com http://www.cegisbd.com

Environmental Laboratory

Memo No. ELAB202303002044 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_004 Collection Date: JAN/23

Location: Jetty.

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	202.27	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	3.7876	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0825	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: RAlam 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 16.04.2023

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: 8802 58817649-52, 9842581, 9842551 Fax: 88 02 9843128 e-mail: cegis@cegisbd.com http://www.cegisbd.com

Environmental Laboratory

Memo No. ELAB202303002045 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_005 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	208.03	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	2.0634	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0351	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: RAlam 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 16.04.2023

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. ELAB202303002046 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_006 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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_6	Sulphate ($SO4^{2-}$)	-	-	-	-	211.48	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	-	-	7	-	3.5983	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0741	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002047 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_007 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	198.41	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^-$)	-	-	7	-	5.1754	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0743	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002048 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_008 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	202.02	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	5.0072	ppm	UV-VIS	
03		Phosphate ($PO4^{3}$-)	-	-	0.5	-	0.1257	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002049 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_009 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	211.53	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	4.7128	ppm	UV-VIS	
03		Phosphate ($PO4^{3}$-)	-	-	0.5	-	0.1109	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002050 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_010 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	199.39	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	5.7431	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0800	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002051 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_011 Collection Date: JAN/23

Location: N/A

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	193.21	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	1.6218	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.0812	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002052 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_012 Collection Date: JAN/23

Location: Mongla.

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	198.80	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	5.9744	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.6115	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002053 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_013 Collection Date: JAN/23

Location: Harbaria.

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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 ($SO4^{2-}$)	-	-	-	-	185.87	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	5.7221	ppm	UV-VIS	
03		Phosphate ($PO4^{3-}$)	-	-	0.5	-	0.5979	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002054 **Date: 16/04/2023**

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_014 Collection Date: JAN/23

Location: Akrampoint.

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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	SW14	Sulphate ($SO4^{2-}$)	-	-	-	-	232.06	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	3.4932	ppm	UV-VIS	
03		Phosphate ($PO4^{3}$-)	-	-	0.5	-	0.0159	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002055 **Date: 16/04/2023**

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Surface Water ID: FPC007_015 Collection Date: JAN/23

Location: Hironpoint.

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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	SW15	Sulphate ($SO4^{2-}$)	-	-	-	-	236.27	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate ($NO3^{-}$)	-	-	7	-	5.7641	ppm	UV-VIS	
03		Phosphate ($PO4^{3}$-)	-	-	0.5	-	0.0333	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

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. ELAB202303002056 Date: 16/0342023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Ground Water ID: FPC007_016 Collection Date: JAN/23

Location: PPJ RO drinking.

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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	GW₁	Sulphate ($SO4^{2-}$)	400	-	250	-	0.2302	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	-	15.508	ppm	UV-VIS	
03		Phosphate ($PO4^{3}$-)	6	-	-	-	0.7548	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: RAlam 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 16.04.2023

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. ELAB202303002057 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Ground Water ID: FPC007_017 Collection Date: JAN/23

Location: Rajnagar.

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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	GW₂	Sulphate ($SO4^{2-}$)	400	-	250	-	Undetectable	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	-	1.2223	ppm	UV-VIS	
03		Phosphate ($PO4^{3}$-)	6	-	-	-	0.4878	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: RAlam 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: RAlam 16.04.2023

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. ELAB202303002058 Date: 16/04/2023

Test Report

Physical/Chemical/Bacteriological Analysis of water

Project Name: Environmental and Socio-economic Monitoring of Rampal Power Plant. Code: FPC007

Sample Type: Ground Water ID: FPC007_018 Collection Date: JAN/23

Location: Kapashdanga.

Received From: Md. Mutasim Billah Received Date: 21/03/2023 Testing Date: 21/03-16/04/23

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	GW₃	Sulphate (SO_4^{2-})	400	-	250	-	1.9430	ppm	UV-VIS	Sample was collected and supplied by assigned professional. This report is valid only for particular sample tested.
02		Nitrate (NO_3^-)	10	-	45	-	4.8179	ppm	UV-VIS	
03		Phosphate (PO_4^{3-})	6	-	-	-	1.4861	ppm	UV-VIS	

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

Test Performed by

Name: Rafiqul Islam & Rafiqul Alam

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

Signature: 16.04.2023

Approved by

Name: Rafiqul Alam

Designation: Laboratory Expert

Signature: 16.04.2023

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
কৃষি মন্ত্রণালয়
মৃত্তিকা সম্পদ উন্নয়ন ইনস্টিটিউট
বিভাগীয় গবেষণাগার, ঢাকা
মৃত্তিকা ভবন, কৃষি খামার সড়ক, ঢাকা-১২১৫।

প্রাপকঃ

জনাব মোহাম্মদ মোস্তাকুজ্জামান
পরিচালক (ভারপ্রাপ্ত) এবং সিনিয়র স্পেশালিস্ট
সিইজিআইএস, ঢাকা-১২১২।

প্রেরিত মৃত্তিকা নমুনার বিশ্লেষিত ফলাফল

ক্রমিক নম্বর	ল্যাব নম্বর	উপাদানের নাম														
		পিএইচ	লবণাক্ততা	জৈব পদার্থ	মোট নাইট্রোজেন	ফসফরাস (ওলসেন)	পটাশিয়াম	ক্যালসিয়াম	ম্যাগনেসিয়াম	সালফার	বোরণ	দস্তা	লৌহ	ম্যাঙ্গানিজ	লেড	ক্যাডমিয়াম
			ডিএস/মিটার	(%)		সহজলভ্য (ppm)	বিনিময়যোগ্য (meq/100g soil)			সহজলভ্য (ppm)					মোট (ppm)	
১.	৬৮৩১	৭.৭	০.৫১	২.৩৩	০.১৪	১২.০৮	০.৭০	১৭.৮৬	৭.১০	২২১.৮৩	০.৪২	১.১৩	২৫.৫৬	২০.৭৪	২৫.৬০	০.৫৫
২.	৬৮৩২	৭.৮	০.৪৬	২.২৪	০.১৩	৬.০১	০.৬৯	১৭.৫৬	৬.৫২	১৪২.৫২	০.৩১	০.৭৩	১৭.২০	১৪.৯৫	২৪.৫২	০.০৯
৩.	৬৮৩৩	৭.৬	০.৪৯	১.৭৯	০.১০	৬.১৬	০.৭০	১৭.১৩	৬.৮৪	১৭১.৬০	০.২৭	০.৪৬	৬.৮৩	৯.৯৪	২৭.৭৫	৫.০২
৪.	৬৮৩৪	৬.৫	০.৬৪	২.১৫	০.১২	৪.২৯	০.৮৬	৬.০৩	৬.৪৭	১২৪.৩৫	০.৬৪	১.১৫	১৬৫.১৭	২৬.৯২	২৮.২১	১.৩০
৫.	৬৮৩৫	৬.৬	০.৬৭	১.৩৪	০.০৮	৫.৭৩	০.৯২	৭.৯৫	৯.০৭	১২৯.৪০	০.৬৩	০.৮৬	৭২.৭৫	২২.৭৬	৩২.৬০	০.৫৯
৬.	৬৮৩৬	৬.৬	০.৭৬	১.৯৭	০.১১	৫.০০	০.৮৬	৭.২৪	৮.১৩	১৬৩.৫৫	০.৫১	০.৬৬	৩০.৮৭	১৩.২৮	২৭.২৯	০.১১
৭.	৬৮৩৭	৮.০	০.৪৯	২.০৬	০.১২	১০.৪৭	০.৬৯	১৩.৬১	৮.০৮	১০৯.৫২	০.৩৬	০.৮২	২৮.০৩	১৫.৯১	২৫.২১	০.০৯
৮.	৬৮৩৮	৮.২	০.৫০	২.২৪	০.১৩	৭.৯৫	০.৬৯	১০.০৭	৭.৩২	১৩৪.৩০	০.৪৪	০.৭৯	২৬.০৯	১৬.৩৯	২৫.৯০	০.০৬
৯.	৬৮৩৯	৮.৩	০.৪৪	২.৪২	০.১৪	১৪.৪০	০.৭৫	১২.৬৭	৮.০৮	১০২.৪৫	০.৪৮	০.৯৯	২৯.৩৮	১৮.৯৫	২৪.২৯	০.১৫
১০.	৬৮৪০	৭.৯	১.২০	২.৬০	০.১৫	১৪.৯৬	০.৭৫	৩১.৪১	৬.৯১	৪২৫.২৫	০.৬৯	১.৩৯	২৭.০৪	৩৮.৯৪	২৫.৪৪	০.২৬
১১.	৬৮৪১	৮.০	১.২৮	২.০৮	০.১২	৯.৫৬	০.৯২	২৮.৭৩	৬.৬৩	৪৬৪.৭০	০.৫৭	২.১৫	৩২.৬৫	৩৮.৭৩	২৪.৫২	০.১৭
১২.	৬৮৪২	৭.৮	১.০২	২.৯৬	০.১৭	৮.৬৮	০.৫৪	২৫.৭০	৫.৫৩	৩৭৬.৮০	০.৭৩	১.৯০	৪৪.১২	৩৬.৯৬	২৫.৯০	০.১৯
১৩.	৬৮৪৩	৭.৯	০.১০	১.৬১	০.০৯	১০.৯২	০.৫৯	২৮.৬৫	৬.৩৮	৪৭৮.৮২	০.৩৭	১.৬৯	২১.৪৭	৩২.৫৫	২৫.৬৭	০.১৩
১৪.	৬৮৪৪	৮.১	০.৮০	১.৫২	০.০৯	৬.৮৯	০.৮৬	৩১.০৭	৬.৮৪	৪৮১.৯৭	০.৪৫	১.২৭	২২.৪১	৩১.৬৭	৩০.২৯	০.২২
১৫.	৬৮৪৫	৮.২	১.২০	২.৬০	০.১৫	৭.১২	০.৯২	২৭.৯৯	৭.৬৬	৩১৪.৩২	০.৪৩	১.৮৫	৩৬.৫৬	৪৪.৬১	৩৪.৬৮	০.২২
১৬.	৬৮৪৬	৮.২	০.৫০	১.৭৯	০.১০	৮.৫৮	০.৮৬	২৫.৩৫	৬.৫৭	১০২.৩৬	০.৩৭	০.৯৩	৩১.৮৭	৮.৬১	২৯.৩৬	০.৩৫
১৭.	৬৮৪৭	৮.১	০.৩৮	২.১৫	০.১২	১৬.৮২	১.০৩	১১.৭৭	৯.৬৩	৪০.৮৫	০.৩২	০.৮৭	২৪.৮৬	৬.৯৯	৩০.৯৮	০.২৯
১৮.	৬৮৪৮	৮.২	০.৪০	২.৫১	০.১৫	১২.২১	০.৮৬	৯.৬৩	৮.৮৪	৬৪.৮০	০.৩৬	১.১৪	৩৪.৩৬	১০.২০	৩০.৯৮	০.৩৫

02/03/2026
(ড. মাসুদা বেগম)
উর্ধ্বতন বৈজ্ঞানিক কর্মকর্তা
ফোন ঃ ০২-৪১০২৫০৬৬।

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

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Project Title : **2×660 MW Maitree Super Thermal Project**
Project Location : **Rampal, Bagherhat**

Description of Sample : Ambient Air
Sample Collector : Adroit Environment Consultants Ltd. (Monitoring team)
Sampling date : 26th January to 8th February 2023
Reporting date : 26th February 2023

Description of analysis

Sample Location ID	Concentration present of different parameter in ambient air							
	$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO	O_3	Remarks
AQ1	59.24	91.30	155.86	16.26	31.49	0.8	38	Complies
AQ2	40.29	74.81	121.17	11.09	23.25	0.8	17	Complies
AQ3	37.86	57.94	102.30	12.69	15.78	0.7	16	Complies
AQ4	51.57	64.49	124.91	17.32	23.09	0.3	12	Complies
AQ5	53.71	69.26	130.48	12.51	18.59	0.2	14	Complies
AQ6	35.19	42.07	85.63	13.27	20.18	0.3	11	Complies
AQ7	47.31	70.50	124.46	14.26	21.67	0.1	35	Complies
AQ8	54.94	97.62	159.36	25.70	27.24	0.8	63	Complies
AQ9	50.11	74.37	133.66	16.42	23.94	0.5	37	Complies
AQ10	55.86	81.08	146.79	19.51	29.29	0.7	25	Complies
AQ11	43.95	58.71	111.63	17.48	15.72	0.8	21	Complies
AQ12	56.81	81.45	144.17	19.56	18.61	0.8	20	Complies
AQ13	57.36	96.94	161.53	26.24	31.89	0.9	56	Complies
Units	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/ m³	µg/m³	
Test Duration (Hours)	24	24	8	8	8	8	8	
Method of Analysis	Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob & Hochheiser	CO Meter	O_3 Meter	
DoE Standard	65	150	NF	80	80	5	100	
IFC/WB Standard	75	150	NF	125	200	NF	160	

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

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

1. Fine Particulate Matter ($PM_{2.5}$).
2. Respirable Dust Content (PM_{10}).
3. Suspended Particulate Matter (SPM).
4. Oxides of Nitrogen (NO_X).
5. Oxides of Sulfur (SO_2).
6. Carbone Mono-Oxide (CO).

***Comment:** All the stated parameters do conform to the standard allowable limits.*

Md. Faisal Bin Mahmud
Associate Consultant

Md. Saiful Islam
Chief Operating Officer

Head Office: House # 01(2nd Floor), Road # 16, Sector # 07, Uttara, Dhaka-1230, Bangladesh
Registered Office: 2678/B, kuripara, Uttarkhan, Dhaka-1230, Bangladesh. Tel: +88-02-48950261-62
Mob: 01733376609-10, Fax: +88-02-9116714, Email: aecldhaka@gmail.com, nukhan05@gmail.com
www.aecl-bd.org